Topic: Cells and Control

Duration: Triple 12 lessons

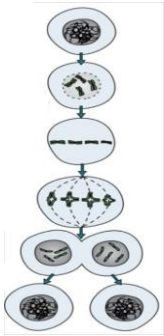
Composite: Unit test

Key vocabulary:

Mitosis
Cell division
Percentile
Multicellular
Stem cells
Specialised
Differentiation
Meristem
Cerebral hemispheres
Medulla Oblongata
Reflex arc
Retina
Cornea
Iris
Lens

Core knowledge Components
Powerful knowledge components crucial to commit to long term memory (IN RED BOX)

CELLS AND CONTROL - Part 1 (Purple – Triple)

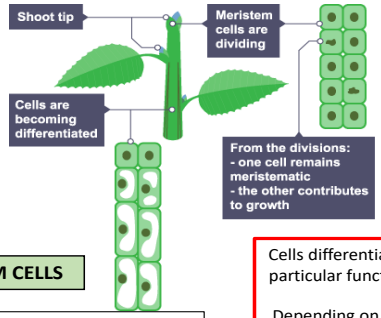


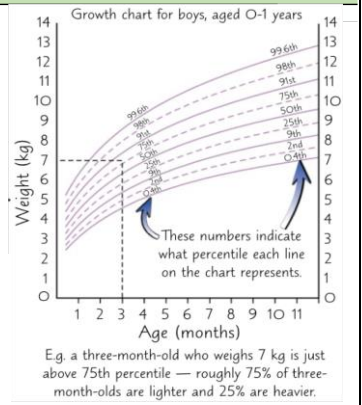
MITOSIS		
Stage 1	*Interphase (not part of mitosis)*	Before mitosis: Increase the number of sub-cellular structures e.g. ribosomes, mitochondria. DNA replication makes copies of chromosomes.
Stage 2	*Prophase*	Nucleus breaks down and spindle fibres appear.
Stage 3	*Metaphase*	Chromosomes are lined up 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

MITOSIS produces two genetically identical DIPLOID CELLS

Multicellular organisms use mitosis to grow or replace cells that have been damaged. Some organisms use mitosis to reproduce and this is known as asexual reproduction (can reproduce without a partner). For instance, bacteria.

Cell division and growth	
Growth in plants	Cell division and differentiation, elongation (cells increase in length)
Growth in animals	Cell division by mitosis. Differentiation the process by which a cell changes to become specialised.





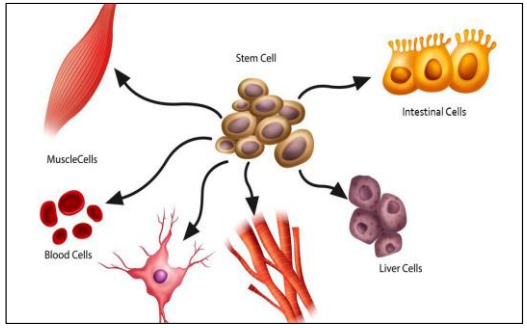
Percentile charts can be used to monitor growth

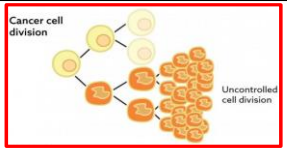
Benefits and risks of using stem cells
BENEFITS
Cure some diseases such as sickle cell anaemia – cured with a bone marrow transplant.
It may be possible to use embryonic stem cells to produce new cardiac muscle cells into someone with a heart disease.
RISKS
Tumour development – stem cells divide very quickly. If scientists are unable to control that rate at which the transplanted cells divide inside a patient, a tumour may develop.
Disease transmission – viruses live inside cells. If donor stem cells are infected with a virus and this is not picked up, the virus could be passed on to the patient.
Rejection – If the transplanted cells are not grown using the patients own stem cells, the patients body may recognise them as foreign and trigger an immune response to try and get rid of them. The patient can take antirejection drugs to suppress this response, but this make the patient susceptible to diseases.

STEM CELLS

Meristems
In plants, the only cells that divide by mitosis are found in plant tissues called meristems. Meristems tissue is found in the areas of a plant that are growing (the tips of the roots and shoots). Meristems produce unspecialised cells that are able to divide and form any cell type in the plant - they go on to make xylems and phloem which are specialised tissues.

Cells differentiate to become specialised cells (cells with a particular function). Undifferentiated cells are called stem cells.
Depending on what instructions are given, stem cells can divide by mitosis to become new cells, which then differentiate.
Stem cells are found in early human embryos and are able to differentiate into any type of cells. Adults have stem cells in their bone marrow and are able to differentiate into some types of cells such as blood and skin cells.



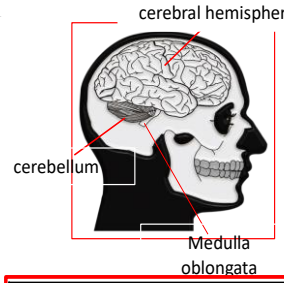


Cancer
If there's a change in one of the genes that controls cell division, the cell may start dividing uncontrollably. This can result in a mass of abnormal cells called a tumour. If the tumour invades and destroys surrounding tissue it is called cancer.

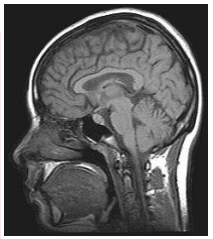
Links to previous and future topics

KS3 – Cells, Moving and Breathing, Microorganisms, plants

CELLS AND CONTROL - Part 2 (Purple – Triple)

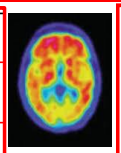


The Brain	
Cerebral hemispheres	Largest part of the human brain. Higher thinking skills e.g. speech, decision making.
Cerebellum	Balance and voluntary muscle function e.g. walking, lifting.
Medulla oblongata	Involuntary (automatic) body functions e.g. breathing, heart rate.

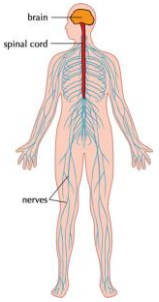


The Eye
Sense organ containing receptors sensitive to light intensity and colour

Investigating the brain	
CT Scanner	Uses X-rays to produce an image of the brain. A CT scan shows the main structures of the brain, but not the functions.
PET Scanner	Use radioactive chemicals to show which parts of the brain are active whilst the patient is in the scanner. PET scans are very detailed and can be used to investigate both the structure and function of the brain.

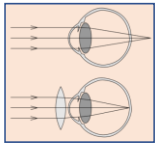


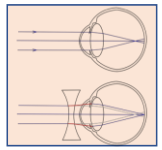
Adult stem cells cannot be differentiated to form neurones in the spinal cord and brain to repair damage/disease



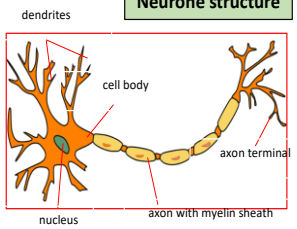
The complexity and delicacy of the brain tumours/spinal injuries very difficult

Defects of the eye	
Hyperopia (long sightedness)	Myopia (short sightedness)
Lens can not be made thick enough, light focuses after the retina. Treated using a convex lens so the light is focused on the retina.	Lens too thick, light focuses, before the retina. Treated using a concave lens so light is focused on the retina.

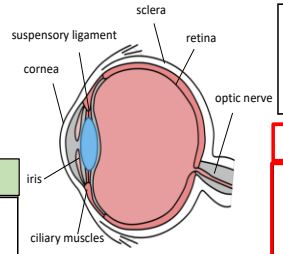




Neurone structure

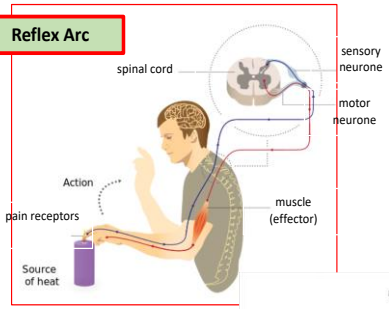


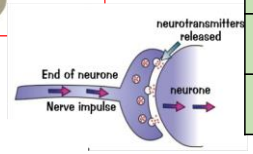
Axon	Carries electrical impulse to axon terminals.
Dendron	Carries electrical impulse from receptor cells in sensory neurones.
Myelin sheath	Insulates the electrical impulse in the neurone.



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.

Reflex Arc





Synapse (gap where two neurones meet).

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.

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

Structures of the eye	
Retina	Light sensitive cell layer made of rod (light intensity) and cone (red, green, blue colour perception) cells.
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.

Impressive reading	Impressive speaking	Impressive writing	Resilience	Graph/Numeracy skills:	Employability via:
Read with purpose: spot the error activity. Research on stem cells	Present your news article for either for or against stem cell	Write a news article about the use of stem cells. Compose an argument for either for or against their use.	• Use of transferable mathematical skills. • Scientific investigation skills in using fiddly equipment.	• Use percentile graphs to monitor growth	Cellular scientists, lab technicians, cellular researcher, nurse, **Biochemists**, Biomedical engineer, Biotechnologist., Chemist, Chemical laboratory technician., Clinical **research** specialist., Epidemiologist.
Culture capital: Ernest McCulloch and James Till discovery of blood forming stem cells.					

SEND

Communication & Interaction	Cognition & Learning	SEMH	Physical/Sensory
• Unambiguous terms and clear language used is presentations/handouts • Unambiguous terms and clear language used by teacher • ADHD pupils are given instructions directly by use of their names Use of post-it plans to help pupils work through a task	• Chunking of activities into manageable portions, so as not to lead to cognitive overload • Use of low stakes/high gains activities for knowledge recall • Topics are mapped out visually for pupils to see Links to previous learning established	• Consideration to seating positions • Awareness of specific pupil triggers Communication channels kept open	• Consideration to seating positions • Clear access for physically compromised pupils Opportunities for different sensory learning activities threaded into topics

Topic: Y10 Key Concepts in Biology Triple		Duration: 12 LESSONS	Composite: Unit test
Key vocabulary:	**Core knowledge Components**	**Powerful knowledge components crucial to commit to long term memory**	**Links to previous and future topics**
Cell Membrane Nucleus Cytoplasm Mitochondria Ribosome Chloroplast Vacuole Eukaryote Prokaryote Plasmid Flagellum Specialised Gamete Acrosome Epithelia Ciliated Haploid Resolution Magnification Specimen Enzyme Catalyst Active site Denature Optimum Variable Calorimetry Osmosis Diffusion Active transport Gradient Calorimeter lipid Carbohydrate, protein Reagent.	CORE • What are the main parts of a plant and animal cell? • What is the main difference between a prokaryote and a eukaryotic cell? • What is the role of mitochondria in a cell? • What are the major adaptations in eggs and sperm; oviducts and intestines? • What are the names of the parts of the microscope? • What is the equation used to work out the magnification power of a microscope? • What is the equation that can help work out the size of an object using a microscope? • What is diffusion? • Why is osmosis a special kind of diffusion? • Why do animal and plant cells have different structures? • How have technological improvements improved our understanding of cells? • What processes can carry substances into and out of cells? • What are the main steps you should use when setting up and using a microscope? • How can experiments be used to work out the amount of osmosis or diffusion that is occurring? • Outline the role of enzymes in breakdown of food chemicals. • Explain the lock and key theory of enzyme activity. • Explain how graphs can identify the optimum activity and rate of an enzyme reaction. • Explain the effect of temperature and pH on the active site and explain denaturation. • Identify suitable reagents to test and identify the main food groups in foodstuffs. • Be able to use data from calorimetry investigations to estimate the energy in food.	**Powerful Knowledge** • What are the main parts of a plant and animal cell? • What is the main difference between a prokaryote and a eukaryotic cell? • What is the role of mitochondria and ribosomes in a cell? • What are the major adaptations in eggs and sperm; oviducts and intestines • What are the names of the parts of the microscope? • What is the equation used to work out the magnification power of a microscope? • What is the equation that can help work out the size of an object using a microscope? • What is diffusion? • Why is osmosis a special kind of diffusion? • What are enzymes? • What happens to an enzyme when it is denatured? • What are the main food groups? • Steps in calorimetry •	KS3: Cells, Reproduction (gametes), Light. Particles and solutions, KS4 Cells & Control; Cardiovascular disease; Exchange & Transport in Animals Plants and their structures.

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
Developments in microscopy	Explaining differences in prokaryotic and eukaryotic cells.	Sequencing steps in processes ie setting up a slide	Using the IAMS equation and practicing rearranging in order to problem solve. Changing units.	Working collaboratively, sharing ideas, awareness of safety and biohazards. Well developed numeracy and understanding of scale. Careers: Doctor, nurse, biomedical scientist, physio, ecologist, pharmacist, nutritionist / dietician. Personal trainer.

SEND
Communication & Interaction Cognition & Learning SEMH Physical/Sensory
Clear outline of key vocab. Misconceptions outlined, start of lesson retrieval practice, delivery chunked into associated topics and within the lesson. Dual codes where possible and demonstrations with explicit instructions, targeted discussion and questioning with empathetic seating and grouping