

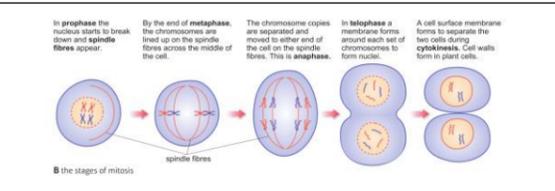
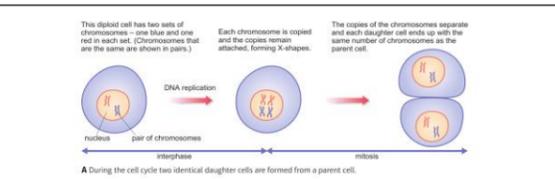
## CB2a Mitosis

What is the cell cycle?

A sequence of growth and division that happens in cells. It includes interphase and mitosis and leads to the production of 2 daughter cells that are identical to the parent cell.

How many chromosomes are found in the nuclei of human body cells?

The nuclei of human body cells contain 2 copies of each of 23 types of chromosome, making 46 in all.



What are the advantages and disadvantages of asexual reproduction? Asexual reproduction is much faster than sexual reproduction because organisms do not need each other for reproduction. However sexual reproduction produces variation.

Give an example of one animal and one plant that relies on asexual reproduction? Strawberry plants use stems that grow along the ground, called runners. Animals such as aphids also reproduce asexually.

What is asexual reproduction? Asexual reproduction produces offspring that are clones, which means that their cells have the same chromosomes as their parent (they are genetically identical).

Explain the growth of cancer tumours. Changes in cells can sometimes turn them into cancer cells, which means that they undergo uncontrollable cell division. This rapid cell division produces growing lumps of cells called tumours that can damage the body and cause death.

## CB2 – Cells and Control (paper 1)

### CB2b Growth in Animals

What is growth?

Growth is an increase in size as a result of an increase in number or size of cells.

How can growth be recorded?

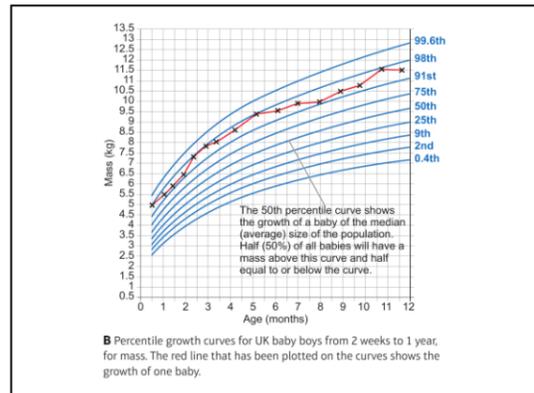
By measuring length or mass over time.

What is a percentile growth curve?

These charts were created by measuring a very large number of babies, the measurements were divided into 100 groups. When divided like this we can find out what percentage of readings are below a certain value or percentile. For example 25 percent of babies will have masses below the 25th percentile line.

What is cell differentiation?

The process by which a less specialised cell becomes more specialised for a particular function. The cell normally changes shape to achieve this.



What do the curved lines show?

The curved lines show the rate of growth of a baby who stays at exactly the same percentile within the population.

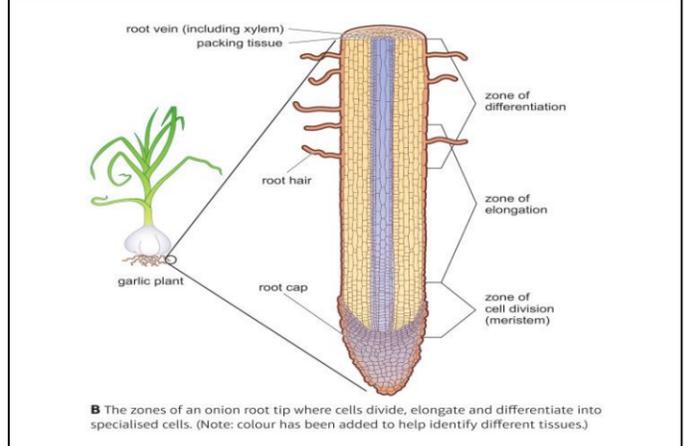
Give some examples of specialised human cells

A red blood cell has no nucleus, allowing more space for red haemoglobin molecules. Nerve cells have a long fibre that carries electrical impulses around the body. Muscle cells contain special contractile proteins that can shorten the cell.

### CB2c Growth in Plants

Explain how plants grow?

A group of cells near the end of each root and shoot allows the plant to grow. These groups of cells are called meristems. The cells in meristems divide rapidly by mitosis. The cells produced increase in length (elongation) and differentiate into specialised cells.



Give examples of specialised plant cells.

Examples of specialised plant cells are root hair cells and xylem cells. There are many different kinds of specialised cells in a plant, allowing the plant to carry out many different processes effectively.

### CB2d Stem Cells

What are stem cells?

Stem cells are cells that can divide repeatedly over a long period of time to produce cells that then differentiate. In plants these cells are found in meristems.

How do cells become specialised in most animals?

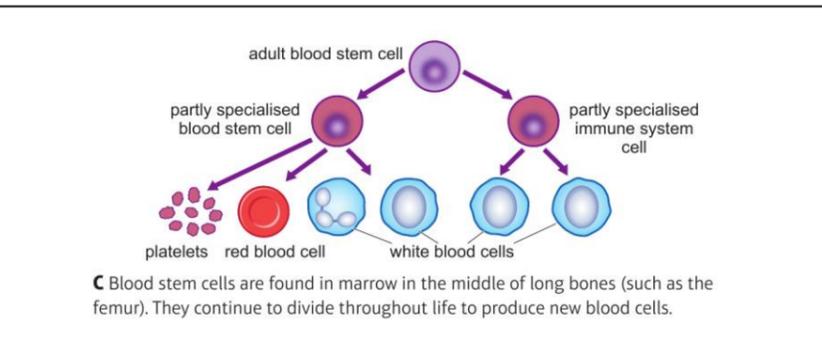
A fertilised egg cell divides to form an embryo. The cells of an early stage embryo are embryonic stem cells that can produce any type of specialised cell. As the cells divide the embryo develops different areas that will become the different organs. The stem cells then become more limited in the types of specialised cells they can produce.

What happens to stem cells in a fully developed animal?

By the time the young animal is fully developed, the stem cells produce the type of specialised cell that is in the tissue. These are called adult stem cells.

What is the function of an adult stem cell?

The adult stem cells in humans allow the tissues to grow and to replace old or damaged cells.



How can stem cells be used to treat diseases?

Scientists have studied embryonic stem cells to treat diseases such as type 2 diabetes or to replace damaged cells. This is done by stimulating stem cells to produce specialised cells and injecting them into the places they are needed.

What are the problems with using stem cells?

If the stem cell continues to divide inside the body after they replace damaged cells, they can cause cancer. Also stem cells from one person are often killed by the immune system of the person they are put into. This is called rejection.

### CB2e The Nervous System

What is the central nervous system?

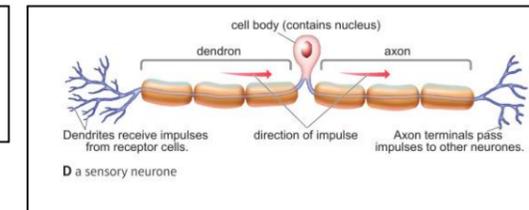
The brain and spinal cord form the central nervous system (CNS), which controls your body. Nerves make up the rest of the nervous system, this organ system allows all the parts of your body to communicate using electrical signals called nerve impulses.

What is a stimulus?

Anything your body is sensitive to, including changes inside your body and in your surroundings. Sense organs (such as eyes, ears and skin) contains receptor cells that detect stimuli. For example skin contains receptor cells that detect the stimulus of temperature change.

What is neurotransmission?

The travelling or transmission of impulses is called neurotransmission and happens in neurones. Neurones have a cell body and long extensions to carry impulses.



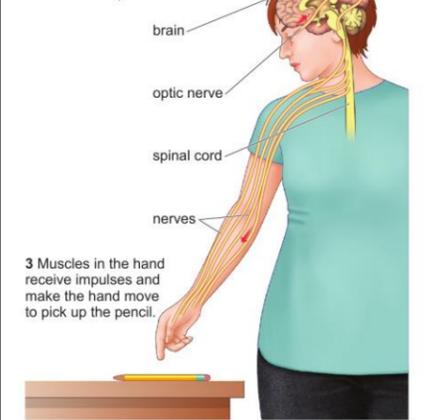
Why are dendrons and axons frequently long?

They are long to allow fast neurotransmission over long distances.

What is a myelin sheath?

It is a fatty layer surrounding dendrons and axons. They electrically insulate a neurone, stopping the signal losing energy. It also makes an impulse jump along the cell between the gaps in the myelin and speeds up neurotransmission.

1 Impulses from receptor cells in the eye are transmitted by sensory neurones in the optic nerve to the brain. The brain processes these impulses and 'sees' the pencil.  
2 The brain can send more impulses to tell parts of the body to do something (the response).



3 Muscles in the hand receive impulses and make the hand move to pick up the pencil.  
**C** This is what happens in the nervous system when someone picks up a pencil.

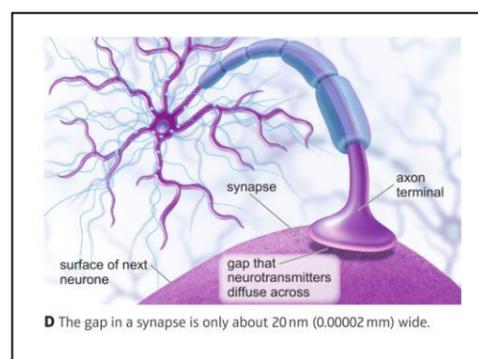
### CB2f Neurotransmission Speeds

What is an effector?

When the brain coordinates a response to a stimulus, impulse are sent to effector and these carry out an action. Effector include muscles and glands.

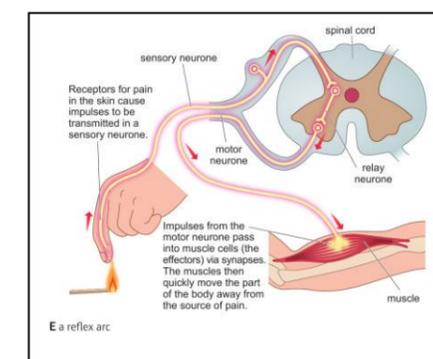
Explain the role of different neurones?

Motor neurone carry impulse to effectors. Relay neurones are short neurones found in the spinal cord, where they link motor and sensory neurones. Neither of these types of neurone has a Dendron and the dendrites are on the cell body.



What is a reflex action?

Reflex actions are responses that are automatic, extremely quick and protect the body. For example moving your finger away from a hot candle.



Why are synapses useful?

They are useful because neurotransmitters are only released from axon terminals and so impulse only flow in one direction. They also allow many fresh impulses to be generated in many neurones connected to one neurone.

What is a reflex arc?

A neurone pathway consisting of a sensory neurone passing impulses to a motor neurone via a relay neurone which allows a reflex action to occur.

What is a synapse?

One neurone meets another at a synapse which contains a tiny gap. When an impulse reaches an axon terminal a neurotransmitter substance is released into the gap. This is detected by the next neuron which generates a new impulse.

## Key Vocabulary Definitions

Asexual reproduction – producing new organism from 1 parent only, these organisms are genetically identical to the parent.

Axon – the long extension of a neurone that carries an impulse away from the dendron or dendrites towards other neurones.

Axon terminals – the small button at the end of the branches that leave an axon.

Cancer cells – a cell that continues dividing causing disease.

Clones – the offspring from asexual reproduction, all the cells in a clone are genetically identical to each other and to the parents' cells.

Daughter cells - a new cell produced from the division of a parent cell.

Dendrite – a fine extension from a neurone which carries impulse towards the cell body.

Dendron – large long extension of a sensory neurone that carries impulse from a dendrite towards the axon.

Differentiation – a process by which a less specialised becomes more specialised for a particular function. The cell normally changes shape to achieve this.

Diploid – a cell or nucleus that has 2 sets of chromosomes. In humans, almost all cells except the sperms and egg cells are diploid.

DNA – deoxyribonucleic acid. A polymer made of sugar and phosphate groups joined to bases.

Elongation – when something gets longer such as a cell in a plant root or shoot before it differentiates into a specialised cell.

Haploid – a cell or nucleus that has one set of chromosomes. Gametes are haploid.

Impulses – an electrical signal transmitted along a neurone.

Mitosis – the process of cells dividing to produce two diploid daughter cells that are genetically identical to the parent.

Neurones – a cell that transmits electrical impulses in the nervous system.

Neurotransmission – impulses passing from neurone to neurone.

Neurotransmitter – a substance that diffuses across the gap between one neurone and the next at a synapse, and triggers an impulse to be generated.

Percentile – the value of a variable below which a certain percentage of observations fall. For example, in an ordered set of data the 20<sup>th</sup> percentile is the value at which 20 percent of the data points are the same or lower.

Rejection – when the immune system attacks and kills cells and tissue that come from another person such as blood cells or stem cells.

Root hair cells – a cell found on the surface of plant roots that has a large surface area to absorb water and dissolved mineral salts quickly from the soil.

Stem cells – an unspecialised cell that continues to divide by mitosis to produce more stem cells and other cells that differentiate into specialised cells.

Synapse - the point at which 2 neurones meet. There is a tiny gap between neurones at a synapse.

Tumour – a lump formed of cancer cells.

Xylem cells – a long, thick-walled tube formed in plants, made from many dead xylem cells. The vessels carry water and dissolved mineral salts through the plant.

## Calculations

There are many different ways of measuring growth in plants, including height, leaf surface area and mass. Percentage changes are often worked out for these values and can be calculated using this formula:

Final value – starting value ÷ starting value × 100%