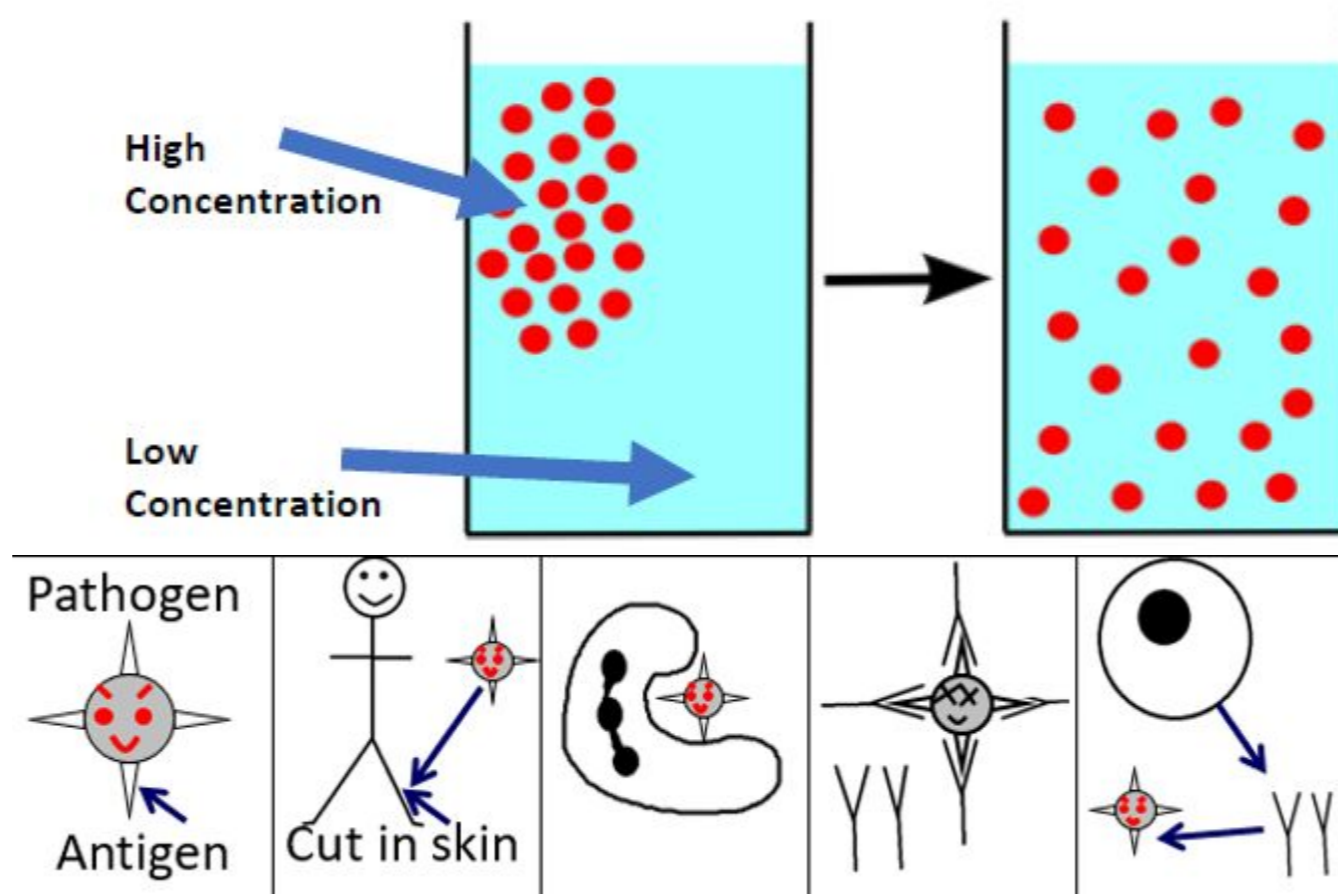


### B3 Disease and Staying Healthy

Keyword	Definition
<b>Differences between animal and bacteria cell</b>	Bacteria cells are smaller. Bacteria cells have no nucleus. Bacteria cells have a cell wall.
<b>Communicable disease</b>	A disease that is caused by a transferrable pathogen
<b>Pathogen</b>	Micro-organism that causes infectious disease, can be transferred.
<b>Two bacteria diseases</b>	Salmonella, gonorrhoea
<b>Two viral diseases</b>	Measles, HIV
<b>Two fungal diseases</b>	Athlete's Foot, Rose Black Spot
<b>Ways to prevent pathogen transfer</b>	Disinfect surfaces. Cover mouth when coughing / sneezing. Wash hands after toilet / handling raw food. Quarantine / isolate infected.
<b>1<sup>st</sup> line body defences</b>	Skin – barrier to prevent pathogen entry Stomach acid – kills pathogens Mucus – sticky to trap pathogens Hairs – trap pathogens
<b>Immune response</b>	White blood cells Make antibodies to kill pathogen Make antitoxins to neutralise toxins Engulf and digest pathogens

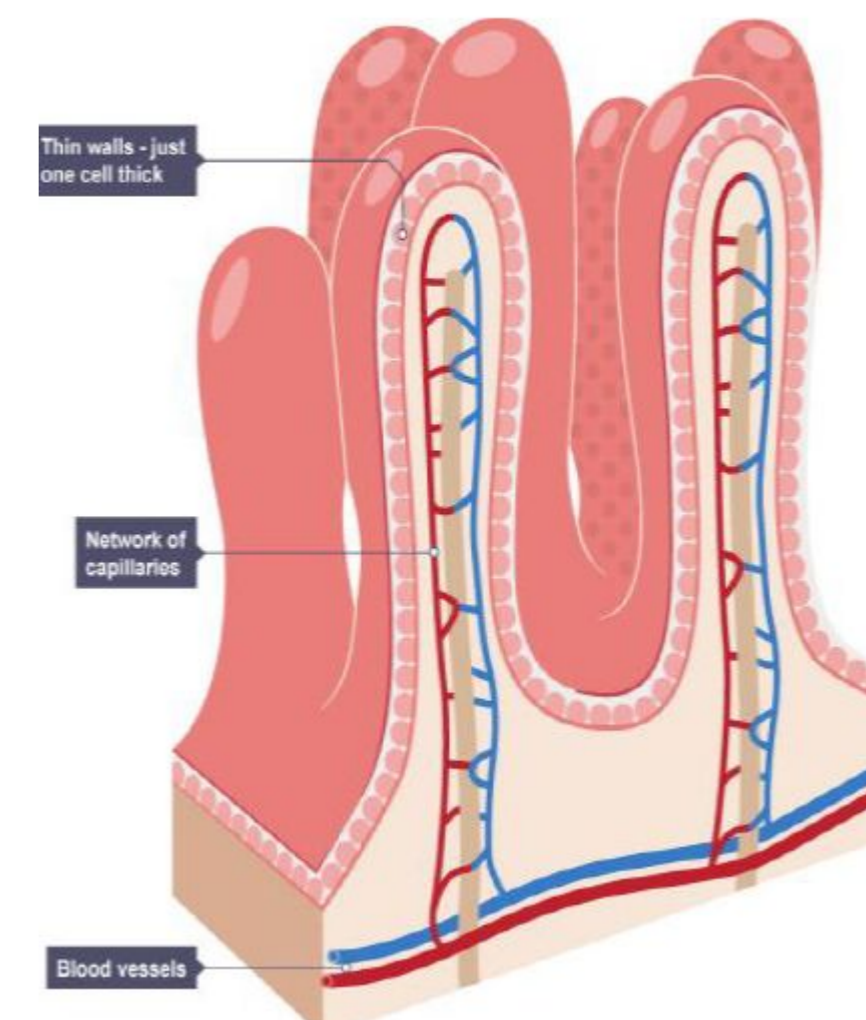
Particles move in and out of cells by **diffusion**.  
During diffusion, particles spread out from where they are in **high concentration** to where they are in **low concentration**.

Glucose and oxygen move from the blood **into** cells by diffusion.  
Carbon dioxide moves **out of** cells to the blood by diffusion.



Pathogen with antigens  
Pathogen gets in through a cut  
White blood cells engulf and digest bacteria  
White blood cells produce antibodies  
Antibodies destroy bacteria and stay in blood

### Adaptations of the Small Intestine



The small intestine is adapted for efficient absorption of digested food into the blood stream by:

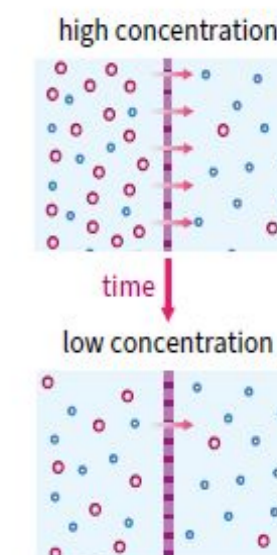
- Having a very large surface area.
- Surrounded by lots of blood capillaries.
- Thin walls (1 cell thick) for faster absorption.

During **diffusion**, particles spread out from where they are in an area of **high concentration** to where they are in an area of **low concentration**.

Factors which affect the rate of diffusion:

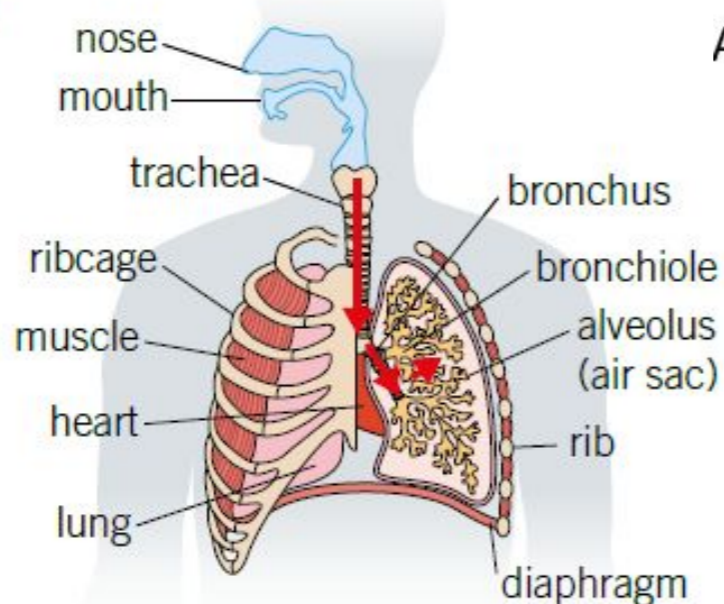
- concentration gradient
- temperature
- surface area

**Osmosis** is a special type of diffusion. It is the movement of water molecules from an area where they are in a high concentration to an area where they are in low concentration, through a **partially permeable membrane**.

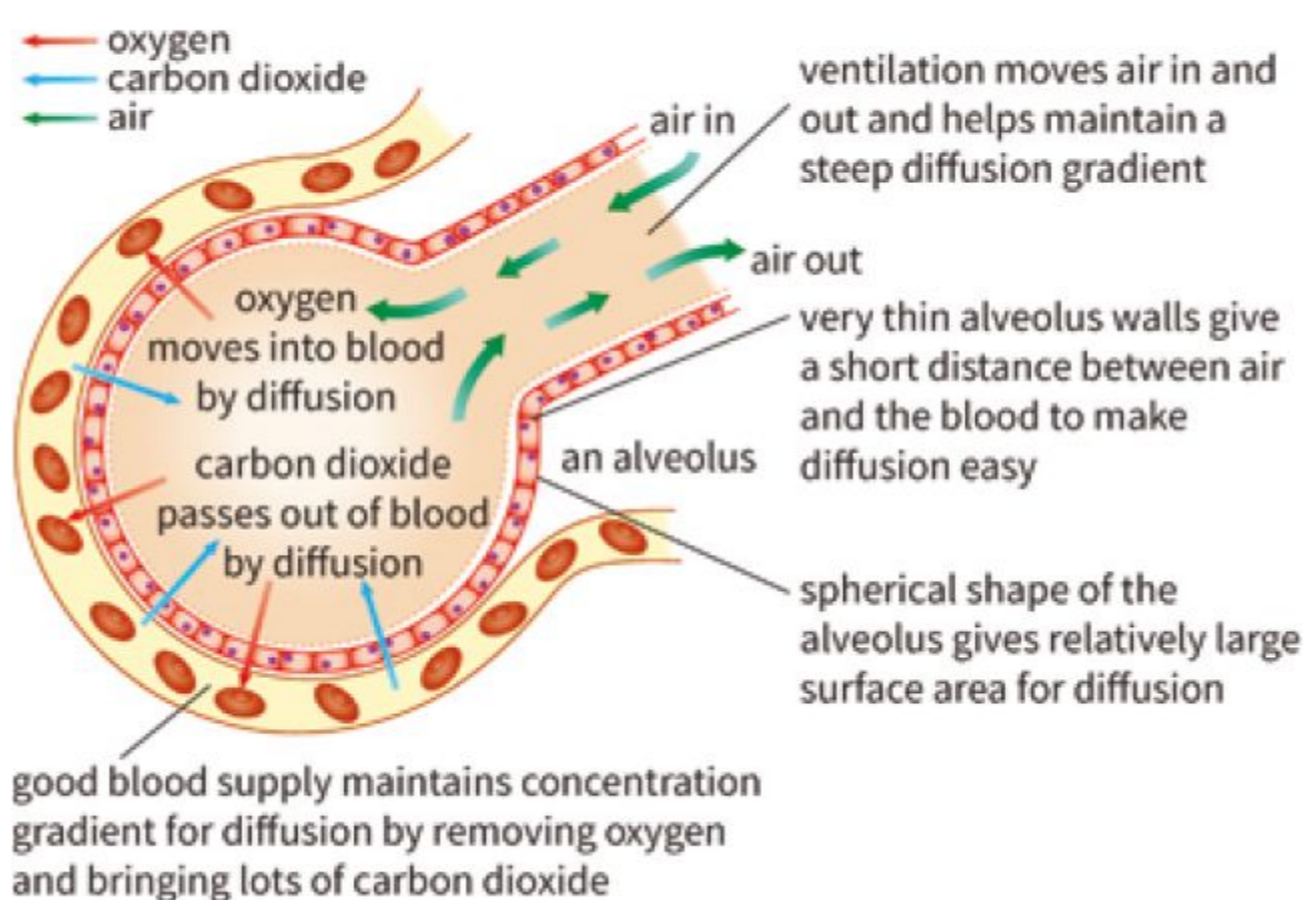


The respiratory system is involved in:

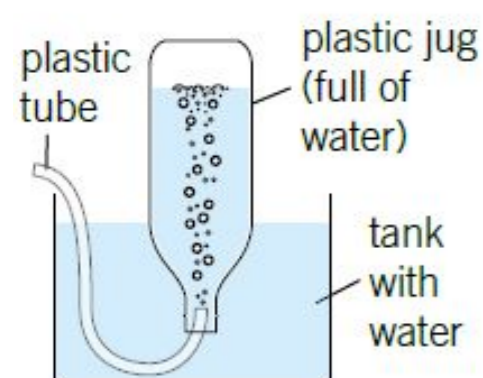
- breathing in oxygen (for **respiration**)
- breathing out waste carbon dioxide.



### Adaptations of an alveolus



<b>When you breathe in (inhale)</b>	<ul style="list-style-type: none"> <li>• muscles between ribs contract</li> <li>• ribs are pulled up and out</li> <li>• diaphragm contracts and flattens</li> <li>• volume of the chest increases</li> <li>• pressure inside the chest decreases</li> <li>• air rushes into the lungs</li> </ul>
<b>When you breathe out (exhale)</b>	<ul style="list-style-type: none"> <li>• muscles between ribs relax</li> <li>• ribs are pulled in and down</li> <li>• diaphragm relaxes and moves up</li> <li>• volume in the chest decreases</li> <li>• pressure inside the chest increases</li> <li>• air is forced out of the lungs</li> </ul>

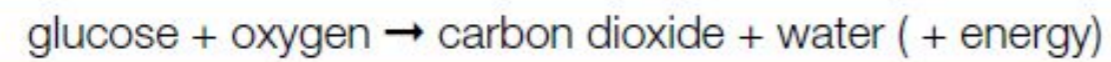


### Measuring lung volume

When you breathe out fully into the plastic tube, air from your lungs pushes water out of the bottle.  
**volume of air in the plastic bottle**

=  
**lung volume**

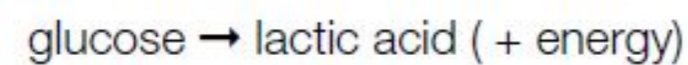
## with oxygen Aerobic respiration



- Respiration occurs in the **mitochondria** of cells to produce energy.
- Glucose is absorbed from the small intestine into the blood **plasma**. It is transported to the cells where it diffuses in.
- Oxygen is breathed in and diffuses into the bloodstream. Oxygen is then carried by haemoglobin to the cells where it diffuses in.
- Carbon dioxide diffuses out of the cells into the blood plasma. It is transported to the lungs where it diffuses into the air sacs and is exhaled.

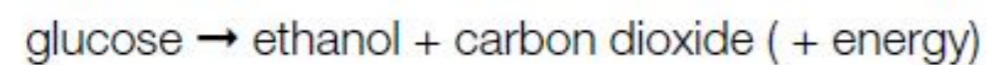
## without oxygen

### Anaerobic respiration (in animals)



- This occurs when there is not enough oxygen for aerobic respiration, such as during strenuous exercise.
- It transfers less energy than aerobic respiration.
- The lactic acid produced can cause muscle cramps. This causes increased inhalation to break down lactic acid – the oxygen needed is called the **oxygen debt**.

### Fermentation (in microorganisms)



- Yeast respire anaerobically – this fermentation is important in food production (e.g., bread, beer, and wine).

Keyword	Definition
<b>Oxygen debt</b>	Amount of oxygen needed to break down lactic acid from anaerobic respiration
<b>Nicotine</b>	Addictive, speeds up heart rate – greater risk of heart attack
<b>Tar</b>	Causes cancer – mouth, lungs, trachea Paralyses cilia so mucus not removed Blocks alveoli so less gas exchange with blood
<b>Carbon monoxide</b>	Binds to haemoglobin in red blood cells so less oxygen carried to cells, less energy released by aerobic respiration
<b>Three smoking diseases</b>	Lung cancer, lung disease, heart disease
<b>Drug</b>	Chemical that changes chemical reactions in cell or body e.g. caffeine, alcohol
<b>Short term effects of alcohol</b>	Slower reaction time, loss of inhibitions
<b>Long term effects of alcohol</b>	Brain damage, liver damage

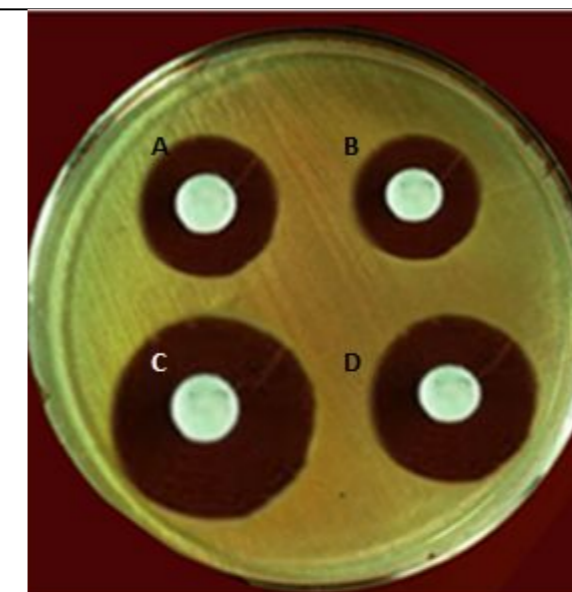
Testing Antibiotic work.

Clear area around antibiotic disc = Zone of Inhibition

The bacteria have been killed in this area.

Larger area around antibiotic disc.

More bacteria have been killed. Antibiotic is more effective.



## Drugs

Drugs are any chemicals that affect the way your brain and body work.

Medicinal drugs	Recreational drugs
<ul style="list-style-type: none"> <li>• used in medicine</li> <li>• benefit your health if used correctly</li> <li>• used to treat symptoms or cure illness</li> <li>• some have side effects</li> </ul> examples include: painkillers, antibiotics, and cough mixture	<ul style="list-style-type: none"> <li>• taken for enjoyment/to relax/stay awake</li> <li>• normally have no health benefits</li> <li>• many can be harmful</li> <li>• many are illegal</li> </ul> examples include: alcohol, caffeine, heroine, cocaine, tobacco

## Smoking

Cigarette smoke is full of harmful chemicals including:

**tar** – clogs the lining of the lungs and alveoli, contains cancer-causing chemicals

**nicotine** – an addictive stimulant

**carbon monoxide** – stops blood from carrying oxygen.

Smoking can cause many different diseases, including:

- heart disease
- emphysema
- respiratory infections
- strokes
- lung cancer

Smoking during pregnancy increases the risk of miscarriage and low birth weight babies, and can also affect the foetus' development.

## Alcohol

Alcohol is a depressant because it slows down your body's reactions

Drinking large amounts of alcohol over a long time can cause:

- stomach ulcers
- heart disease
- reduced fertility
- brain damage
- liver damage (cirrhosis)

Drinking during pregnancy increases the risk of:

- miscarriage
- stillbirth
- premature birth
- low birth weight babies
- Foetal Alcohol Syndrome (FAS)

**Addiction** – When your body becomes used to the chemical changes caused by a drug and you need to take the drug to feel normal.

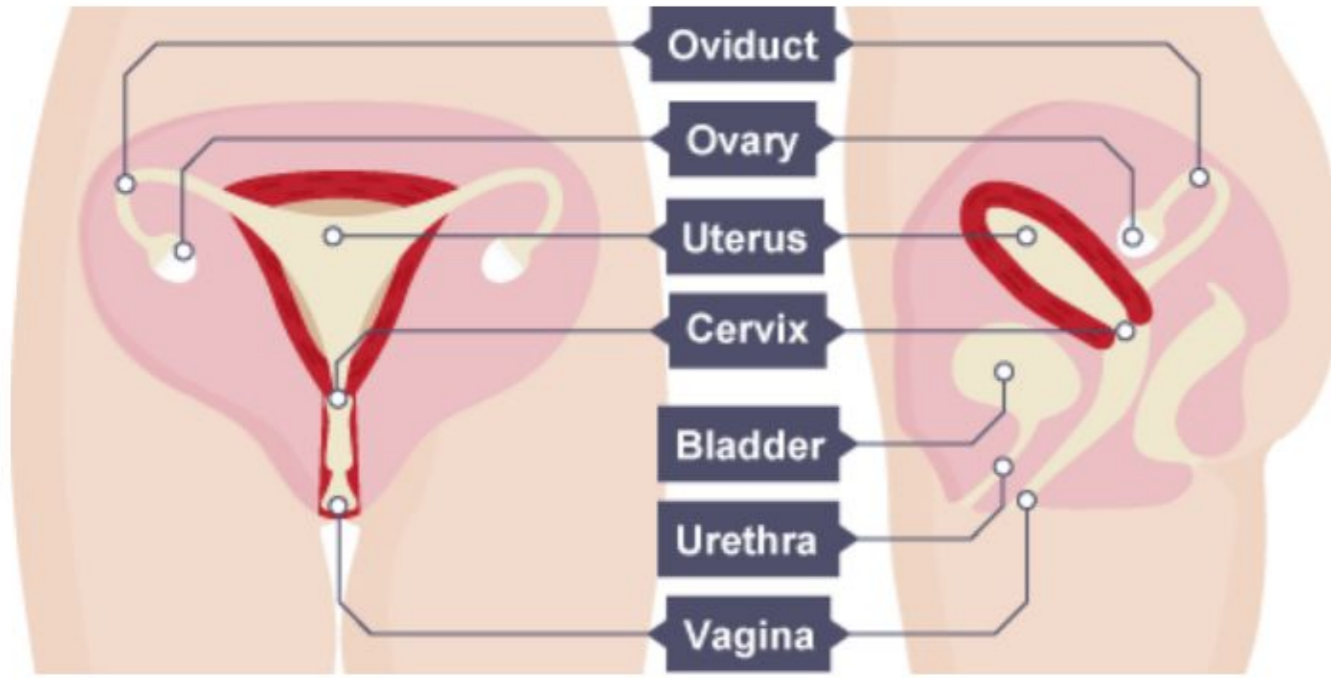
When a person who is addicted to a drug tries to stop taking it, they may suffer from sickness, nausea, stomach cramps, headaches, anxiety, and sweating. These are called **withdrawal symptoms**.

### Further Reading:

- <https://www.bbc.co.uk/bitesize/topics/znvycdm>
- <https://www.bbc.co.uk/bitesize/topics/zf339j6>
- <https://www.bbc.co.uk/bitesize/topics/zvrrd2p>
- <https://www.bbc.co.uk/bitesize/topics/ztmnb9q>

### The Female Reproductive System

The two ovaries contain hundreds of undeveloped female gametes. These are called ova (one is called an ovum). Women have these cells in their body from birth. Each ovary is connected to the uterus by an oviduct, sometimes known as the fallopian tube. Every month, an egg develops, becomes mature and is released from an ovary.

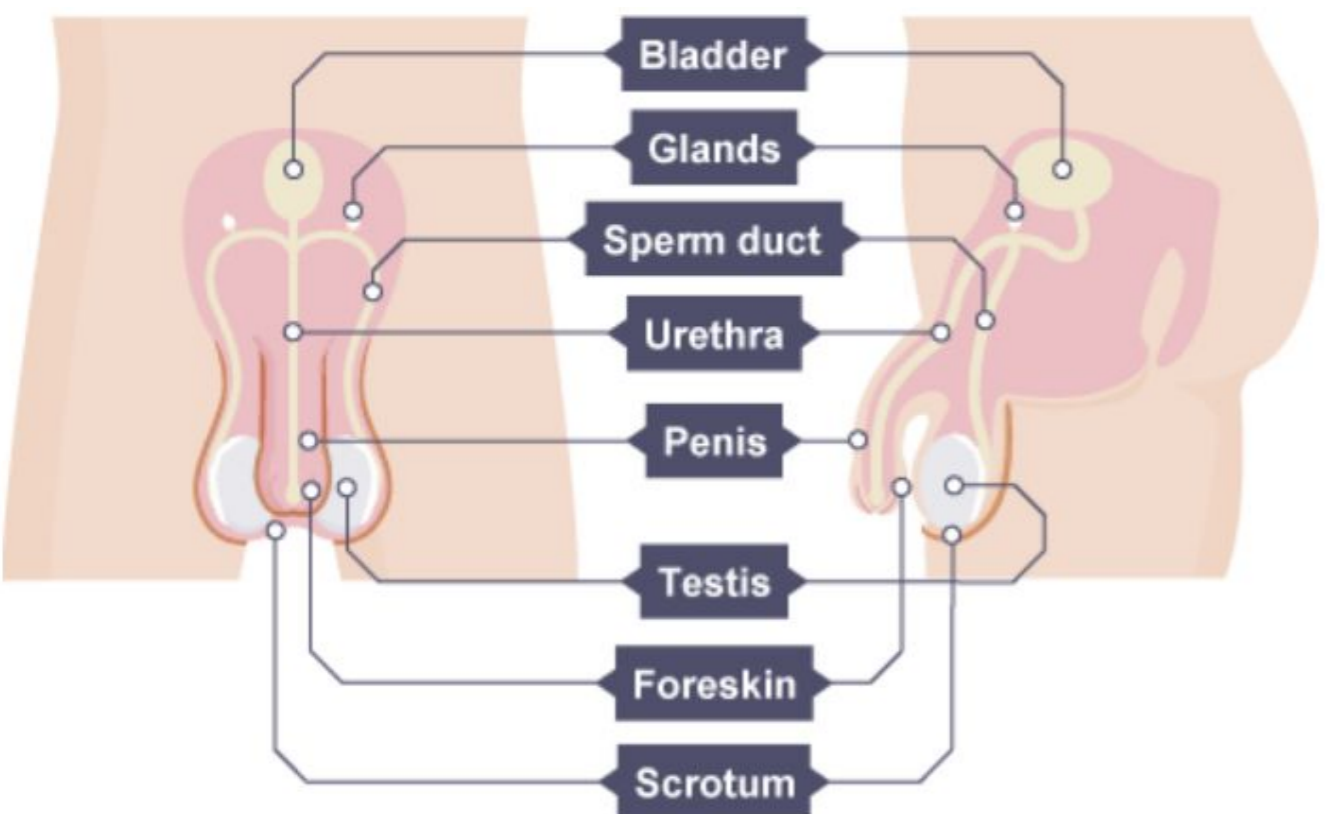


The uterus is where a baby develops until its birth.

- The cervix is a ring of muscle at the lower end of the uterus. It keeps the baby in place while the woman is pregnant.
- The vagina is a muscular tube that leads from the cervix to the outside of the woman's body.

### The Male Reproductive System

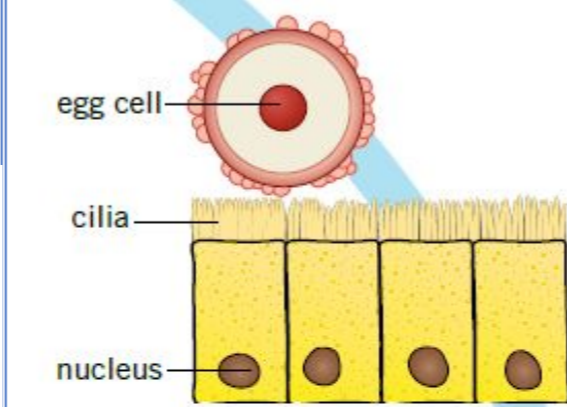
The testes produce millions of male gametes (sex cells) called sperm. The sperm pass through sperm ducts, and mix with fluids produced by the glands. The penis passes urine and semen out of the male's body. The urethra is the tube which carries the urine or semen.



## B4 Genes, Evolution and Reproduction

### Fertilisation

An egg is released every month.



The egg cell is moved along the oviduct towards the uterus by **cilia**.

Sperm cells are produced in the **testicles/testes**.

Sperm are mixed with nutrients and fluid from the glands to form **semen**.

During sexual intercourse a male will release semen into the vagina (**ejaculation**).

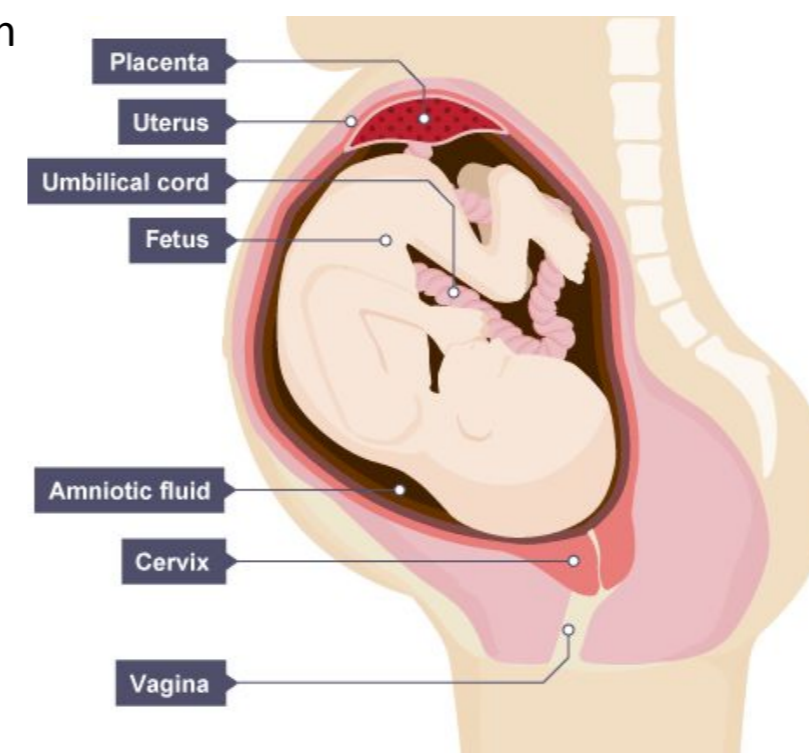
If a sperm meets the egg **fertilisation** may happen.

The fertilised egg may then **implant** in the uterus lining and form an **embryo** (ball of cells)

### Foetus Development & Placenta

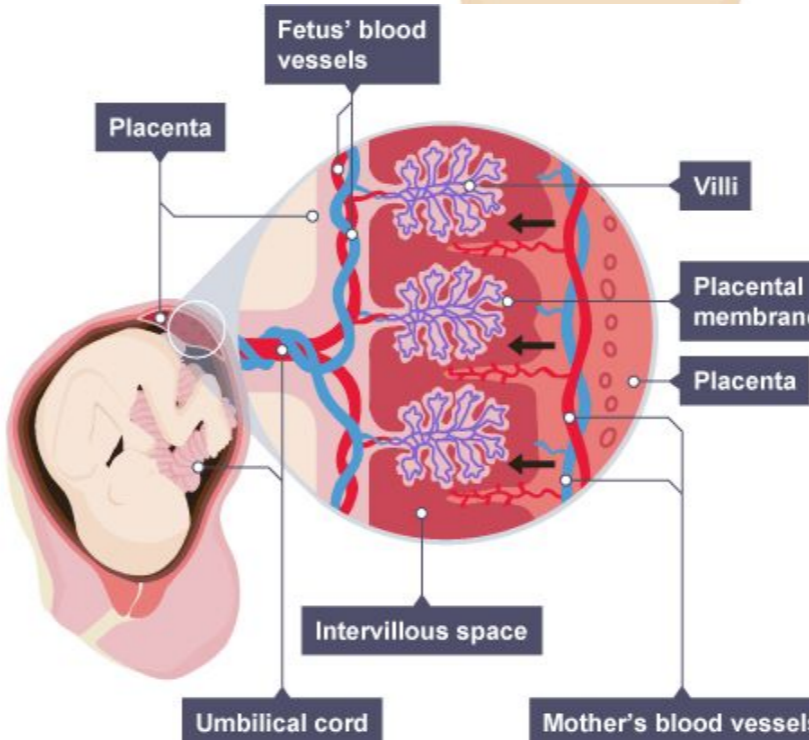
The foetus relies upon its mother as it develops.

- Protection against knocks and bumps.
- Oxygen
- Nutrients (food & Water)

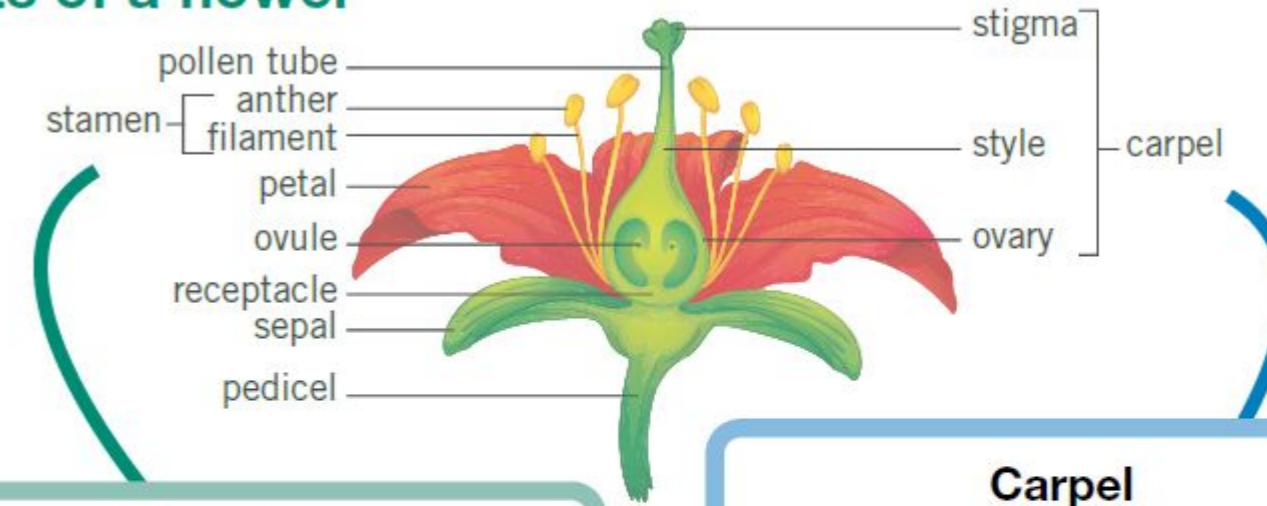


The placenta is an organ responsible for providing oxygen and nutrients, and removing waste substances. It grows into the wall of the uterus and is joined by the foetus by the umbilical cord.

- Oxygen & nutrients diffuse from mother to foetus.
- Carbon dioxide and other waste substances diffuse across the placenta from foetus to mother.



### Parts of a flower



#### Stamen

- male** part of the flower
- the **anther** produces pollen
  - the **filament** holds up the anther

#### Carpel

- female** part of the flower
- the **stigma** is sticky to catch grains of pollen
  - the **style** holds up the stigma
  - the ovary contains **ovules**

### Pollination

Pollination is the fertilisation of the ovule, which occurs when pollen is transferred from an anther to the stigma. Pollination can occur due to insects or the wind.

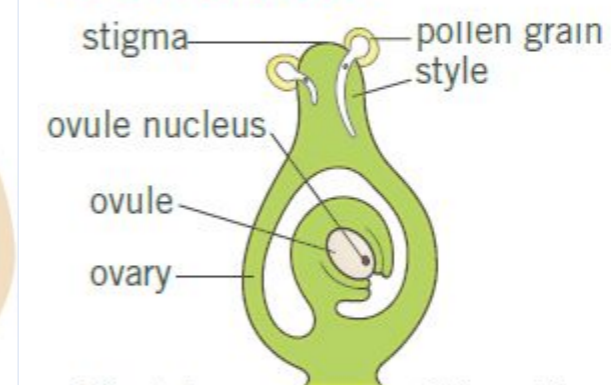
#### cross-pollination

between two **different** plants

#### self-pollination

between the male and female parts of the **same** plant

### Fertilisation



The tube grows out of the pollen grain and down through the style.



The pollen nucleus moves down the tube.



The pollen nucleus joins with the ovule nucleus. Fertilisation takes place and a seed will form.

The ovules become seeds and are dispersed away from each other and from the parent plant. This is so they have space to grow and do not compete for resources such as nutrients. Dispersal can be by wind, animal, water or by explosion.

### Germination

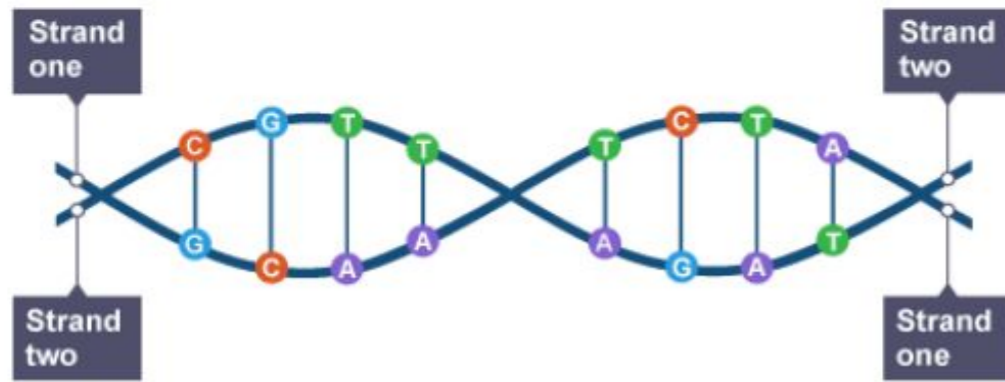
When a seed starts to grow it is called **germination**.

To germinate, seeds need:

- water – for the seed to swell and the embryo to start growing
- oxygen – for respiration and transferring energy for germination
- warmth – to help speed up the reactions in the plant.

**DNA**  
DNA is found in the nuclei of cells and organized into chromosomes. This genetic information is passed from one generation to the next. It is called heredity and why we resemble our parents. The genetic information itself is contained in a complex molecule called DNA.

DNA molecules contain two strands. The strands are twisted around each other to form a double helix. These strands are held together by bonds between base pairs.



A DNA molecule showing its base pairs, G-C and A-T

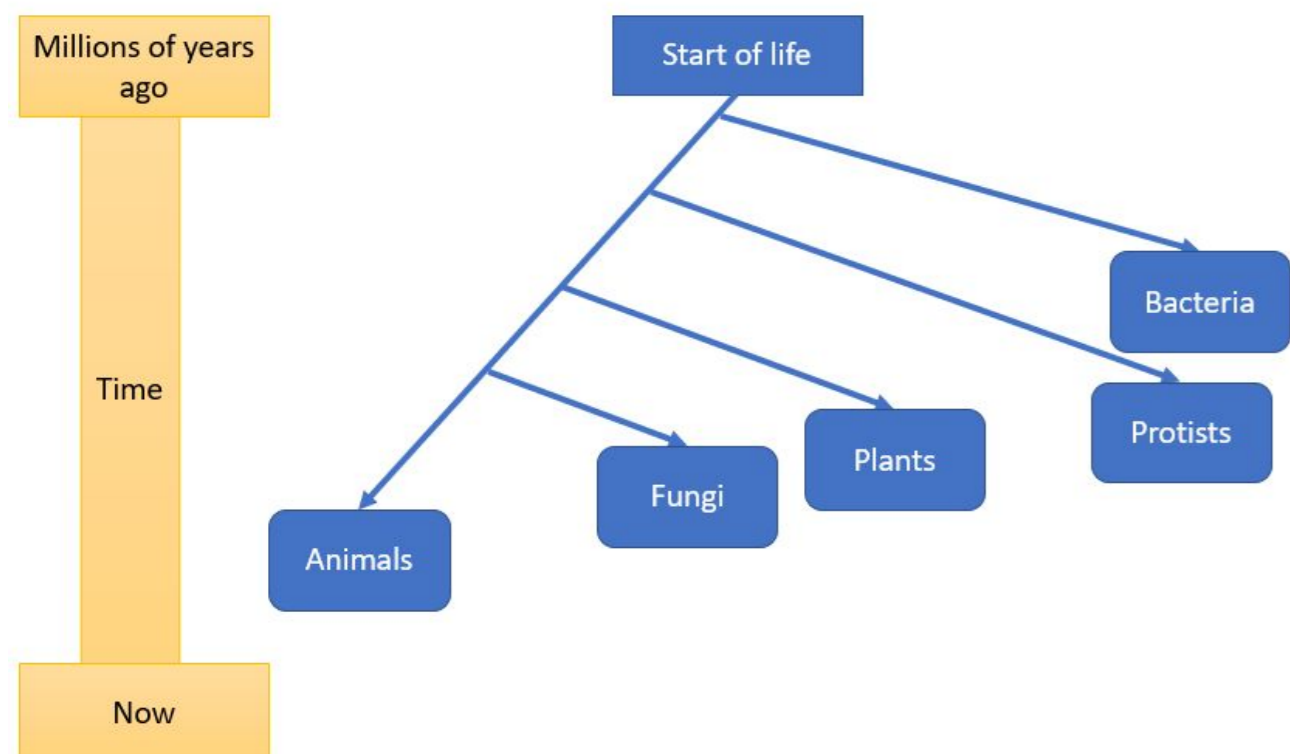
**Chromosomes and Genes**

DNA molecules are so long and thin, it is coiled into structures called chromosomes. The chromosomes are found in the nucleus of each cell.

Human body cells each contain 23 pairs of chromosomes, half of which are from each parent. Human gametes (eggs and sperm) each contain 23 chromosomes. When an egg is fertilized by a sperm, it becomes a cell with 23 pairs of chromosomes. This is why children resemble both their parents – half of their chromosomes and DNA come from their mother, and half from their father.

A gene is a section of DNA that is responsible for characteristics such as eye colour. Humans have around 20,000 genes. One copy of all your chromosomes is called your genome.

**Evolutionary tree**



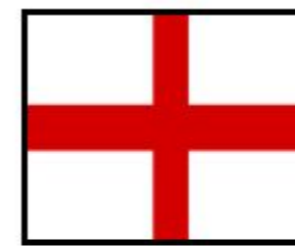
**B4 Genes, Evolution and Reproduction**

**Environmental Variation**

Characteristics of animal and plant species can be affected by factors such as climate, diet, accidents, culture and lifestyle.

If you eat too much food then you will become heavier.

Variation caused by the surroundings is called environmental variation. Examples include your language and religion.



**Inherited Variation**

Variation in characteristics that is a result of genetic information from parents.

Examples include:

- Eye colour
- Hair colour
- Lobed or lobeless ears
- Ability to roll your tongue.



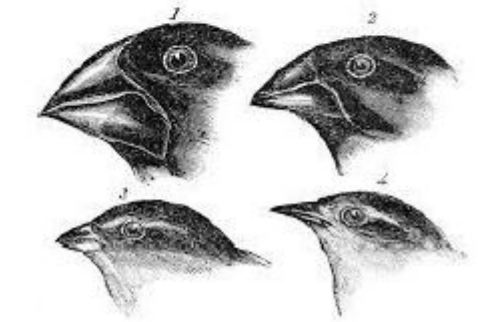
**Evolution**

Change in the inherited characteristics of a population over time through a process of natural selection, which may result in the formation of a new species.

The theory of evolution by natural selection states that all species of living things have evolved from simple life forms that first developed more than three billion years ago.

Natural selection of variants that give rise to phenotypes best suited to their environment.

- Variation (mutation)
- Adaptation
- Survival & Reproduction



**Extinction**

The permanent loss of all the members of a species

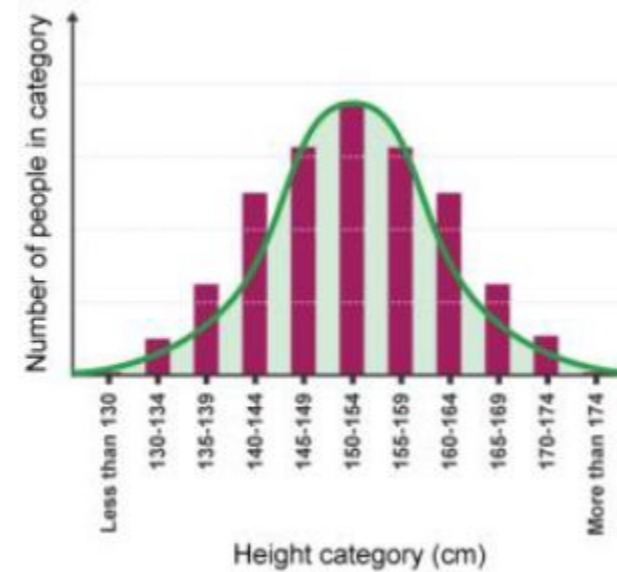
**Reasons for extinction:**

- Introduction of a NEW disease
- Introduction of a NEW competitor
- Introduction of a NEW predator / overhunting
- Lack of food / prey
- Environmental change (temp., rainfall, loss of habitat etc.)
- Natural disaster



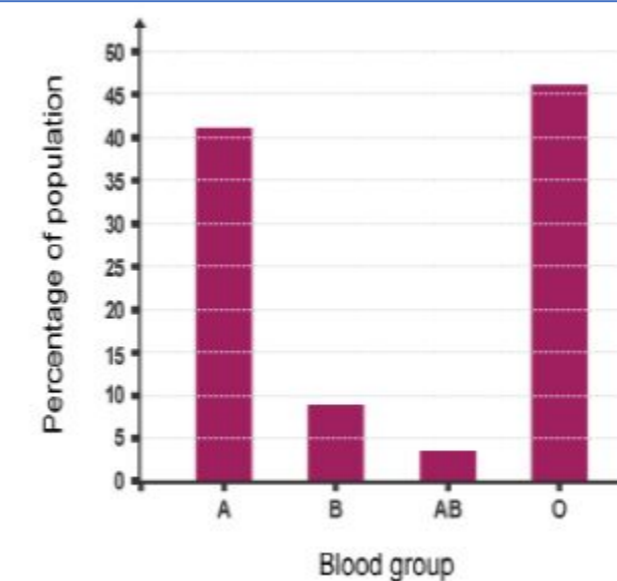
**Continuous Variation**

Human height is an example. It ranges from the smallest person on Earth to the tallest. Continuous variation shows characteristics that change gradually over time.



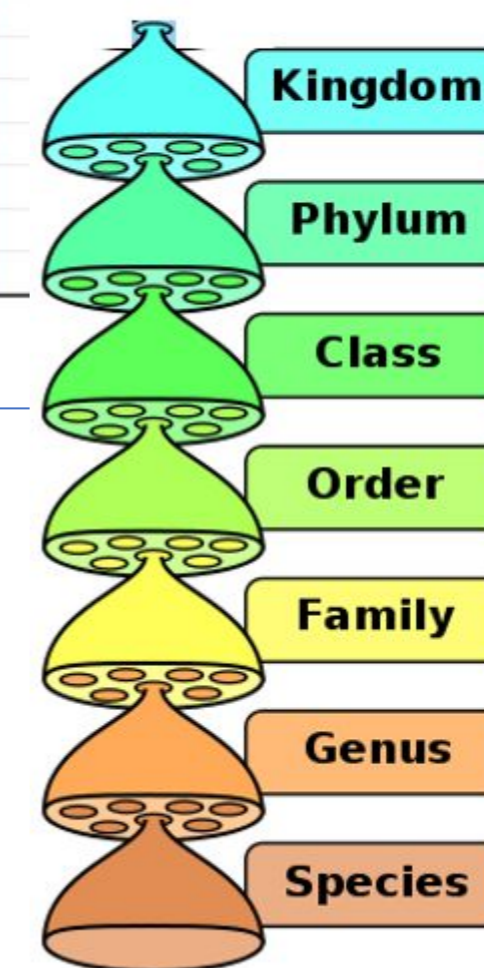
**Discontinuous Variation**

A characteristic of any species with only a limited number of possible values. Eye colour and blood group are examples.



**Further Reading:**  
<https://www.bbc.co.uk/bitesize/topics/znycdm>  
<https://www.bbc.co.uk/bitesize/topics/zybbkqt>  
<https://www.bbc.co.uk/bitesize/topics/zxhhvcw>  
<https://www.bbc.co.uk/bitesize/topics/zpffr82>

**The Classification Ladder**



We can further classify an organism into these subgroups.

Largest number of organisms

The number of organisms decreases

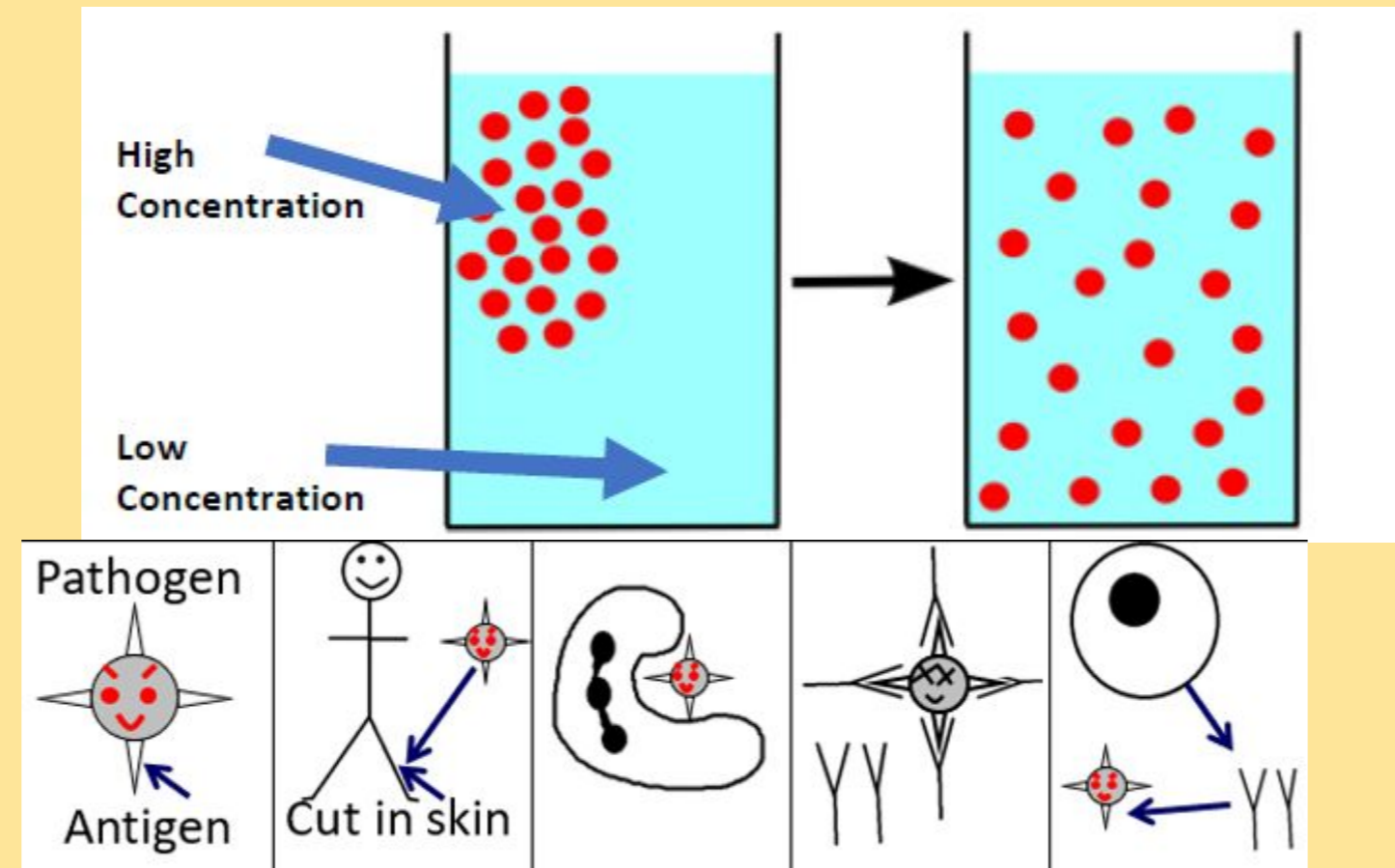
Smallest number of organisms – the animal is named.

Keyword	Definition
<b>Differences between animal and bacteria cell</b>	Bacteria cells are smaller. Bacteria cells have no nucleus. Bacteria cells have a cell wall.
<b>Communicable disease</b>	A disease that is caused by a transferrable pathogen
<b>Pathogen</b>	Micro-organism that causes infectious disease, can be transferred.
<b>Two bacteria diseases</b>	Salmonella, gonorrhoea
<b>Two viral diseases</b>	Measles, HIV
<b>Two fungal diseases</b>	Athlete's Foot, Rose Black Spot
<b>Ways to prevent pathogen transfer</b>	Disinfect surfaces. Cover mouth when coughing / sneezing. Wash hands after toilet / handling raw food. Quarantine / isolate infected.
<b>1<sup>st</sup> line body defences</b>	Skin – barrier to prevent pathogen entry Stomach acid – kills pathogens Mucus – sticky to trap pathogens Hairs – trap pathogens
<b>Immune response</b>	White blood cells Make antibodies to kill pathogen Make antitoxins to neutralise toxins Engulf and digest pathogens

## B3 Disease and Staying Healthy

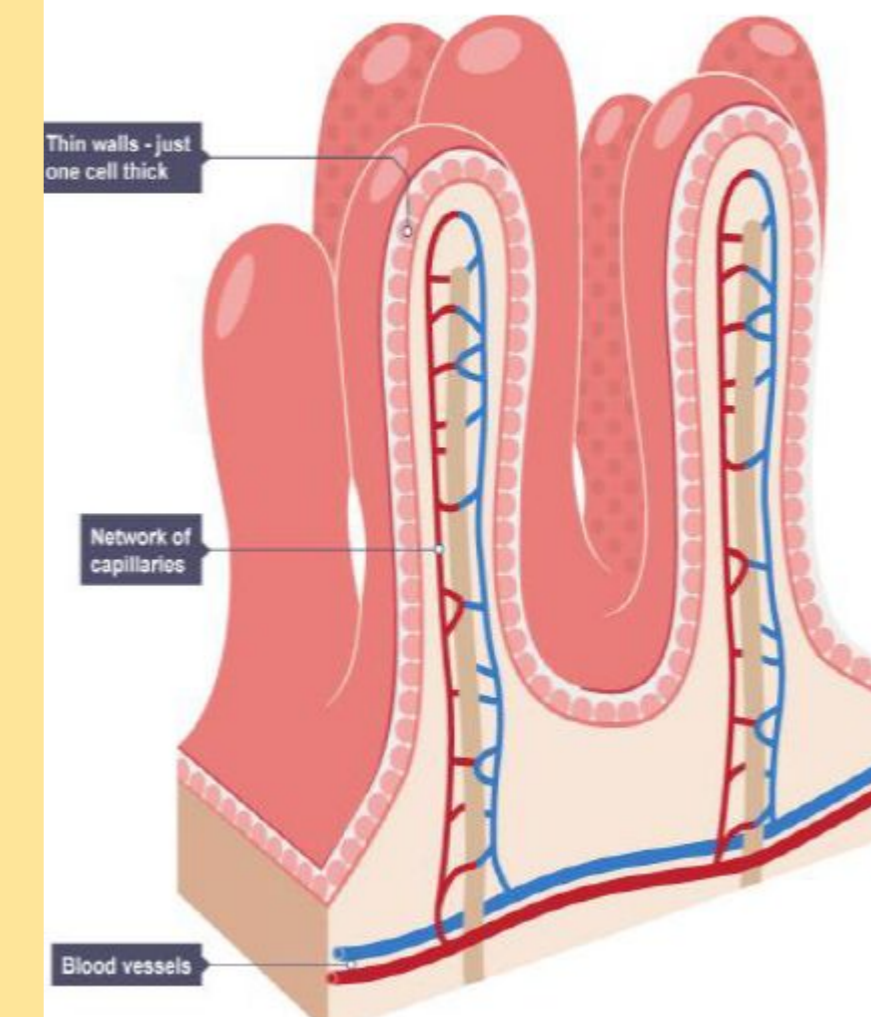
Particles move in and out of cells by **diffusion**.  
During diffusion, particles spread out from where they are in **high concentration** to where they are in **low concentration**.

Glucose and oxygen move from the blood **into** cells by diffusion.  
Carbon dioxide moves **out of** cells to the blood by diffusion.



Pathogen with antigens  
Pathogen gets in through a cut  
White blood cells engulf and digest bacteria  
White blood cells produce antibodies  
Antibodies destroy bacteria and stay in blood

### Adaptations of the Small Intestine



The small intestine is adapted for efficient absorption of digested food into the blood stream by:

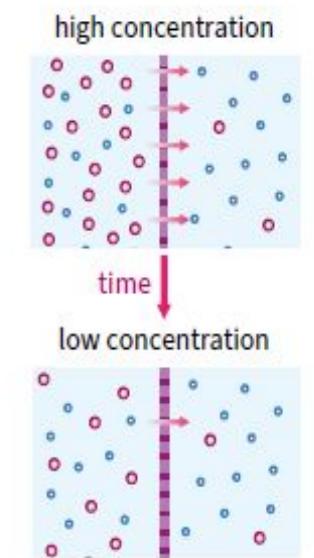
- Having a very large surface area.
- Surrounded by lots of blood capillaries.
- Thin walls (1 cell thick) for faster absorption.

During **diffusion**, particles spread out from where they are in an area of **high concentration** to where they are in an area of **low concentration**.

Factors which affect the rate of diffusion:

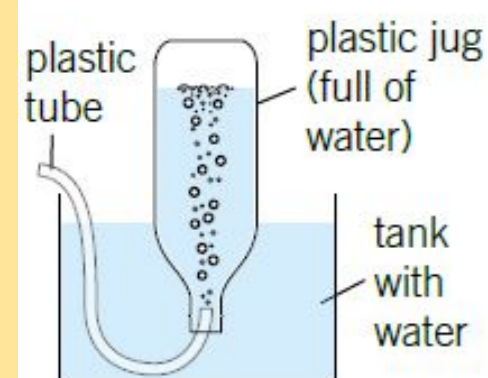
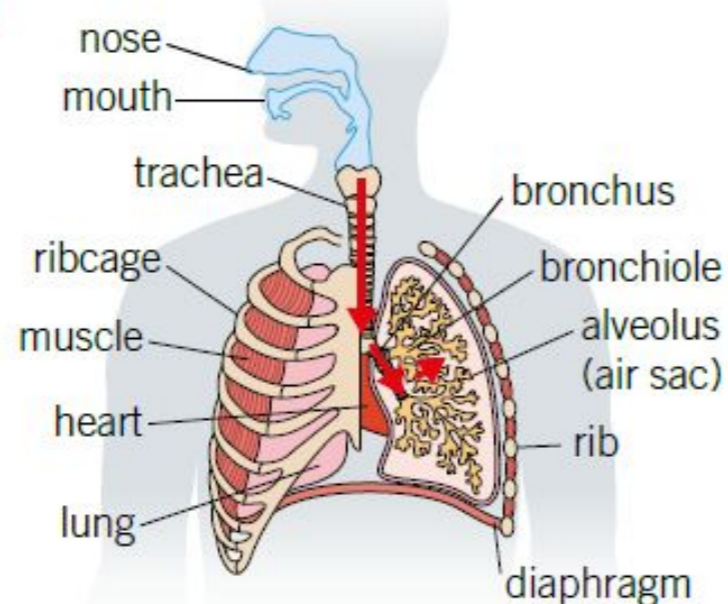
- concentration gradient
- temperature
- surface area

**Osmosis** is a special type of diffusion. It is the movement of water molecules from an area where they are in a high concentration to an area where they are in low concentration, through a **partially permeable membrane**.



The respiratory system is involved in:

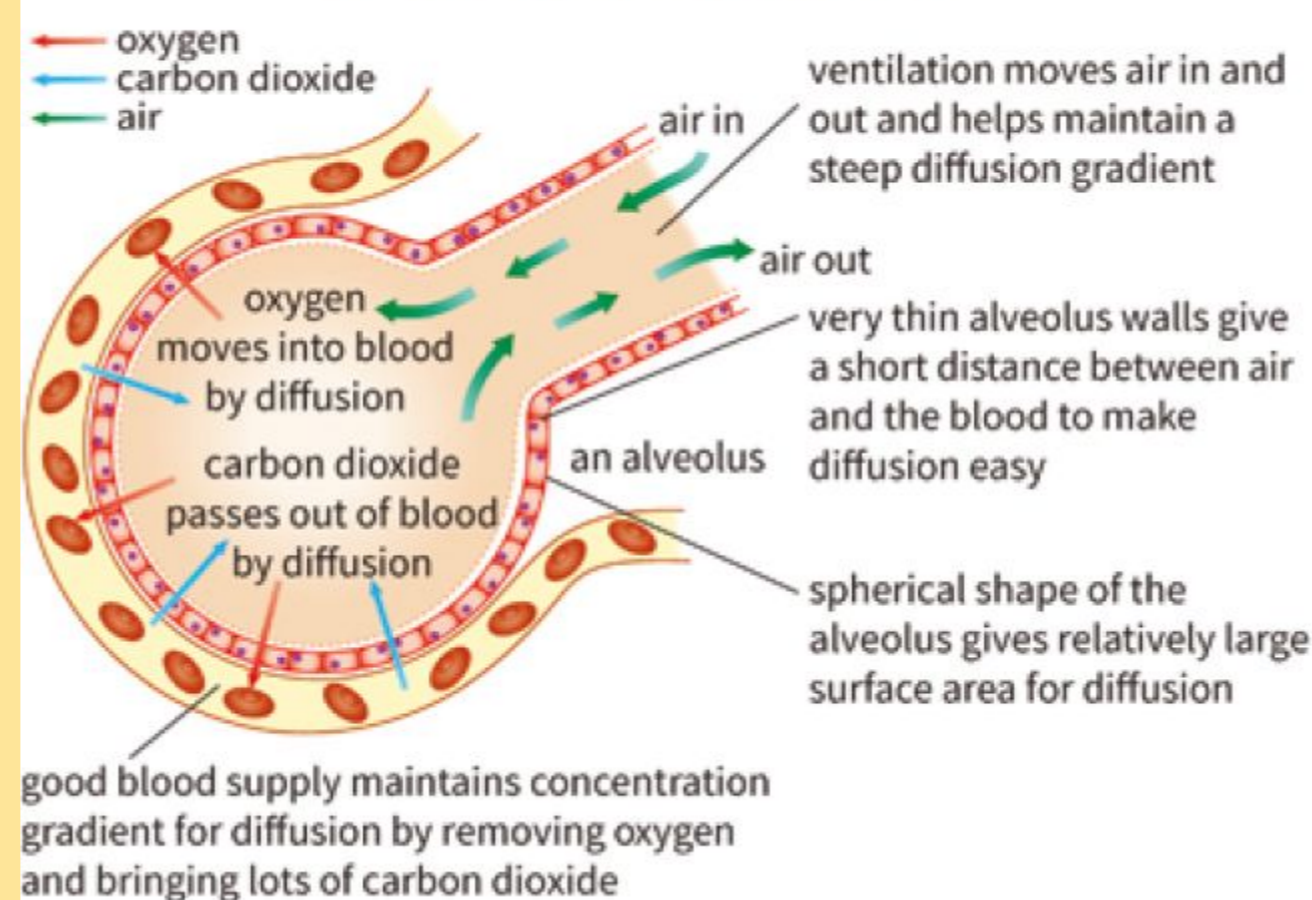
- breathing in oxygen (for **respiration**)
- breathing out waste carbon dioxide.



### Measuring lung volume

When you breathe out fully into the plastic tube, air from your lungs pushes water out of the bottle.  
**volume of air in the plastic bottle = lung volume**

### Adaptations of an alveolus



#### When you breathe in (inhale)

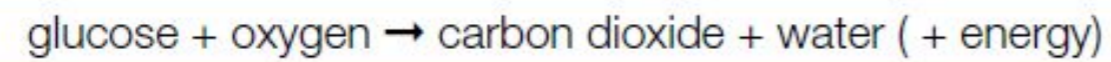
- muscles between ribs contract
- ribs are pulled up and out
- diaphragm contracts and flattens
- volume of the chest increases
- pressure inside the chest decreases
- air rushes into the lungs

#### When you breathe out (exhale)

- muscles between ribs relax
- ribs are pulled in and down
- diaphragm relaxes and moves up
- volume in the chest decreases
- pressure inside the chest increases
- air is forced out of the lungs

# B3 Disease and Staying Healthy

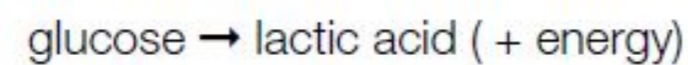
## with oxygen Aerobic respiration



- Respiration occurs in the **mitochondria** of cells to produce energy.
- Glucose is absorbed from the small intestine into the blood **plasma**. It is transported to the cells where it diffuses in.
- Oxygen is breathed in and diffuses into the bloodstream. Oxygen is then carried by haemoglobin to the cells where it diffuses in.
- Carbon dioxide diffuses out of the cells into the blood plasma. It is transported to the lungs where it diffuses into the air sacs and is exhaled.

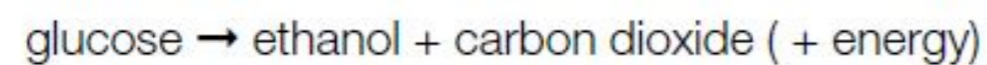
## without oxygen

### Anaerobic respiration (in animals)



- This occurs when there is not enough oxygen for aerobic respiration, such as during strenuous exercise.
- It transfers less energy than aerobic respiration.
- The lactic acid produced can cause muscle cramps. This causes increased inhalation to break down lactic acid – the oxygen needed is called the **oxygen debt**.

### Fermentation (in microorganisms)



- Yeast respire anaerobically – this fermentation is important in food production (e.g., bread, beer, and wine).

## Drugs

Drugs are any chemicals that affect the way your brain and body work.

Medicinal drugs	Recreational drugs
<ul style="list-style-type: none"> <li>• used in medicine</li> <li>• benefit your health if used correctly</li> <li>• used to treat symptoms or cure illness</li> <li>• some have side effects</li> </ul> examples include: painkillers, antibiotics, and cough mixture	<ul style="list-style-type: none"> <li>• taken for enjoyment/to relax/stay awake</li> <li>• normally have no health benefits</li> <li>• many can be harmful</li> <li>• many are illegal</li> </ul> examples include: alcohol, caffeine, heroine, cocaine, tobacco

## Smoking

Cigarette smoke is full of harmful chemicals including:

**tar** – clogs the lining of the lungs and alveoli, contains cancer-causing chemicals

**nicotine** – an addictive stimulant

**carbon monoxide** – stops blood from carrying oxygen.

Smoking can cause many different diseases, including:

- heart disease
- emphysema
- respiratory infections
- strokes
- lung cancer

Smoking during pregnancy increases the risk of miscarriage and low birth weight babies, and can also affect the foetus' development.

## Alcohol

Alcohol is a depressant because it slows down your body's reactions

Drinking large amounts of alcohol over a long time can cause:

- stomach ulcers
- heart disease
- reduced fertility
- brain damage
- liver damage (cirrhosis)

Drinking during pregnancy increases the risk of:

- miscarriage
- stillbirth
- premature birth
- low birth weight babies
- Foetal Alcohol Syndrome (FAS)

**Addiction** – When your body becomes used to the chemical changes caused by a drug and you need to take the drug to feel normal.

When a person who is addicted to a drug tries to stop taking it, they may suffer from sickness, nausea, stomach cramps, headaches, anxiety, and sweating. These are called **withdrawal symptoms**.

Keyword	Definition
<b>Oxygen debt</b>	Amount of oxygen needed to break down lactic acid from anaerobic respiration
<b>Nicotine</b>	Addictive, speeds up heart rate – greater risk of heart attack
<b>Tar</b>	Causes cancer – mouth, lungs, trachea Paralyses cilia so mucus not removed Blocks alveoli so less gas exchange with blood
<b>Carbon monoxide</b>	Binds to haemoglobin in red blood cells so less oxygen carried to cells, less energy released by aerobic respiration
<b>Three smoking diseases</b>	Lung cancer, lung disease, heart disease
<b>Drug</b>	Chemical that changes chemical reactions in cell or body e.g. caffeine, alcohol
<b>Short term effects of alcohol</b>	Slower reaction time, loss of inhibitions
<b>Long term effects of alcohol</b>	Brain damage, liver damage

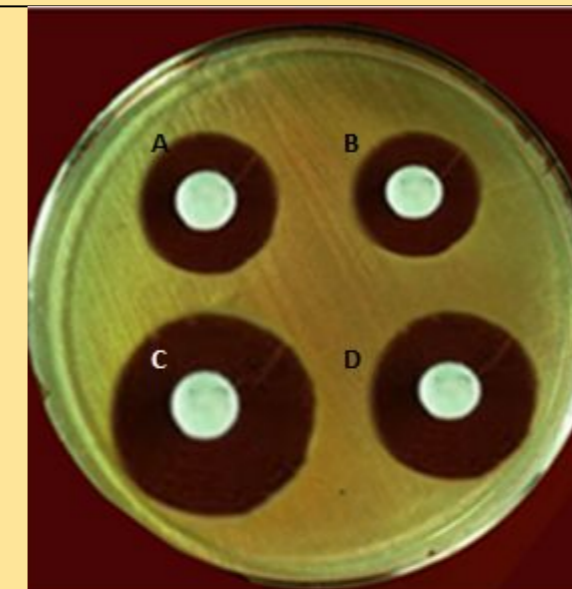
Testing Antibiotic work.

Clear area around antibiotic disc = Zone of Inhibition

The bacteria have been killed in this area.

Larger area around antibiotic disc.

More bacteria have been killed. Antibiotic is more effective.



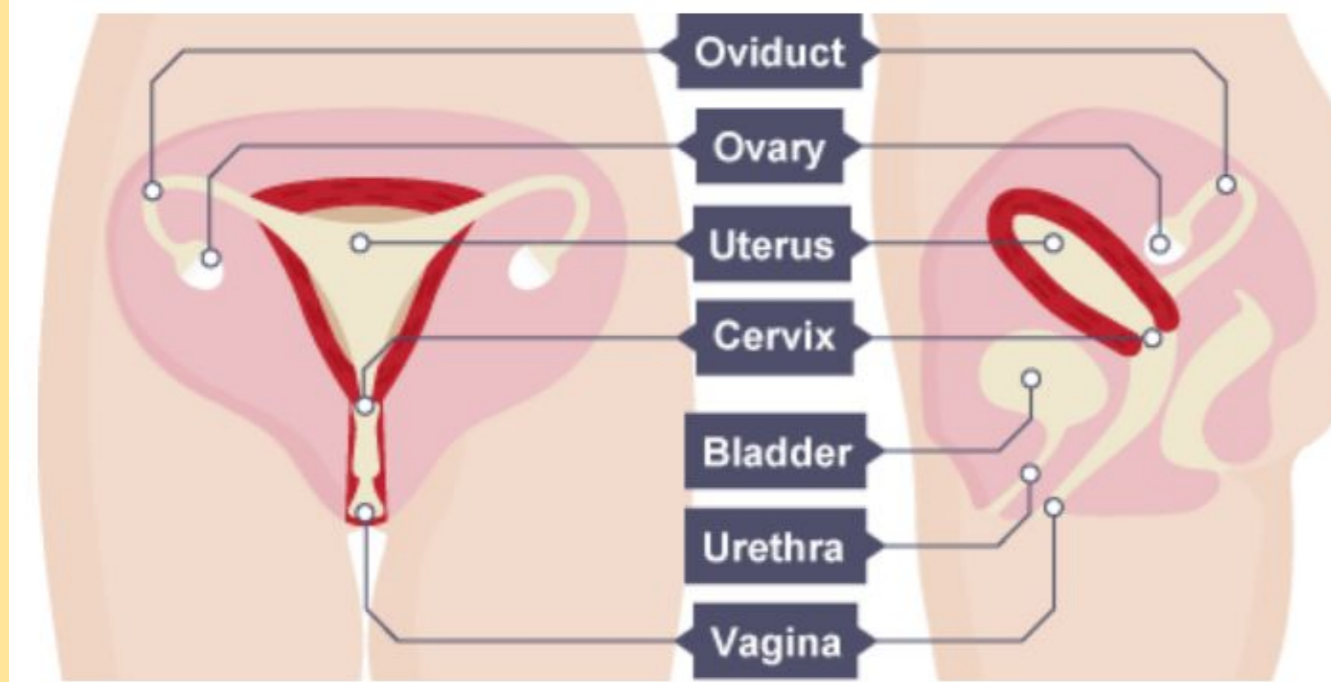
### Further Reading:

- <https://www.bbc.co.uk/bitesize/topics/znvycdm>
- <https://www.bbc.co.uk/bitesize/topics/zf339j6>
- <https://www.bbc.co.uk/bitesize/topics/zvrrd2p>
- <https://www.bbc.co.uk/bitesize/topics/ztnnb9q>

# B4 Genes, Evolution and Reproduction

## The Female Reproductive System

The two ovaries contain hundreds of undeveloped female gametes. These are called ova (one is called an ovum). Women have these cells in their body from birth. Each ovary is connected to the uterus by an oviduct, sometimes known as the fallopian tube. Every month, an egg develops, becomes mature and is released from an ovary.

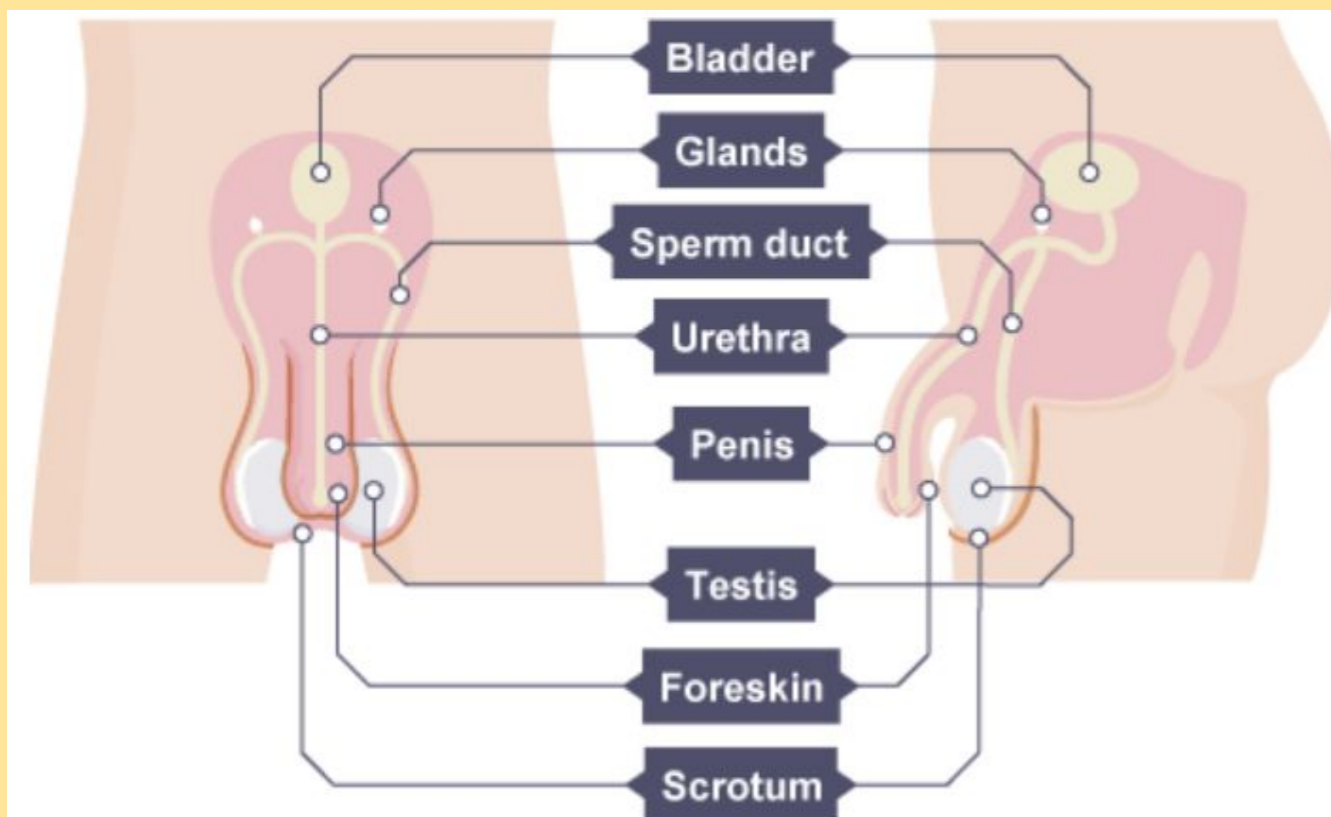


The uterus is where a baby develops until its birth.

- The cervix is a ring of muscle at the lower end of the uterus. It keeps the baby in place while the woman is pregnant.
- The vagina is a muscular tube that leads from the cervix to the outside of the woman's body.

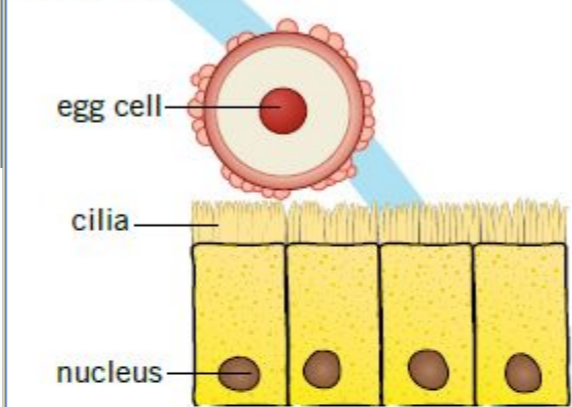
## The Male Reproductive System

The testes produce millions of male gametes (sex cells) called sperm. The sperm pass through sperm ducts, and mix with fluids produced by the glands. The penis passes urine and semen out of the male's body. The urethra is the tube which carries the urine or semen.



## Fertilisation

An egg is released every month.



The egg cell is moved along the oviduct towards the uterus by **cilia**.

Sperm cells are produced in the **testicles/testes**.

Sperm are mixed with nutrients and fluid from the glands to form **semen**.

During sexual intercourse a male will release semen into the vagina (**ejaculation**).

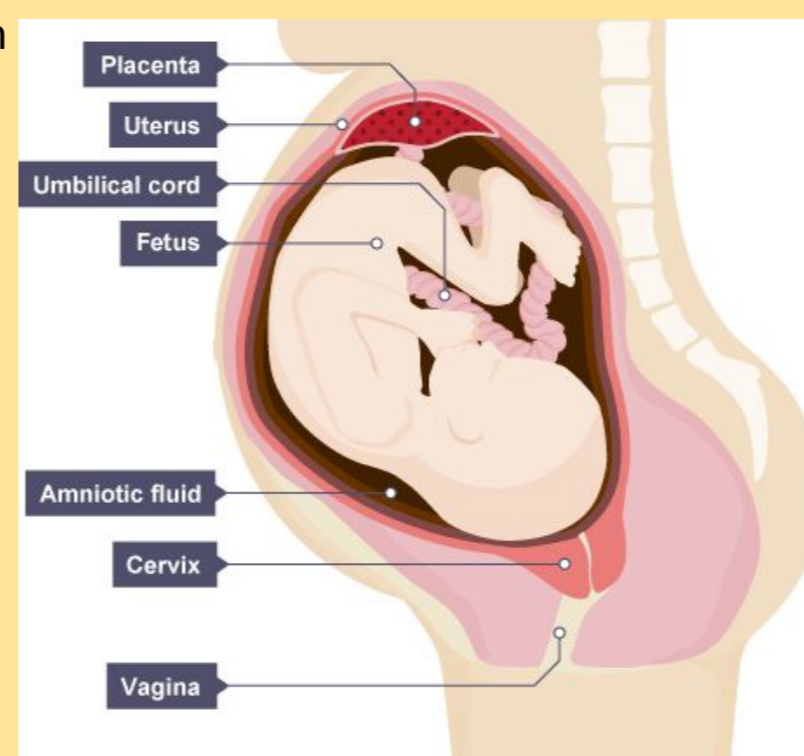
If a sperm meets the egg **fertilisation** may happen.

The fertilised egg may then **implant** in the uterus lining and form an **embryo** (ball of cells)

## Foetus Development & Placenta

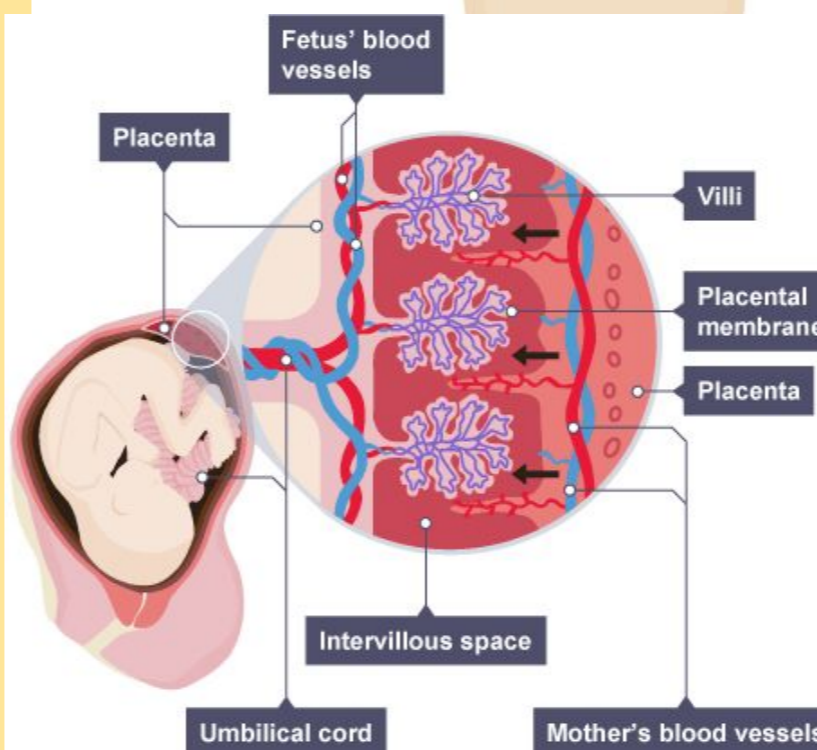
The foetus relies upon its mother as it develops.

- Protection against knocks and bumps.
- Oxygen
- Nutrients (food & Water)

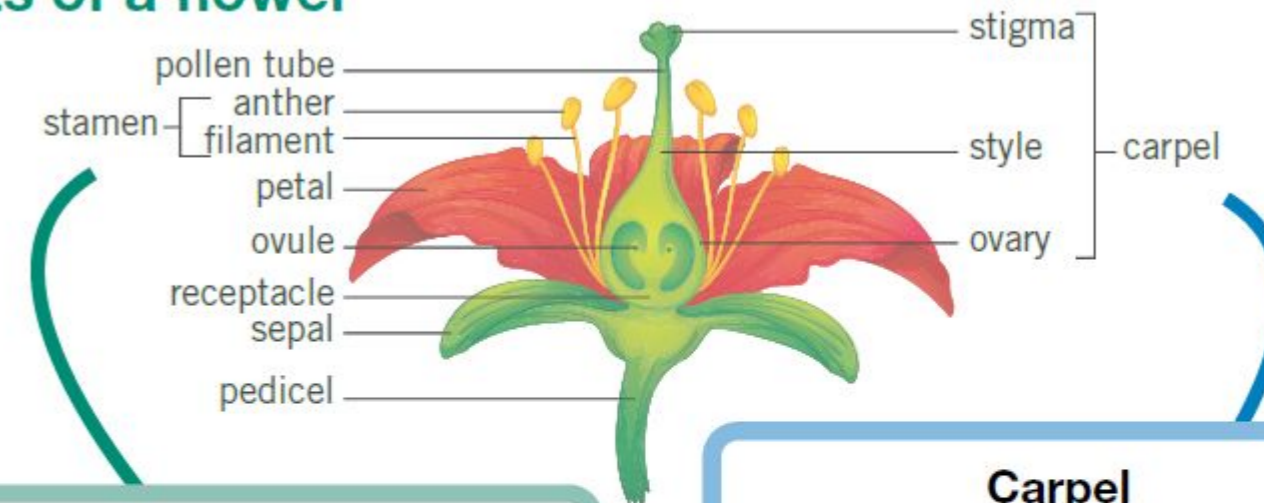


The placenta is an organ responsible for providing oxygen and nutrients, and removing waste substances. It grows into the wall of the uterus and is joined by the foetus by the umbilical cord.

- Oxygen & nutrients diffuse from mother to foetus.
- Carbon dioxide and other waste substances diffuse across the placenta from foetus to mother.



## Parts of a flower



### Stamen

- male** part of the flower
- the **anther** produces pollen
  - the **filament** holds up the anther

### Carpel

- female** part of the flower
- the **stigma** is sticky to catch grains of pollen
  - the **style** holds up the stigma
  - the ovary contains **ovules**

## Pollination

Pollination is the fertilisation of the ovule, which occurs when pollen is transferred from an anther to the stigma. Pollination can occur due to insects or the wind.

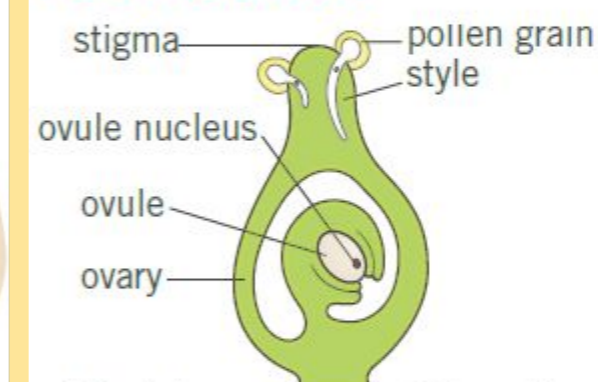
### cross-pollination

between two **different** plants

### self-pollination

between the male and female parts of the **same** plant

## Fertilisation



The tube grows out of the pollen grain and down through the style.



The pollen nucleus moves down the tube.



The pollen nucleus joins with the ovule nucleus. Fertilisation takes place and a seed will form.

The ovules become seeds and are dispersed away from each other and from the parent plant. This is so they have space to grow and do not compete for resources such as nutrients. Dispersal can be by wind, animal, water or by explosion.

## Germination

When a seed starts to grow it is called **germination**.

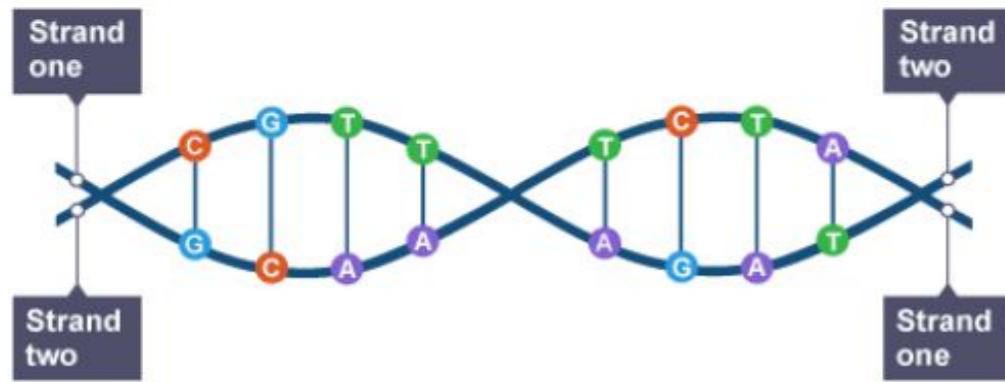
To germinate, seeds need:

- water – for the seed to swell and the embryo to start growing
- oxygen – for respiration and transferring energy for germination
- warmth – to help speed up the reactions in the plant.

## DNA

DNA is found in the nuclei of cells and organized into chromosomes. This genetic information is passed from one generation to the next. It is called heredity and why we resemble our parents. The genetic information itself is contained in a complex molecule called DNA.

DNA molecules contain two strands. The strands are twisted around each other to form a double helix. These strands are held together by bonds between base pairs.



A DNA molecule showing its base pairs, G-C and A-T

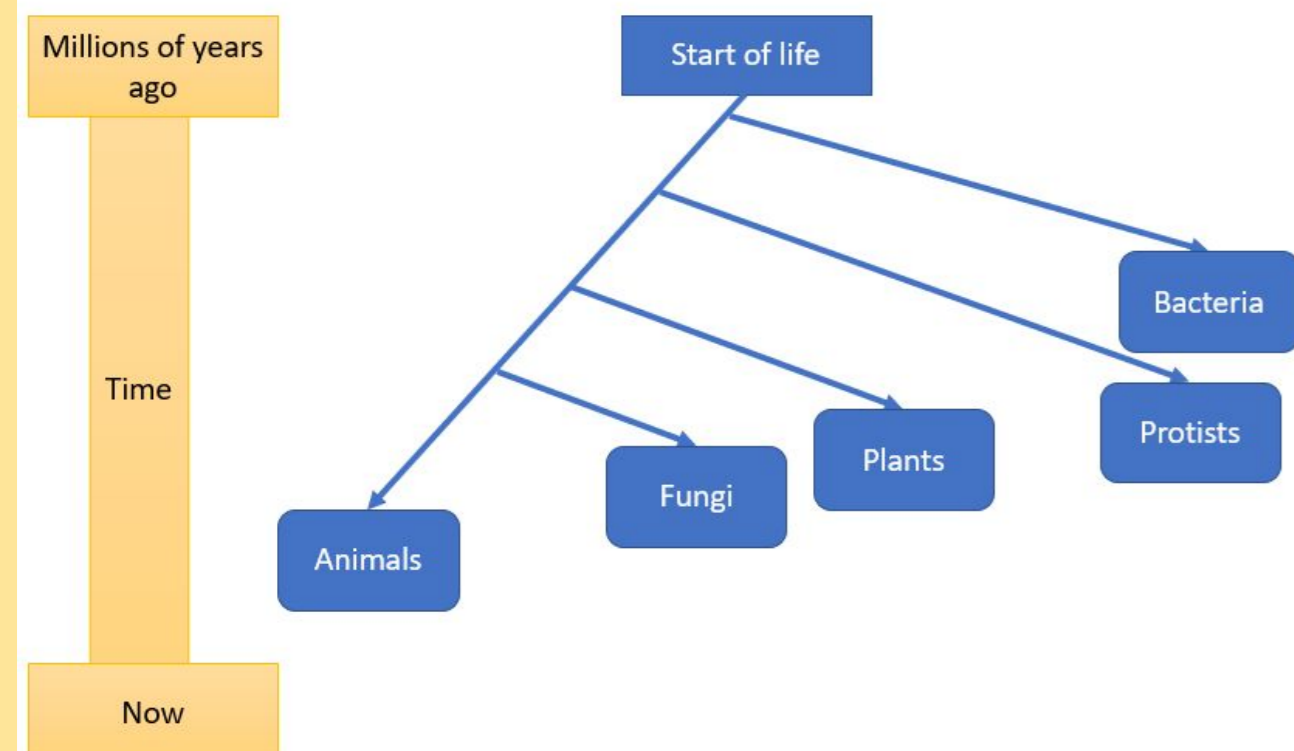
## Chromosomes and Genes

DNA molecules are so long and thin, it is coiled into structures called chromosomes. The chromosomes are found in the nucleus of each cell.

Human body cells each contain 23 pairs of chromosomes, half of which are from each parent. Human gametes (eggs and sperm) each contain 23 chromosomes. When an egg is fertilized by a sperm, it becomes a cell with 23 pairs of chromosomes. This is why children resemble both their parents – half of their chromosomes and DNA come from their mother, and half from their father.

A gene is a section of DNA that is responsible for characteristics such as eye colour. Humans have around 20,000 genes. One copy of all your chromosomes is called your genome.

## Evolutionary tree



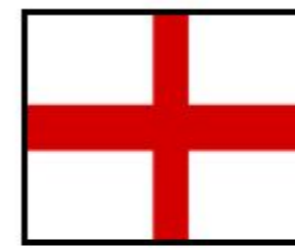
# B4 Genes, Evolution and Reproduction

## Environmental Variation

Characteristics of animal and plant species can be affected by factors such as climate, diet, accidents, culture and lifestyle.

If you eat too much food then you will become heavier.

Variation caused by the surroundings is called environmental variation. Examples include your language and religion.



## Inherited Variation

Variation in characteristics that is a result of genetic information from parents.

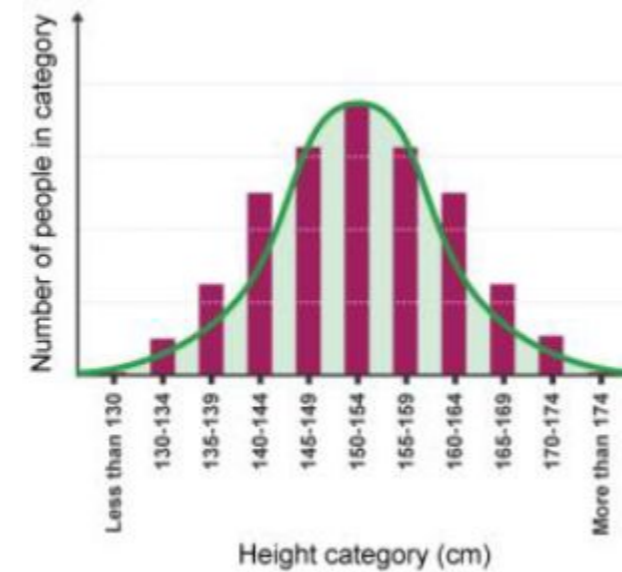
Examples include:

- Eye colour
- Hair colour
- Lobed or lobeless ears
- Ability to roll your tongue.



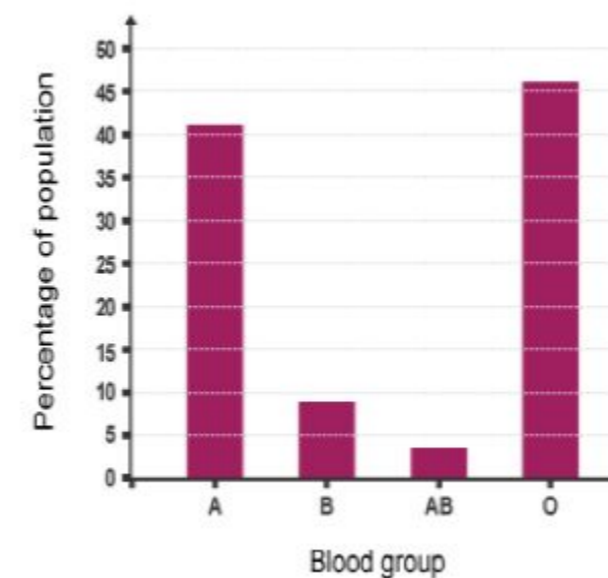
## Continuous Variation

Human height is an example. It ranges from the smallest person on Earth to the tallest. Continuous variation shows characteristics that change gradually over time.



## Discontinuous Variation

A characteristic of any species with only a limited number of possible values. Eye colour and blood group are examples.



### Further Reading:

- <https://www.bbc.co.uk/bitesize/topics/znycdm>
- <https://www.bbc.co.uk/bitesize/topics/zybbkqt>
- <https://www.bbc.co.uk/bitesize/topics/zxhhvcw>
- <https://www.bbc.co.uk/bitesize/topics/zpfr82>

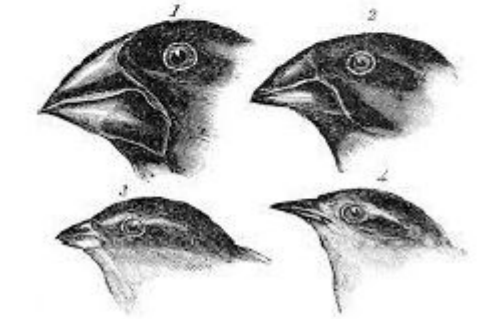
## Evolution

Change in the inherited characteristics of a population over time through a process of natural selection, which may result in the formation of a new species.

The theory of evolution by natural selection states that all species of living things have evolved from simple life forms that first developed more than three billion years ago.

Natural selection of variants that give rise to phenotypes best suited to their environment.

- Variation (mutation)
- Adaptation
- Survival & Reproduction



## Extinction

The permanent loss of all the members of a species

### Reasons for extinction:

- Introduction of a NEW disease
- Introduction of a NEW competitor
- Introduction of a NEW predator / overhunting
- Lack of food / prey
- Environmental change (temp., rainfall, loss of habitat etc.)
- Natural disaster



## The Classification Ladder

