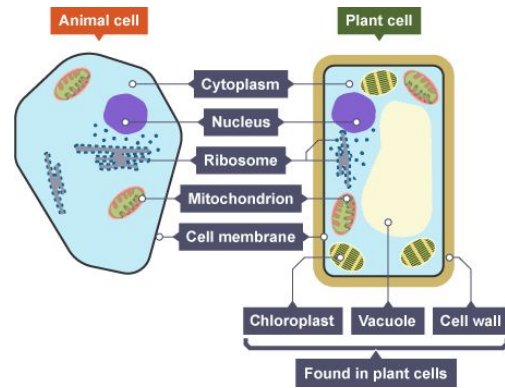


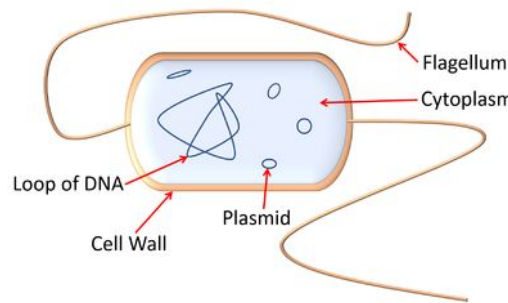
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Describe how to prepare an uncontaminated sample
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Describe the function of stem cells in different organisms
Describe the process of therapeutic cloning
Evaluate the use of stem cells
Define diffusion, osmosis and active transport
Describe how different factors affect diffusion
Explain the effect of surface area to volume ratio on exchanging materials

**Plant and Animal cells**



**Prokaryotic Cells**



**Organelle Functions**

Nucleus	Contains genetic information, controls the cell
Cell membrane	Controls what can enter and leave the cell
Cytoplasm	Where most chemical reactions take place
Ribosomes	Where protein synthesis takes place
Mitochondria	Releases energy through respiration
Cell wall	Strengthens and supports the cell
Chloroplasts	Where photosynthesis takes place
Permanent Vacuole	Filled with cell sap (a solution of sugar, salts and water)

**Microscopy Calculations**

Image size = Actual size x Magnification  
 Actual size = Image size ÷ Magnification  
 Magnification = Image size ÷ Actual size

**Using a Microscope**

- Use a cover slip to avoid the lens getting damaged or stained
- Make sure the lens **does not touch** the sample to avoid it getting scratched
- Focus it first on the **lowest magnification**
- The **objective lens** changes the magnification
- The **fine focus** makes the image clearer

**Transport in Cells**

**Diffusion** – Movement of particles from a high to low concentration (E.g. oxygen in to the lungs, carbon dioxide in to the leaf)

**Osmosis** – Movement of water from a high to low concentration through a semi-permeable membrane (E.g. water in to root hair cells)

**Active Transport** – Movement of molecules from a low to high concentration. Requires energy (E.g. minerals in to root hair cells, glucose in to the blood from the small intestine)

**Mitosis**

Cell division to produce **genetically identical cells**

1. DNA and organelles replicate
2. Chromosomes are pulled apart
3. New two nuclei and cell membranes form

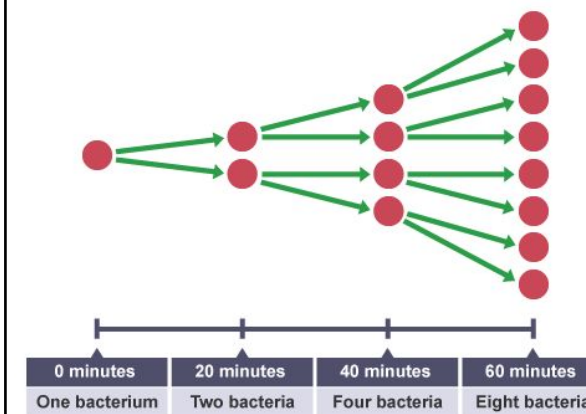
**Meiosis**

Cell division to produce **gametes** (E.g. sperm and egg, pollen and egg)

Cells contain **half the number** of chromosomes – the **full number is restored at fertilisation**

**Binary Fission**

Bacteria can replicate **every 20 minutes** if the condition is correct by a process called **binary fission**.



**Factors affecting diffusion**

**Temperature** – As temperature increases, rate of diffusion increases as molecules have more energy.

**Concentration Gradient** – The greater the gradient (difference in concentration), the faster diffusion takes place.

**Surface Area of Membrane** – The larger the surface area of the membrane, the longer it takes for diffusion to occur as particles have further to travel.

**Surface Area to Volume Ratio**

When the **size of an organism increases**, it's surface area to volume **ratio decreases**.

This means there are **more cells on the inside** compared to the outside.

This is why **multicellular organisms need specialised exchange systems**.

In **unicellular organisms**, diffusion is sufficient

**Specialised Cells**

Cells that are adapted to a specific function.

Cells become specialised when they go through a process called **differentiation**.

- Most types of animal cells differentiate early on (while it is still an embryo)
- Most plant cells keep the ability to differentiate throughout their life (meristem cells)

When a cell differentiates, it acquires different organelles (e.g. mitochondria, ribosomes) to help it carry out its function.

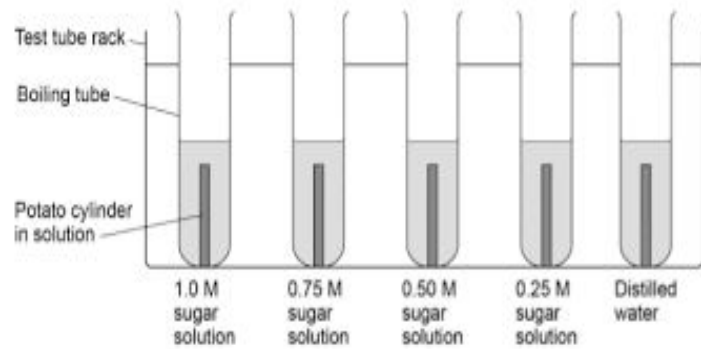
**Stem Cells**

Cells that are **undifferentiated** and can turn in to any type of cell.

In **adults** they are found in marrow but these can **only become blood cells**.

In **plants** they are called **meristem cells** and found in the **root, fruit and shoot tips**.

**Osmosis Required Practical**



**Variables**

**Independent variable** (the thing that you change) – the concentration of the sugar or salt solution

**Dependent variable** (the thing that you measure) – the percentage change in mass

**Control variables** (the things that you keep the same)

- Temperature
- Time
- Volume of solution
- Length of potato chip

We **dry the potato chips** before weighing them to **remove any excess water** that could affect the results.

We measure **percentage change in mass** instead of just change in mass.

This is because all the potatoes have **different starting masses** and so gives us a valid comparison.

$$\% \text{ change} = (\text{change} \div \text{original}) \times 100$$

If a potato is placed in a **high sugar or salt concentration** solution, it will **lose mass** as it loses water through osmosis.

This is because **there is more water in the potato chip** compared to the solution.

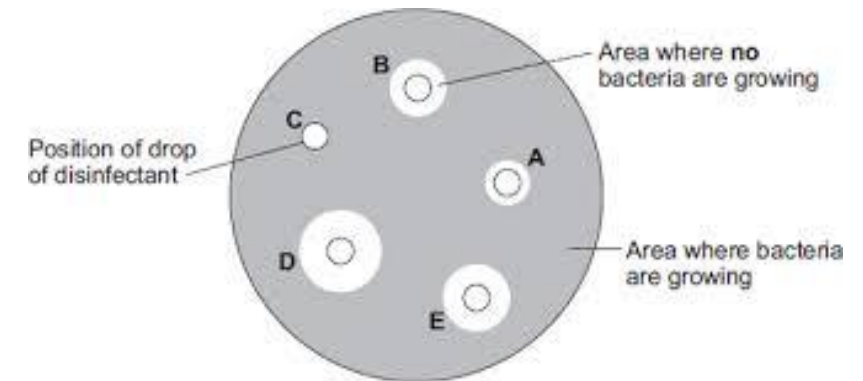
The water moves **from a high concentration** (inside the potato) **to a low concentration** (inside the solution) through a **partially permeable membrane**.

If a potato is placed in a **low sugar or salt concentration** solution, it will **gain mass** as it loses water through osmosis.

This is because **there is less water in the potato chip** compared to the solution.

The water moves **from a high concentration** (inside the solution) **to a low concentration** (inside the potato) through a **partially permeable membrane**.

**Culturing Micro-organisms**



**Variables**

**Independent variable** (the thing that you change) – the type of antibiotic

**Dependent variable** (the thing that you measure) – the area that the bacteria did not grow

**Control variables** (the things that you keep the same)

- Temperature
- Time
- Size of disc
- Species of bacteria

We **dry the potato chips** before weighing them to **remove any excess water** that could affect the results.

We measure **percentage change in mass** instead of just change in mass.

This is because all the potatoes have **different starting masses** and so gives us a valid comparison.

$$\text{Zone of inhibition} = \text{Full area where it did not grow} - \text{area of disc}$$

$$\text{Area of a circle} = \pi r^2$$

**Keeping a sterile environment**

- **Use a Bunsen Burner** – this kills any surrounding bacteria
- **Keep the lid on** unless absolutely necessary – this prevents any surrounding bacteria contaminating the agar
- **Store at 25°C** to prevent the growth of harmful pathogens
- **Disinfect surfaces before and after use** to prevent contamination of the sample and to maintain a sterile environment

The bacteria is grown on **agar gel** to provide nutrients (e.g. carbohydrates) for the bacteria

**B7 Gums-to-bums**

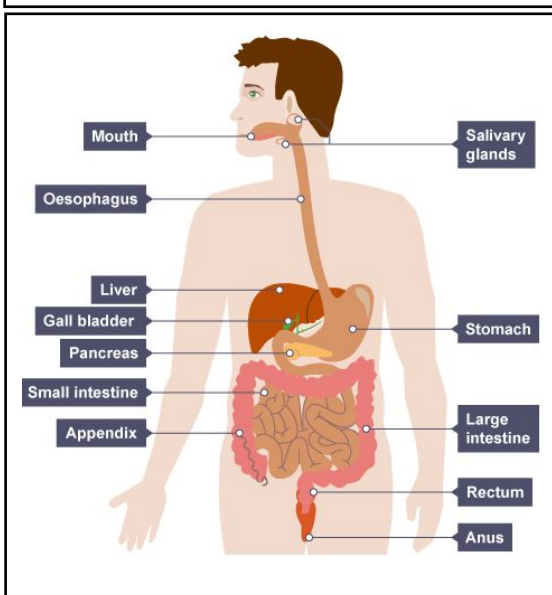
Below is a checklist of everything you need to know for this topic:

Define the key terms cell, tissue and organ
Label and give the function of organs in the digestive system
Calculate the rate for a chemical reaction
Describe the lock and key theory of enzyme activity
Recall the roles and sites of production of amylase, lipase and protease
Describe the function of bile
Explain how to test for carbohydrates, lipids and proteins
Investigate the effect of pH on the rate of reaction for amylase
Label the structure of the heart
Label the structures of the breathing system
State the role of and where to find the pacemaker
Explain how the structure of the arteries, veins and capillaries relates to their function
State the function of each component of blood
Explain how different components of blood are adapted to their function
Evaluate the advantages and disadvantages of different methods of treating heart disease
Explain how different types of diseases can interact
Define what is meant by a non-communicable disease
Explain the effect of lifestyle on local, national and global levels
State risk factors for cancer and cardiovascular disease
Explain how the structure of a plant tissue is related to its function
Explain the effect of temperature, humidity, air movement and light intensity on transpiration rate
Describe the processes of transpiration and translocation

**Cell** – the smallest unit of a living organism

**Tissue** – A group of cells working together to perform a similar function

**Organ** – A group of organs working together to perform a similar function



**Functions of organs in the digestive system**

Organ	Function
Mouth	Produces digestive enzymes, breaks down food in to smaller pieces
Oesophagus	Connects the mouth to the stomach
Stomach	Contains acid, releases enzymes to break down food
Liver	Detoxifies food, produces bile
Gallbladder	Stores bile
Small intestine	Absorbs nutrients from food
Large intestine	Absorbs fluids from food

**Tissues of the stomach**

**Glandular tissue** – Releases digestive juices and enzymes

**Epithelial tissue** – Lines the stomach, protects it against stomach acid

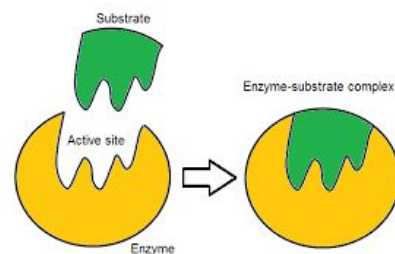
**Muscular tissue** – Contracts and relaxes to churn food

**The role of bile**

Bile **neutralises the stomach acid** as it is an alkali.

It also **emulsifies fats** which **increases the surface area for lipase to act on**.

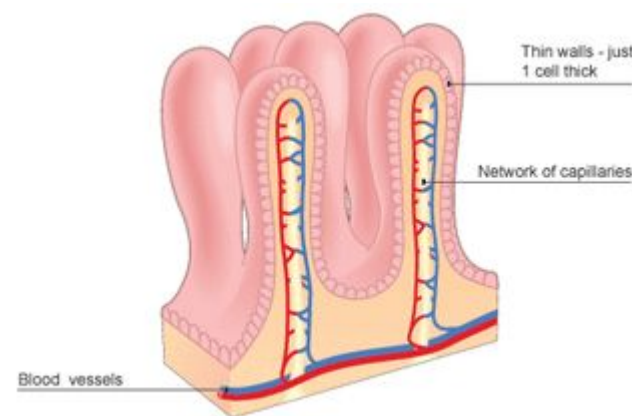
**Enzyme Activity**



At **extreme temperatures and pH**, enzymes will **denature**.

This means the **active site is no longer complementary** to the substrate

**Small intestine villi**



**Long and thin to increase surface area.**

Lots of **mitochondria** to release energy for **active transport**.

Surrounded by **capillaries** for ease of transport of materials.

Walls are **one cell thick** to provide a **short diffusion pathway**.

Enzyme	Sites of production	Breaks down	Produces	Molecule	Reagent	Colour before	Colour after
Amylase	Salivary glands Small Intestine Pancreas	Starch	Glucose	Starch	Iodine	Orange	Blue/Black
Protease	Stomach Small intestine Pancreas	Proteins	Amino acids	Glucose	Benedict's	Blue	Green (little bit of glucose) Orange (lots of glucose)
Lipase	Small intestine Pancreas	Lipids	Fatty acids and glycerol	Proteins	Biuret's	Blue	Lilac
				Lipids	Sudan III	N/A	Red layer forms on top

Required Practical: Investigating the effect of pH on the activity of amylase

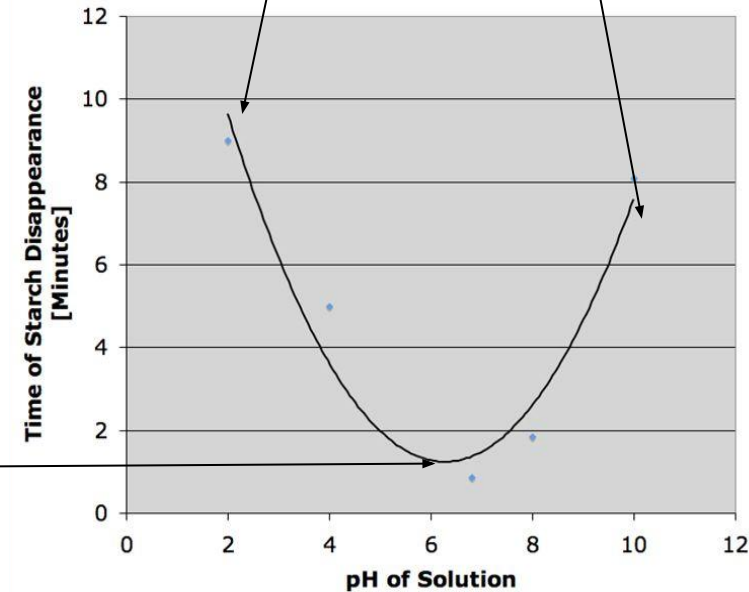
Method

- Place 2ml of the **correct pH solution** into the test tube.
- Place 2ml of **amylase** into the tube.
- Add 2ml of **starch** into the tube – start the stop clock immediately.
- After 30 secs remove three drops of the mixture using the pipette and place onto the first spot of **iodine** (should turn black).
- Repeat every 30 seconds adding the drop onto the next iodine spot in the tile.
- Record time taken until no starch is left (when the iodine stays **orange**).
- Repeat for other pH solutions

Graph

These pHs are too extreme for amylase to work.

The enzyme has **denatured**.



This is the **optimum pH** for amylase.

It broke down all the starch in the fastest time.

Variables

**Independent variable** (the thing you change):  
the pH of the amylase solution

**Dependent variable** (the thing you measure):  
the time taken to break down the starch

**Control variables:**

- Temperature
- Volume of amylase
- Volume of pH solution
- Volume of starch

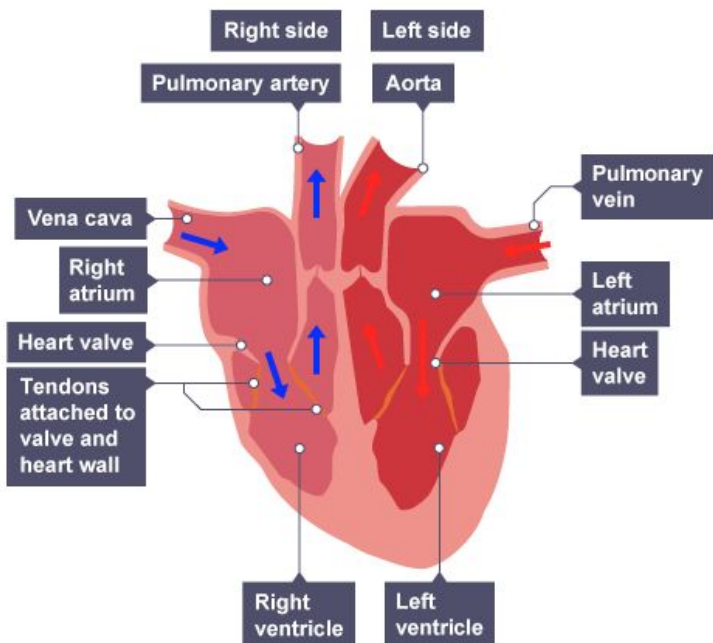
Problems with the experiment

The sample was **only tested every 30 seconds** – the starch could have all broken down by then

The end point of the reaction is measured by looking at the colour change – **this is a subjective measure**

The **accuracy** of the experiment can be improved by:

- Testing **more frequent pH** intervals (e.g. 2.1, 2.2, 2.3)
- By measuring at **shorter time intervals** (e.g. every 15 seconds)



Humans have a **double circulatory system**:

- The left hand side of the heart sends blood to the body
- The right hand side of the heart sends blood to the lungs

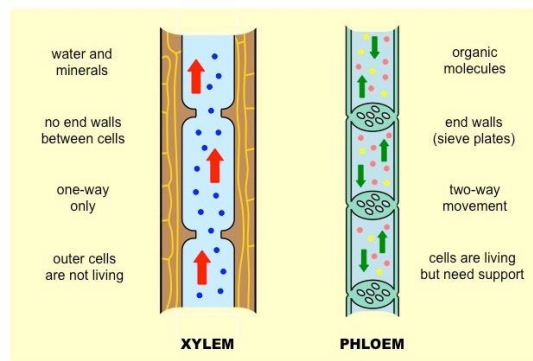
The left hand side of the heart is thicker as:

1. It sends blood further
2. It carries oxygenated blood which flows at a higher pressure.

**Blood Vessels**

<p style="text-align: center;"><b>Artery</b></p>	<p>Carry blood away from the heart.</p> <ul style="list-style-type: none"> <li>- Blood is oxygenated – flows at a higher pressure</li> <li>- Walls have muscle and elastic to withstand high pressure</li> </ul>
<p style="text-align: center;"><b>Vein</b></p>	<p>Carry blood back to the heart</p> <ul style="list-style-type: none"> <li>- Blood is oxygenated – flows at a lower pressure</li> <li>- Walls have valves to prevent backflow and make sure blood flows in one direction</li> </ul>
<p style="text-align: center;"><b>Capillaries</b></p>	<p>Important for exchange of materials</p> <ul style="list-style-type: none"> <li>- Walls are one cell thick to provide a short diffusion pathway</li> </ul>

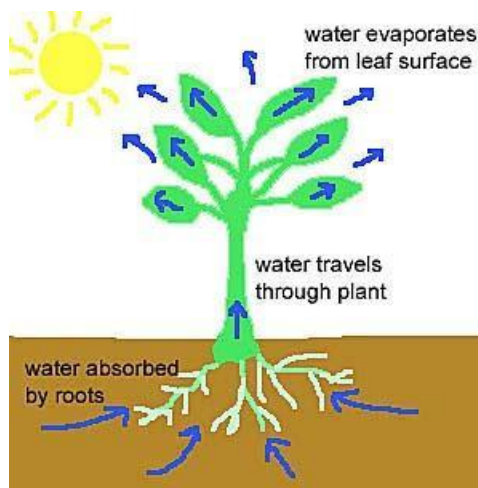
**Transport in Plants**



**Translocation:** Transport of dissolved sugars in both directions in the phloem

**Transpiration:** Loss of water through the stomata in the leaves

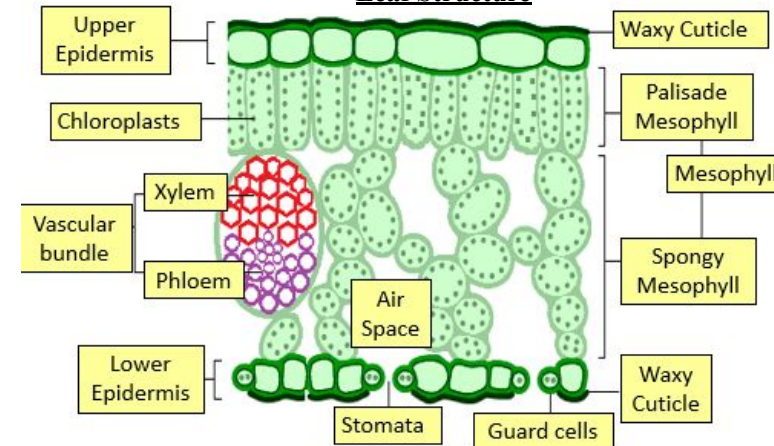
**Transpiration Stream**



Loss of water through the stomata in the leaves

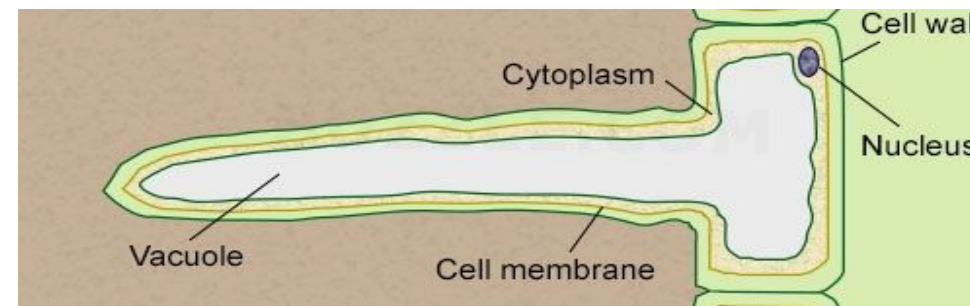
1. The **guard cells open** the stomata and water vapour escapes
2. **Root hair cells** absorb more water
3. This **creates a concentration gradient** – there is more water in the roots than the leaves
4. Water **travels up the xylem** to the leaves
5. The **process repeats**

**Leaf Structure**



Layer	Adaptation and Function
Waxy cuticle	Waterproof layer, protects the leaf
Palisade layer	Cells tightly packed together and packed with chloroplasts to increase surface area for <b>photosynthesis</b>
Spongy mesophyll layer	Contains air spaces to allow for gas exchange
Guard cells	Change shape to open and close the stomata to allow for gas exchange
Stomata	Allow for gas exchange

**Root hair cells**



**Long and thin to increase surface area.**

Lots of **mitochondria** to release energy for **active transport**.

Thin cell wall to provide a **short diffusion pathway**.

**Factors affecting Transpiration**

**Increasing temperature** will **increase transpiration** as molecules have **more energy and evaporate faster**.

**Increasing wind** will **increase transpiration** rate as the concentration gradient is greater.

**Increasing light intensity** will **increase transpiration** as there is more **photosynthesis** taking place so the stomata open more often for gas exchange.

**Increasing humidity** will **decrease transpiration** as there is less of a concentration gradient.

**Coronary Heart Disease**



Healthy Coronary Artery      Coronary Artery with Plaque Buildup

The **coronary artery** supplies the **heart with oxygen**

**Fatty deposits build up** in the coronary artery **reducing blood flow**

The heart does **not get enough oxygen**

It cannot carry out respiration so does not have enough energy

This leads to a heart attack

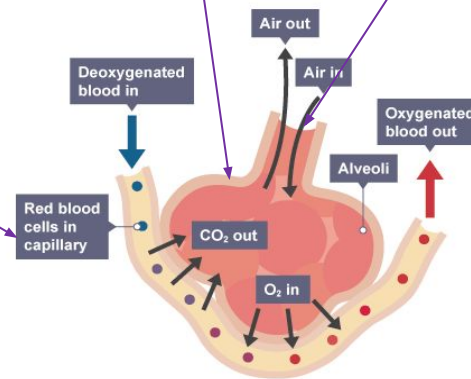
**Alveoli**

The site of gas exchange in the lungs

Lined with a moist surface – easy for gases to diffuse

Wall is only one cell thick – shortens the diffusion distance

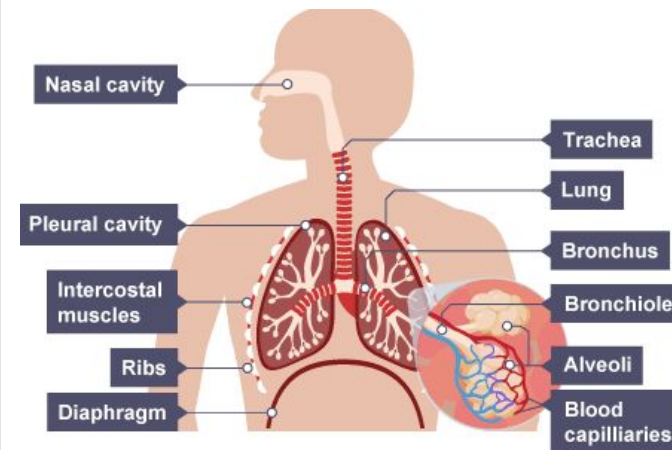
Surrounded by capillary network – easy for gases to diffuse across



Large number present in the lungs – increases the surface area

Small to give a larger surface area to volume ratio

**Breathing System**



**Cancer**

Happens when **cells divide uncontrollably**

**Benign tumours** – non-cancerous, fixed shape

**Malignant tumours** – cancerous, irregular shape

**Metastasis** – When a group of cancer cells break off and travel through the body

**Blood**

Blood is a **tissue**

Component of blood	Function
Red blood cell	Carries oxygen
White blood cell	Fights infection
Platelets	Helps the blood to clot
Plasma	Important in transport of materials (e.g. water, hormones, carbon dioxide)

**Red Blood Cells**

- Do not have a nucleus – means they have more space to carry oxygen

- Contains haemoglobin – binds oxygen

Have a biconcave shape – increases the surface area so more oxygen can be carried



Treatment	How it works	Advantage	Disadvantage
Mechanical heart valves (artificial)	Titanium – replace faulty valves	Last a very long time	Have to take medication to prevent blood clotting around it
Biological heart valves	From pigs/cattle – replace faulty valves	Don't need medication	Only last 12-15 years
Stents	Mesh to keep coronary arteries open	Little risk to patient	Fatty deposits can rebuild
Bypass surgery	Replacing narrowed/blocked coronary artery	No rejection by the body	Major surgery needed
Statins	Medication to reduce cholesterol	Reduce cholesterol to reduce chance of heart disease	Possible side effects e.g. liver damage
Artificial heart	Device to mimic the operation of the heart	Used whilst waiting for donor	Expensive Risk of clotting
Heart transplant	Heart from a donor	Better quality of life	Shortage of donors Major surgery needed Rejection issues

**Risk factors for cancer:**

- Smoking
- Alcohol
- Exposure to radiation
- Genetics
- Viruses

**Risk factors for heart disease:**

- Smoking
- Alcohol
- Genetics
- Being overweight/obese
- High fat diet
- Certain medications

**Different diseases can interact with each other**

- Defects in the immune system mean that an individual is more likely to suffer from infectious diseases.
- Viruses living in cells can be the trigger for cancers.
- Immune reactions initially caused by a pathogen can trigger allergies such as skin rashes and asthma.
- Severe physical ill health can lead to depression and other mental illness.

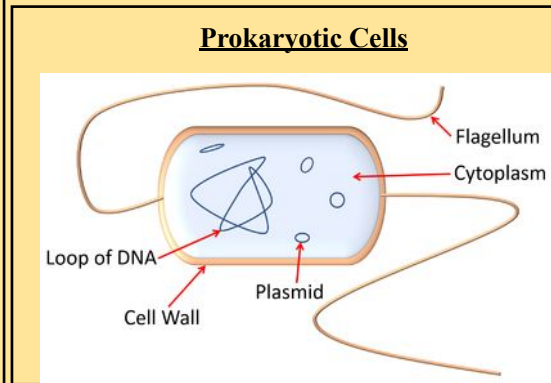
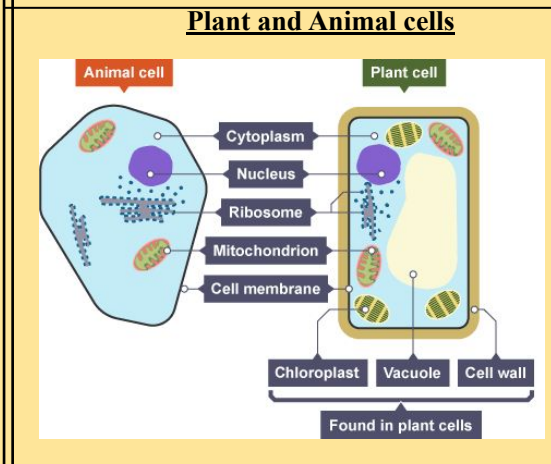
A **non-communicable disease** is a disease that you cannot catch from someone else as it is **not caused by a pathogen**.

Cancer and heart disease are both non-communicable diseases.

# B5 – Cellular Processes and B6 – Growth and repair

Below is a checklist of everything you need to know for this topic:

Structure of plant and animal (eukaryotic) cells
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The function of subcellular organelles in cells
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### Organelle Functions

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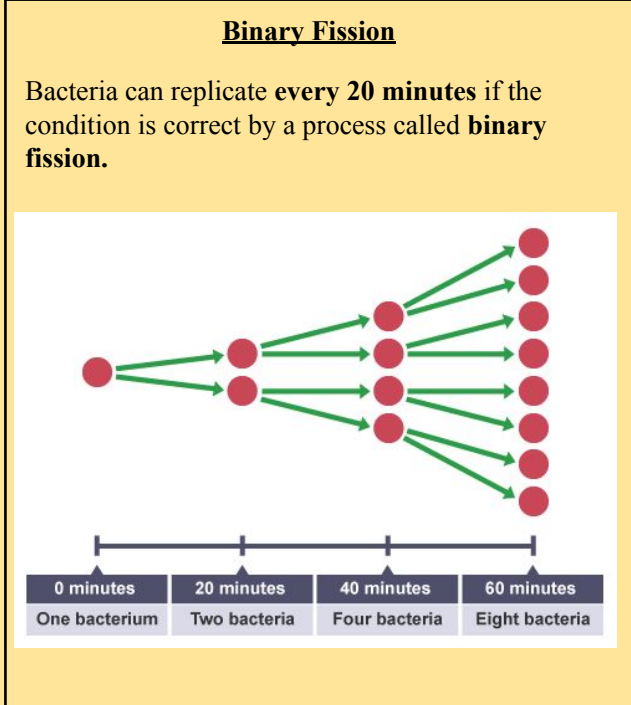
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**Active Transport** – Movement of molecules from a low to high concentration. Requires energy (E.g. minerals in to root hair cells, glucose in to the blood from the small intestine)

- ### Mitosis
- Cell division to produce **genetically identical cells**
1. DNA and organelles replicate
  2. Chromosomes are pulled apart
  3. New two nuclei and cell membranes form



### Meiosis

Cell division to produce **gametes** (E.g. sperm and egg, pollen and egg)

Cells contain **half the number** of chromosomes – the **full number is restored at fertilisation**

### Factors affecting diffusion

**Temperature** – As temperature increases, rate of diffusion increases as molecules have more energy.

**Concentration Gradient** – The greater the gradient (difference in concentration), the faster diffusion takes place.

**Surface Area of Membrane** – The larger the surface area of the membrane, the longer it takes for diffusion to occur as particles have further to travel.

### Surface Area to Volume Ratio

When the **size of an organism increases**, it's surface area to volume **ratio decreases**.

This means there are **more cells on the inside** compared to the outside.

This is why **multicellular organisms need specialised exchange systems**.

In **unicellular organisms**, diffusion is sufficient

### Specialised Cells

Cells that are adapted to a specific function.

Cells become specialised when they go through a process called **differentiation**.

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When a cell differentiates, it acquires different organelles (e.g. mitochondria, ribosomes) to help it carry out its function.

### Stem Cells

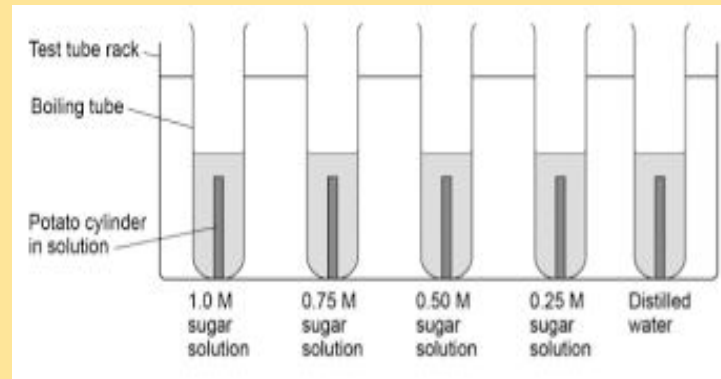
Cells that are **undifferentiated** and can turn in to any type of cell.

In **adults** they are found in marrow but these can **only become blood cells**.

In **plants** they are called **meristem cells** and found in the **root, fruit and shoot tips**.

# B5 – Cellular Processes and B6 – Growth and repair

## Osmosis Required Practical



### Variables

**Independent variable** (the thing that you change) – the concentration of the sugar or salt solution

**Dependent variable** (the thing that you measure) – the percentage change in mass

**Control variables** (the things that you keep the same)

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- Time
- Volume of solution
- Length of potato chip

We **dry the potato chips** before weighing them to **remove any excess water** that could affect the results.

We measure **percentage change in mass** instead of just change in mass.

This is because all the potatoes have **different starting masses** and so gives us a valid comparison.

$$\% \text{ change} = (\text{change} \div \text{original}) \times 100$$

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This is because **there is more water in the potato chip** compared to the solution.

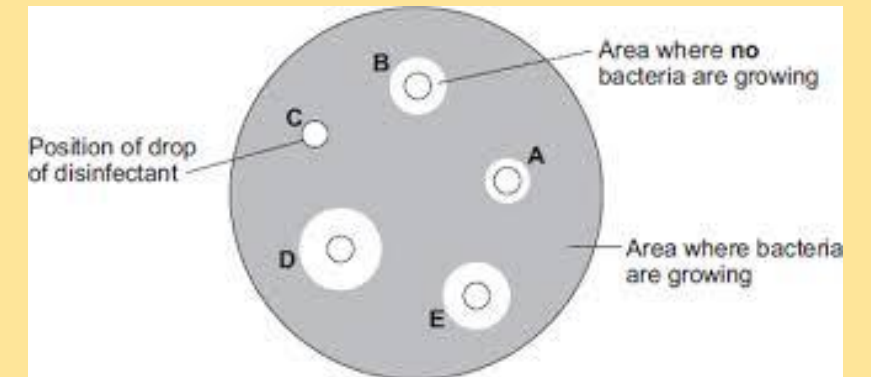
The water moves **from a high concentration** (inside the potato) **to a low concentration** (inside the solution) through a **partially permeable membrane**.

If a potato is placed in a **low sugar or salt concentration** solution, it will **gain mass** as it loses water through osmosis.

This is because **there is less water in the potato chip** compared to the solution.

The water moves **from a high concentration** (inside the solution) **to a low concentration** (inside the potato) through a **partially permeable membrane**.

## Culturing Micro-organisms



### Variables

**Independent variable** (the thing that you change) – the type of antibiotic

**Dependent variable** (the thing that you measure) – the area that the bacteria did not grow

**Control variables** (the things that you keep the same)

- Temperature
- Time
- Size of disc
- Species of bacteria

We **dry the potato chips** before weighing them to **remove any excess water** that could affect the results.

We measure **percentage change in mass** instead of just change in mass.

This is because all the potatoes have **different starting masses** and so gives us a valid comparison.

$$\text{Zone of inhibition} = \text{Full area where it did not grow} - \text{area of disc}$$

$$\text{Area of a circle} = \pi r^2$$

### Keeping a sterile environment

- **Use a Bunsen Burner** – this kills any surrounding bacteria
- **Keep the lid on** unless absolutely necessary – this prevents any surrounding bacteria contaminating the agar
- **Store at 25°C** to prevent the growth of harmful pathogens
- **Disinfect surfaces before and after use** to prevent contamination of the sample and to maintain a sterile environment

The bacteria is grown on **agar gel** to provide nutrients (e.g. carbohydrates) for the bacteria

**B7 Gums-to-bums**

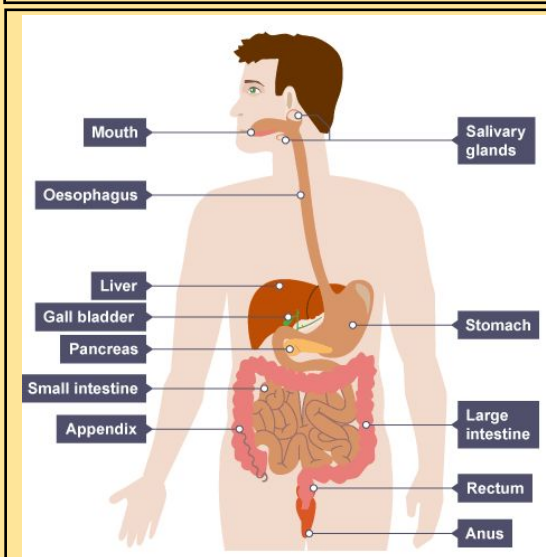
Below is a checklist of everything you need to know for this topic:

Define the key terms cell, tissue and organ
Label and give the function of organs in the digestive system
Calculate the rate for a chemical reaction
Describe the lock and key theory of enzyme activity
Recall the roles and sites of production of amylase, lipase and protease
Describe the function of bile
Explain how to test for carbohydrates, lipids and proteins
Investigate the effect of pH on the rate of reaction for amylase
Label the structure of the heart
Label the structures of the breathing system
State the role of and where to find the pacemaker
Explain how the structure of the arteries, veins and capillaries relates to their function
State the function of each component of blood
Explain how different components of blood are adapted to their function
Evaluate the advantages and disadvantages of different methods of treating heart disease
Explain how different types of diseases can interact
Define what is meant by a non-communicable disease
Explain the effect of lifestyle on local, national and global levels
State risk factors for cancer and cardiovascular disease
Explain how the structure of a plant tissue is related to its function
Explain the effect of temperature, humidity, air movement and light intensity on transpiration rate
Describe the processes of transpiration and translocation

**Cell** – the smallest unit of a living organism

**Tissue** – A group of cells working together to perform a similar function

**Organ** – A group of organs working together to perform a similar function



**Functions of organs in the digestive system**

Organ	Function
Mouth	Produces digestive enzymes, breaks down food in to smaller pieces
Oesophagus	Connects the mouth to the stomach
Stomach	Contains acid, releases enzymes to break down food
Liver	Detoxifies food, produces bile
Gallbladder	Stores bile
Small intestine	Absorbs nutrients from food
Large intestine	Absorbs fluids from food

**Tissues of the stomach**

**Glandular tissue** – Releases digestive juices and enzymes

**Epithelial tissue** – Lines the stomach, protects it against stomach acid

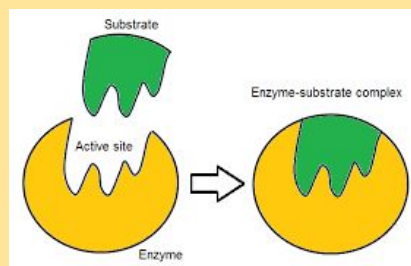
**Muscular tissue** – Contracts and relaxes to churn food

**The role of bile**

Bile **neutralises the stomach acid** as it is an alkali.

It also **emulsifies fats** which **increases the surface area for lipase to act on**.

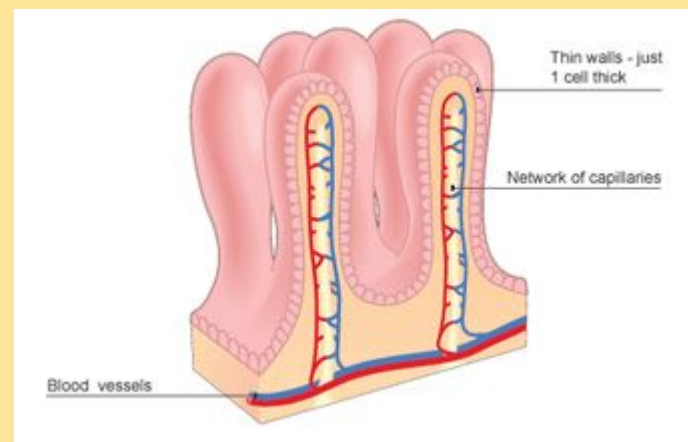
**Enzyme Activity**



At **extreme temperatures and pH**, enzymes will **denature**.

This means the **active site is no longer complementary** to the substrate

**Small intestine villi**



**Long and thin to increase surface area.**

Lots of **mitochondria** to release energy for **active transport**.

Surrounded by **capillaries** for ease of transport of materials.

Walls are **one cell thick** to provide a **short diffusion pathway**.

Enzyme	Sites of production	Breaks down	Produces	Molecule	Reagent	Colour before	Colour after
Amylase	Salivary glands Small Intestine Pancreas	Starch	Glucose	Starch	Iodine	Orange	Blue/Black
				Glucose	Benedict's	Blue	Green (little bit of glucose) Orange (lots of glucose)
Protease	Stomach Small intestine Pancreas	Proteins	Amino acids	Proteins	Biuret's	Blue	Lilac
				Lipids	Sudan III	N/A	Red layer forms on top

# B7 Gums-to-bums

## Required Practical: Investigating the effect of pH on the activity of amylase

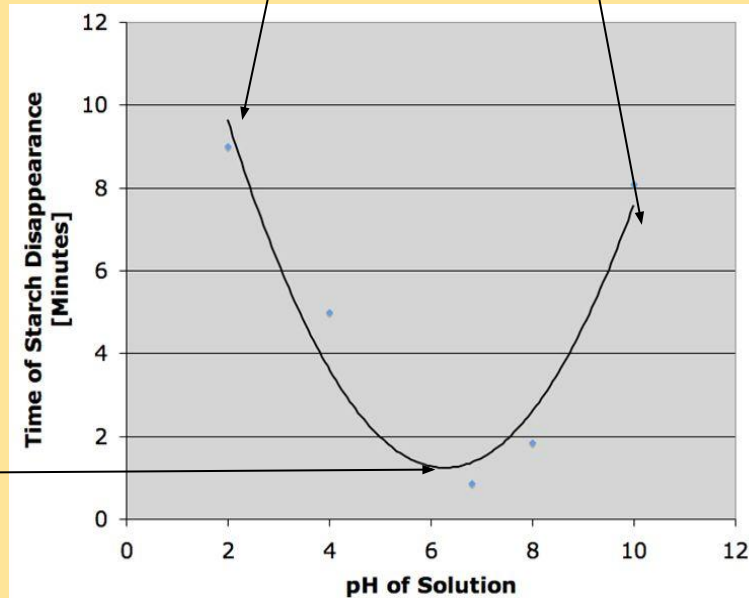
### Method

- Place 2ml of the **correct pH solution** into the test tube.
- Place 2ml of **amylase** into the tube.
- Add 2ml of **starch** into the tube – start the stop clock immediately.
- After 30 secs remove three drops of the mixture using the pipette and place onto the first spot of **iodine** (should turn black).
- Repeat every 30 seconds adding the drop onto the next iodine spot in the tile.
- Record time taken until no starch is left (when the iodine stays **orange**).
- Repeat for other pH solutions

### Graph

These pHs are too extreme for amylase to work.

The enzyme has **denatured**.



This is the **optimum pH** for amylase.

It broke down all the starch in the fastest time.

### Variables

**Independent variable** (the thing you change):  
the pH of the amylase solution

**Dependent variable** (the thing you measure):  
the time taken to break down the starch

#### Control variables:

- Temperature
- Volume of amylase
- Volume of pH solution
- Volume of starch

### Problems with the experiment

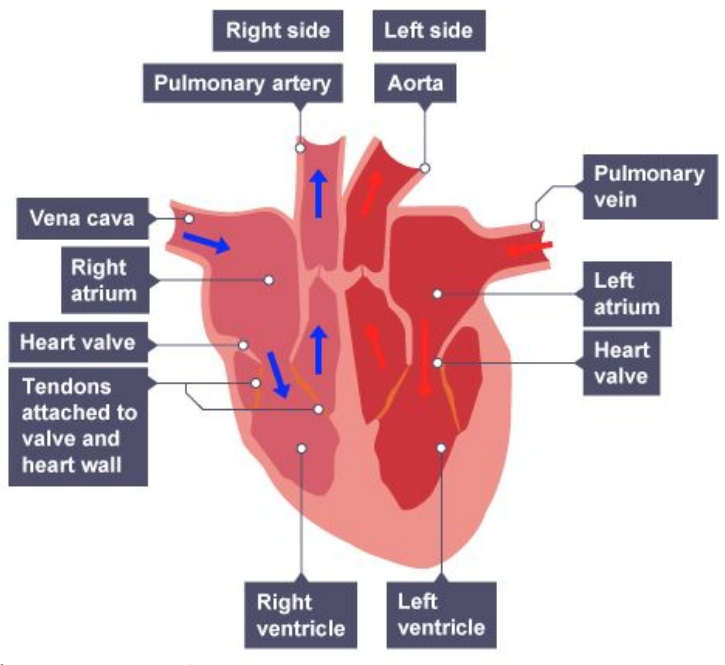
The sample was **only tested every 30 seconds** – the starch could have all broken down by then

The end point of the reaction is measured by looking at the colour change – **this is a subjective measure**

The **accuracy** of the experiment can be improved by:

- Testing **more frequent pH** intervals (e.g. 2.1, 2.2, 2.3)
- By measuring at **shorter time intervals** (e.g. every 15 seconds)

# B7 Gums-to-bums



Humans have a **double circulatory system**:

- The left hand side of the heart sends blood to the body
- The right hand side of the heart sends blood to the lungs

The left hand side of the heart is thicker as:

1. It sends blood further
2. It carries oxygenated blood which flows at a higher pressure.

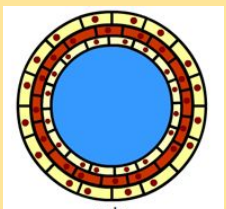
## Blood Vessels



Artery

Carry blood away from the heart.

- Blood is oxygenated – flows at a higher pressure
- Walls have muscle and elastic to withstand high pressure



Vein

Carry blood back to the heart

- Blood is oxygenated – flows at a lower pressure
- Walls have valves to prevent backflow and make sure blood flows in one direction

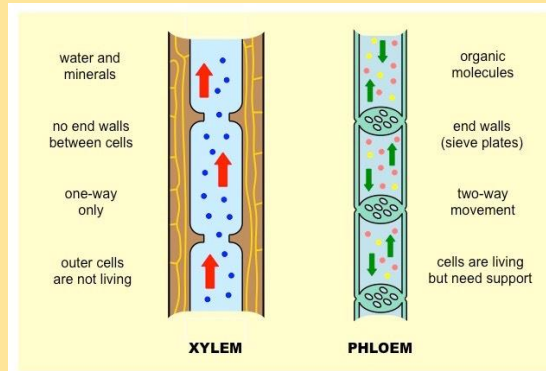


Capillaries

Important for exchange of materials

- Walls are one cell thick to provide a short diffusion pathway

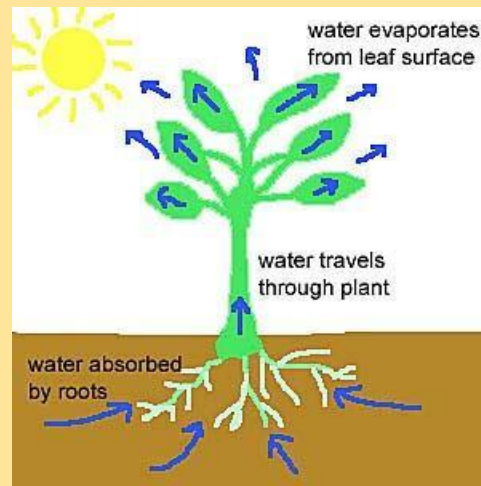
## Transport in Plants



**Translocation:** Transport of dissolved sugars in both directions in the phloem

**Transpiration:** Loss of water through the stomata in the leaves

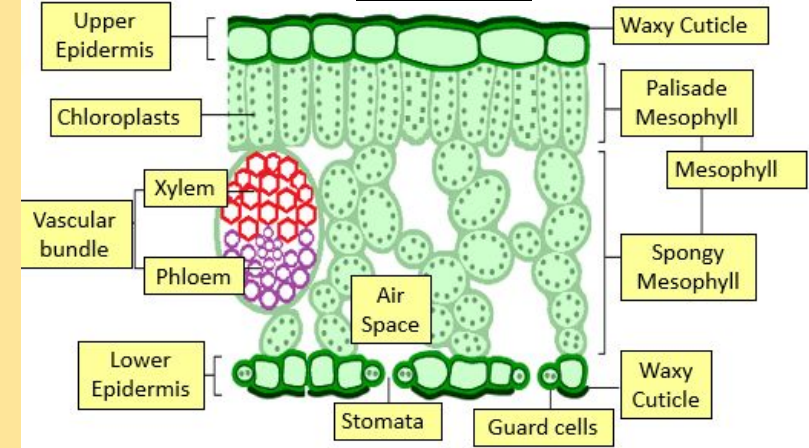
## Transpiration Stream



Loss of water through the stomata in the leaves

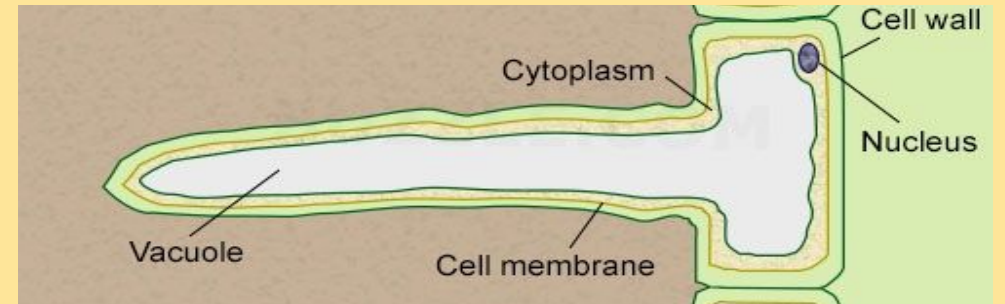
1. The **guard cells open** the stomata and water vapour escapes
2. **Root hair cells** absorb more water
3. This **creates a concentration gradient** – there is more water in the roots than the leaves
4. Water **travels up the xylem** to the leaves
5. The **process repeats**

## Leaf Structure



Layer	Adaptation and Function
Waxy cuticle	Waterproof layer, protects the leaf
Palisade layer	Cells tightly packed together and packed with chloroplasts to increase surface area for <b>photosynthesis</b>
Spongy mesophyll layer	Contains air spaces to allow for gas exchange
Guard cells	Change shape to open and close the stomata to allow for gas exchange
Stomata	Allow for gas exchange

## Root hair cells



**Long and thin to increase surface area.**

Lots of **mitochondria** to release energy for **active transport**.

Thin cell wall to provide a **short diffusion pathway**.

## Factors affecting Transpiration

**Increasing temperature** will **increase transpiration** as molecules have **more energy and evaporate faster**.

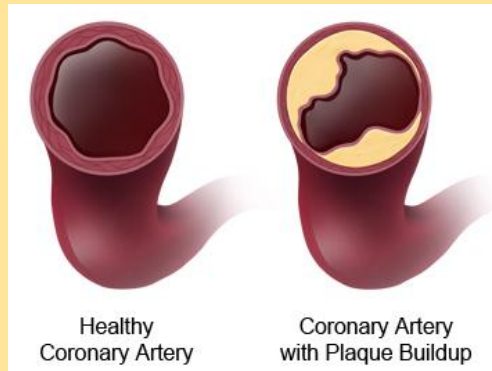
**Increasing wind** will **increase transpiration** rate as the concentration gradient is greater.

**Increasing light intensity** will **increase transpiration** as there is more **photosynthesis** taking place so the stomata open more often for gas exchange.

**Increasing humidity** will **decrease transpiration** as there is less of a concentration gradient.

# B7 Gums-to-bums

## Coronary Heart Disease



The **coronary artery** supplies the **heart with oxygen**

**Fatty deposits build up** in the coronary artery **reducing blood flow**

The heart does **not get enough oxygen**

It cannot carry out respiration so does not have enough energy

This leads to a heart attack

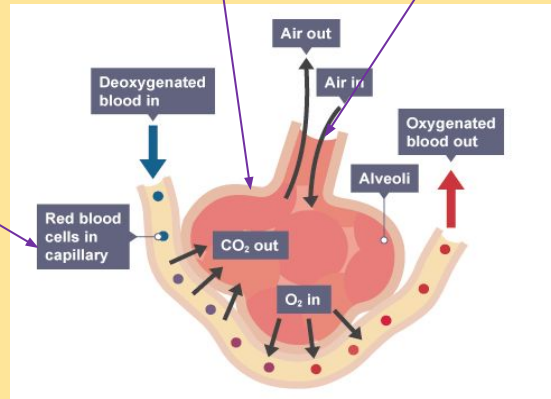
## Alveoli

The site of gas exchange in the lungs

Lined with a moist surface – easy for gases to diffuse

Wall is only one cell thick – shortens the diffusion distance

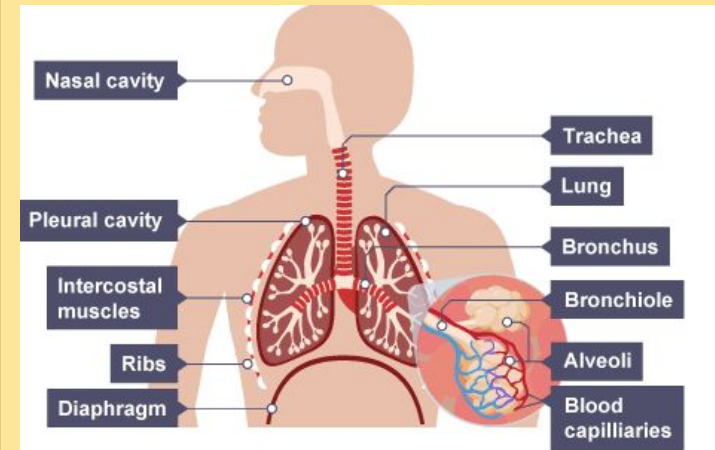
Surrounded by capillary network – easy for gases to diffuse across



Large number present in the lungs – increases the surface area

Small to give a larger surface area to volume ratio

## Breathing System



## Cancer

Happens when **cells divide uncontrollably**

**Benign tumours** – non-cancerous, fixed shape

**Malignant tumours** – cancerous, irregular shape

**Metastasis** – When a group of cancer cells break off and travel through the body

## Blood

Blood is a **tissue**

Component of blood	Function
Red blood cell	Carries oxygen
White blood cell	Fights infection
Platelets	Helps the blood to clot
Plasma	Important in transport of materials (e.g. water, hormones, carbon dioxide)

## Red Blood Cells

- Do not have a nucleus – means they have more space to carry oxygen

- Contains haemoglobin – binds oxygen

Have a biconcave shape – increases the surface area so more oxygen can be carried



Treatment	How it works	Advantage	Disadvantage
Mechanical heart valves (artificial)	Titanium – replace faulty valves	Last a very long time	Have to take medication to prevent blood clotting around it
Biological heart valves	From pigs/cattle – replace faulty valves	Don't need medication	Only last 12-15 years
Stents	Mesh to keep coronary arteries open	Little risk to patient	Fatty deposits can rebuild
Bypass surgery	Replacing narrowed/blocked coronary artery	No rejection by the body	Major surgery needed
Statins	Medication to reduce cholesterol	Reduce cholesterol to reduce chance of heart disease	Possible side effects e.g. liver damage
Artificial heart	Device to mimic the operation of the heart	Used whilst waiting for donor	Expensive Risk of clotting
Heart transplant	Heart from a donor	Better quality of life	Shortage of donors Major surgery needed Rejection issues

## Risk factors for cancer:

Smoking  
Alcohol  
Exposure to radiation  
Genetics  
Viruses

## Risk factors for heart disease:

Smoking  
Alcohol  
Genetics  
Being overweight/obese  
High fat diet  
Certain medications

## Different diseases can interact with each other

- Defects in the immune system mean that an individual is more likely to suffer from infectious diseases.
- Viruses living in cells can be the trigger for cancers.
- Immune reactions initially caused by a pathogen can trigger allergies such as skin rashes and asthma.
- Severe physical ill health can lead to depression and other mental illness.

A **non-communicable disease** is a disease that you cannot catch from someone else as it is **not caused by a pathogen**.

Cancer and heart disease are both non-communicable diseases.