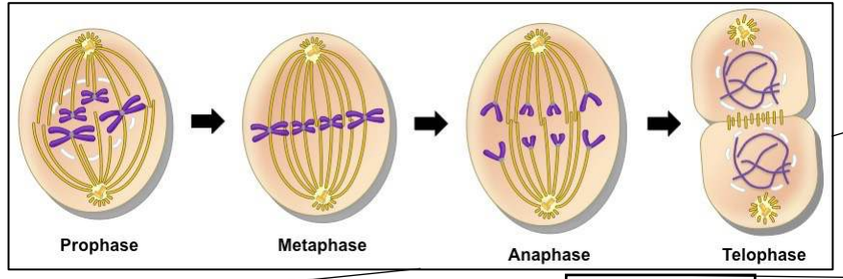


Mitosis occurs during growth, repair, replacement of cells. Asexual reproduction occurs by mitosis in both plants & simple animals producing genetically identical clones.

MITOSIS produces two genetically identical DIPLOID CELLS

Stage 1	***Interphase (not part of mitosis)***	Before mitosis: Increase the number of sub-cellular structures e.g. ribosomes, mitochondria. DNA replication makes copies of chromosomes.
Stage 2	***Prophase***	Nucleus breaks down and spindle fibres appear.
Stage 3	***Metaphase***	Chromosomes are lined up on spindle fibres on the equator (middle) of the cell.
Stage 4	***Anaphase***	Chromosome copies are separated and pulled to opposite ends of the cell.
Stage 5	***Telophase***	A new nuclear membrane forms around each set of chromosomes.
Stage 6	***Cytokinesis***	Cell surface membrane forms to separate the cells (+new cell wall in plants).

Cells divide in a series of stages to produce two daughter cells, each with identical set of chromosomes to the parent cell (in the nucleus).

Cancer — **The result of changes in DNA that lead to uncontrolled growth and division**

MITOSIS is part of THE CELL CYCLE

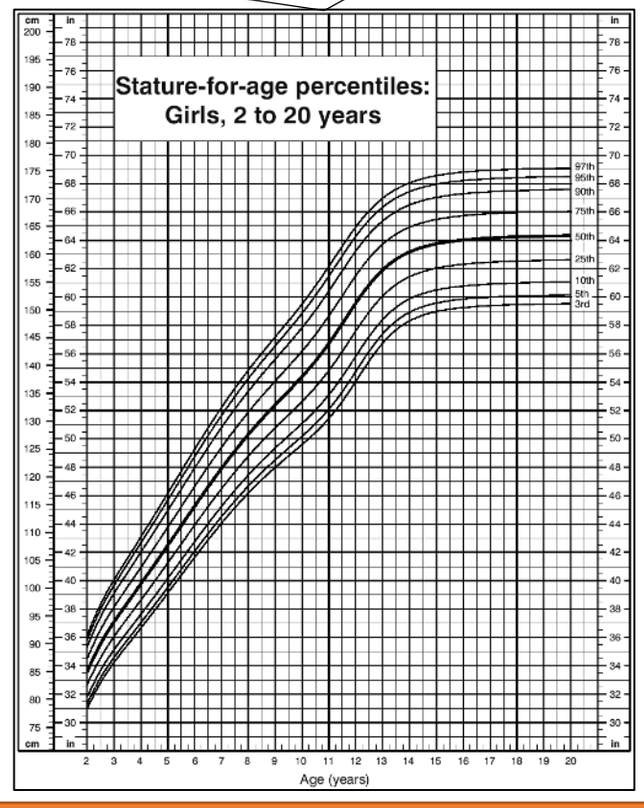
Cell division and growth

Growth in organisms	***Growth in plants***	Cell division and differentiation, elongation (cells increase in length)
	Growth in animals	Cell division and differentiation.

Biology SB2 Cells and Control

Percentile charts can be used to monitor growth

The 50th percentile (bold line) is the median (average) growth of the population at that age. Half will be below and half above.



Cell differentiation

how a cell changes and becomes **specialised** so that different cells can carry out different functions.

STEM CELLS

Undifferentiated cell of an organism

Divides to form more cells of the same type, and can differentiate to form many other cell types.

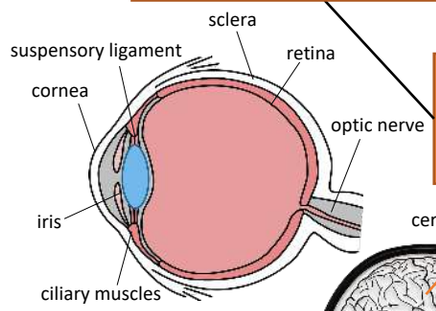
Human Embryonic stem cells	***Can be cloned and made to differentiate into any cell type***	Therapeutic cloning of stem cells to produce new tissue uses same genes so the body does not reject the tissue. Can be a risk of infection
Adult stem cells	***Can form into surrounding human cells e.g. blood cells***	Tissue made from adult stem cells is matched to avoid rejection, risk of infection. Only a few types of cells can be formed.
Meristems (plants)	***Can differentiate into any plant cell type throughout the life of the pant.***	Used to produce clones quickly and economically, e.g. rare species, crop plants with pest /disease resisitance

Treatment with stem cells may be able to help conditions such as diabetes and paralysis. Some people object to the use of stem cells on ethical or religious grounds

Biology SB2 Cells and Control

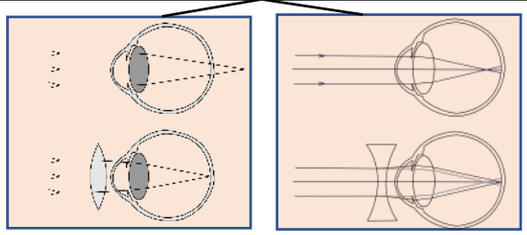
Sense organ containing receptors sensitive to light intensity and colour

The Eye



Structures of the eye	
Retina	Light sensitive cell layer made of rod (light intensity) and cone (red, green, blue colour perception) cells.
Optic nerve	Carries impulse to brain.
Cornea	Transparent layer that covers the pupil and iris.
Iris	Controls size of pupil and the amount of light let in the eyes
Lens	Changes thickness to refract and focus light onto the retina.

Hyperopia (long sightedness)	*Myopia (short sightedness)*
Lens can not be made thick enough. Treated using a convex lens so the light is focused on the retina.	Lens too thick. Treated using a concave lens so light is focused on the retina.

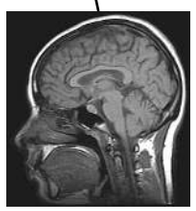


Cataracts are caused by protein build up in the lens blocking light entering the eye. They can be removed with surgery and an artificial lens inserted.

Colour blindness is when cones in the retina do not work properly and some colours cannot be detected.

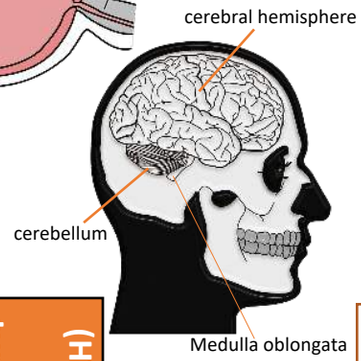
The Brain

Neuro-scientists have been able overcome difficulties of accessing brain tissue in the skull using CT and PET scanning



(HT) The complexity and delicacy of the brain makes treating brain tumours/spinal injuries very difficult

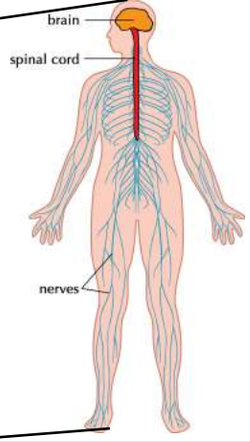
The brain controls complex behaviour. It is made of billions of interconnected neurones.



The brain has different regions that carry out different functions.	
Cerebral hemispheres	Largest part of the human brain. Higher thinking skills e.g. speech, decision making.
Cerebellum	Balance and voluntary muscle function e.g. walking, lifting.
Medulla oblongata	Involuntary (automatic) body functions e.g. breathing, heart rate.

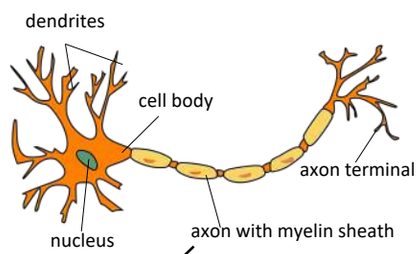
(HT) Adult stem cells cannot be differentiated to form neurones in the spinal cord and brain to repair damage/disease

The human nervous system



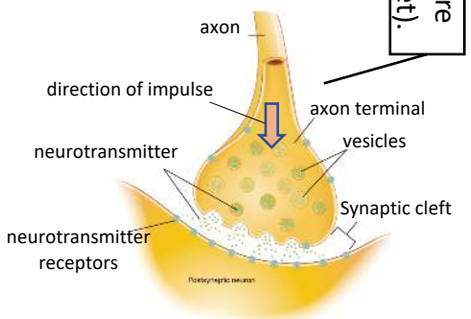
Structure and functions	
Sensory receptor	Detect stimuli e.g. Pressure cells in skin
Sensory neurone	Long axon carries impulse from receptor to spinal cord.
Synapse	Gap where neurones meet. Chemical message using neurotransmitter.
Relay neurone in CNS	Allows impulses to travel between sensory and motor neurones in the spinal cord.
Motor neurone	Long axon carries impulse from receptor to effector.
Effector	Muscle or gland that carries out response.

Neurone structure	
Axon	Carries electrical impulse to axon terminals.
Dendron	Carries electrical impulse from receptor cells in sensory neurones.
Myelin sheath	Insulates the electrical impulse in the neurone.



Typical motor neurone

Synapse (gap where two neurones meet).



Information from receptors passes along cells (neurones) as electrical impulses to the central nervous system (CNS)

The CNS is the brain and the spinal cord.

Reflex actions are automatic and rapid; they do not involve the conscious part of the brain and can protect humans from harm.

Stimulus	Touch hot object
↓	↓
Sensory receptor	Cells in skin
↓	↓
Relay neurone in CNS	CNS
↓	↓
motor neurones	Muscles connected to arm
↓	↓
Response	Hand moves away