

CCEA - GCSE Biology - 2016

CCEA - GCSE Biology - 2016		Nervous System Controls & Responds to Body Functions & Directs Behavior						Nervous System Structure & Function Are Determined By Both Genes & Environment Throughout Life						The Brain is the Foundation of the Mind				Research Leads to Essential Understanding for Therapies																
		1. Brain is the body's most complex organ.			2. Neurons communicate using electrical and chemical signals.			3. Genetically determined circuits are foundation of the nervous system.			4. Life experiences change the nervous system.			5. Intelligence arises as brain reasons, plans, solves problems.		6. The brain makes it possible to communicate knowledge through language.		7. Human brain endows us with a natural curiosity to understand how the world works.		8. Fundamental discoveries promote healthy living and treatment of disease.														
Topic	Learning Objective	a	b	c	d	e	f	a	b	c	d	e	f	g	a	b	c	d	e	f	g	a	b	c	d	a	b	a	b	c	a	b	c	d
3.1 Unit 1: Cells, Living Processes and Biodiversity																																		
1.1 Cells Microscopy	1.1.1 explain how greater resolution of electron microscopes has increased our understanding of cell structures.		*						*																									
Animal cells	1.1.3 demonstrate knowledge of the structure and function of animal cells, including nucleus and chromosomes, cytoplasm, mitochondria as the site of cell respiration, and cell and nuclear membranes.								*																									
Stem cells	1.1.6 demonstrate knowledge and understanding that a stem cell is a simple cell in animals and plants that has the ability to divide to form cells of the same type: • in animals stem cells can be harvested from the (embryonic) umbilical cord or bone marrow (adult). • embryonic stem cells form a full range of cell types while adult stem cells form a limited range of cell types. • most animal stem cells change permanently at an early stage into specialised cells with structures that adapt them to a particular function.	*													*												*			*	*	*	*	
	1.1.7 demonstrate knowledge and understanding that using stem cells in medicine has: • potential benefits, including bone marrow transplants in treating leukaemia. • potential risks with ethical implications, including pre-treatment using radiotherapy or chemotherapy, transfer of viruses or diseases from other animals, formation of tumours or development of unwanted cell types. • the validation of research by peer review.	*													*												*			*	*	*	*	
Specialisation	1.1.8 demonstrate knowledge and understanding that multicelled organisms' cells can form specialised tissues, organs and organ systems.	*													*																			
1.2 Photosynthesis and plants																																		
1.3 Nutrition and food tests																																		
1.4 Enzymes and digestion																																		
1.5 The respiratory system, breathing and respiration																																		
1.6 Nervous system and hormones																																		
Central nervous system	1.6.2 describe and explain the basic structure and function of the central nervous system: the brain and spinal cord together form the central nervous system that controls and co-ordinates the responses between the receptors and effectors, and muscles.	*	*					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*										
The eye	1.6.3 use models and specimens to identify the following component parts of the eye and understand their functions in producing a focused image on the retina under different light conditions: • conjunctiva helps prevent microorganisms entering the eye; • cornea allows light into the eye and causes it to bend (refract) slightly; • pupil allows light into the eye; • iris controls the amount of light entering the eye by changing its diameter; • lens bends (refracts) the light towards the retina; • aqueous and vitreous humour help maintain the shape of the eye and lens; • retina contains cells that are sensitive to different types of light; and • optic nerve transfers nerve impulses from the light sensitive cells of the retina to the brain.		*						*							*																		
	1.6.4 extend their knowledge and understanding of the eye, including how the ciliary muscles and suspensory ligaments change the shape of the lens so that near and distant objects may focus on the retina (accommodation).	*						*							*																			
Neurons and synapses	1.6.5 demonstrate knowledge and understanding how neurones are adapted to their function by their cell body, branched ends, long axon length and insulating myelin sheath.	*	*					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*										
	1.6.6 demonstrate knowledge and understanding of synapses as gaps between neurones that function as junctions, and allow the nerve impulse to pass due to diffusion of a transmitter chemical produced by the end of the neurone leading into the synapse, which in high enough concentration triggers an impulse in the next neurone.	*	*					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*										
Voluntary and reflex actions	1.6.7 distinguish between voluntary and reflex actions, referring to conscious control and speed of response.	*						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*											
Reflex arc	1.6.8 demonstrate knowledge and understanding of the pathway of the spinal reflex arc, including: • a receptor that detects stimuli in the environment and produces nerve impulses. • a sensory, an association and a motor neurone connected by synapses (gaps between neurones). • an effector (a muscle or gland) that responds to impulses from the motor neurone.	*						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*											
Homeostasis	1.6.9 explain the importance of maintaining a constant internal environment for the proper functioning of cells and enzymes in response to internal and external change, limited to controlling blood glucose concentration and osmoregulation.			*																														
Diabetes	1.6.11 explain negative feedback exemplified by the role of insulin in the control of blood glucose. 1.6.12 demonstrate knowledge and understanding that possible long-term effects of diabetes include eye damage, kidney failure, heart disease and strokes.			*																														
Osmoregulation	1.6.15 explain the role of antidiuretic hormone (ADH) as a hormone that causes the kidney to reabsorb more water and so reduce the volume of urine production (negative feedback not required).			*																														
1.7 Ecological relationships and energy flow																																		
3.2 Unit 2: Body Systems, Genetics, Microorganisms and Health																																		
2.1 Osmosis and plant transport																																		
2.2 Circulatory system																																		
Blood vessels																																		
2.3 Reproduction, fertility and contraception																																		
2.4 Genome, chromosomes, DNA and genetics																																		
Genetic conditions	2.4.11 demonstrate knowledge and understanding of and explain the inheritance of these genetic conditions: • haemophilia • cystic fibrosis • Huntington's disease • Down's Syndrome						*							*																				
2.5 Variation and natural selection																																		
2.6 Health, disease, defence mechanisms and treatments	2.6.2 explain the costs to society of communicable and non-communicable diseases, including the economic cost of treatment for the National Health Service.			*																														
Development of medicines	2.6.7 demonstrate knowledge and understanding of how medicines are developed, including: • preclinical trials, using cells, tissues and living organisms, to check if the drug is poisonous and how effective it is; • clinical trials, using healthy volunteers to determine the optimum dosage of the drug (no details of trial procedures are required) • the role of validation of research by peer review.			*																									*	*	*	*		
Noncommunicable diseases	2.6.11 recall that many non-communicable diseases may involve interactions between different types of disease and are caused by the interaction of these factors: • inherited – some people may carry a gene that predisposes them to some cancers. • lifestyle, including: - poor diet: excess sugar and fat intake; - lack of exercise: energy used in exercise being lower than energy intake is the cause of obesity; - overexposure to the sun: ultraviolet (UV) radiation causes mutations leading to skin cancer; - misuse of drugs - alcohol: binge drinking can cause liver disease and affect foetal development (foetal alcohol syndrome) - tobacco smoke: tar can cause bronchitis (narrowing of bronchi and bronchioles), emphysema (damage to alveoli reducing the surface area for gas exchange) and lung cancer (abnormal cell division)			*	*																													
Heart attacks and strokes	2.6.13 demonstrate knowledge and understanding of the cause and effect of a blockage in a blood vessel: a blockage in the blood vessels to the brain causes death of brain cells, resulting in reduced brain function (stroke). 2.6.15 recall that certain lifestyle factors increase or reduce the risk of heart disease and strokes (excess dietary fats, smoking, stress and lack of exercise).			*	*																													

KEY		Description	
Nervous System Controls and Responds to Body Functions and Directs Behavior	1. The brain is the body's most complex organ.	a	There are a hundred billion neurons in the human brain, all of which are in use.
		b	Each neuron communicates with many other neurons to form circuits and share information.
		c	Proper nervous system function involves coordinated action of neurons in many brain regions.
		d	The nervous system influences and is influenced by all other body systems (e.g., cardiovascular, endocrine, gastrointestinal and immune systems).
		e	Humans have a complex nervous system that evolved from a simpler one.
		f	This complex organ can malfunction in many ways, leading to disorders that have an enormous social and economic
	2. Neurons communicate using electrical and chemical signals.	a	Sensory stimuli are converted to electrical signals.
		b	Action potentials are electrical signals carried along neurons.
		c	Synapses are chemical or electrical junctions that allow electrical signals to pass from neurons to other cells.
		d	Electrical signals in muscles cause contraction and movement.
		e	Changes in the amount of activity at a synapses can enhance or reduce its function.
		f	Communication between neurons is strengthened or weakened by an individual's activities, such as exercise, stress, and drug use.
		g	All perceptions, thoughts, and behaviors result from combinations of signals among neurons.
	Nervous System Structure and Function are Determined by Both Genes and Environment Throughout Life	3. Genetically determined circuits are foundation of the nervous system.	a
b			Sensory circuits (sight, touch, hearing, smell, taste) bring information to the nervous system, whereas motor circuits send information to muscles and glands.
c			The simplest circuit is a reflex, in which sensory stimulus directly triggers an immediate motor response.
d			Complex responses occur when the brain integrates information from many brain circuits to generate a response.
e			Simple and complex interactions among neurons take place on time scales ranging from milliseconds to months.
f			The brain is organized to recognize sensations, initiate behaviors, and store and access memories that can last a lifetime.
4. Life experiences change the nervous system.		a	Differences in genes and environments make the brain of each animal unique.
		b	Most neurons are generated early in development and survive for life.
		c	Some injuries harm nerve cells, but the brain often recovers from stress, damage, or disease.
		d	Continuously challenging the brain with physical and mental activity helps maintain its structure and function - "use it or lose it."
		e	Peripheral neurons have greater ability to regrow after injury than neurons in the brain and spinal cord.
		f	Neuronal death is a natural part of development and aging.
		g	Some neurons continue to be generated throughout life and their production is regulated by hormones and experience.
		The Brain is the Foundation of the Mind	5. Intelligence arises as brain reasons, plans, and solves problems.
b	Emotions are based on value judgments made by our brains and are manifested by feelings as basic as love and anger and as complex as empathy and hate.		
c	The brain learns from experiences and makes predictions about best actions in response to present and future challenges.		
d	Consciousness depends on normal activity of the brain.		
6. The brain makes it possible to communicate knowledge through language.	a		Languages are acquired early in development and facilitate information exchange and creative thought.
	b		Communication can create and solve many of the most pressing problems humankind faces.
Research Leads to Essential Understanding for Therapies	7. The human brain endows us with a natural curiosity to understand how the world works.	a	The nervous system can be studied at many levels, from complex behaviors such as speech or learning, to the interactions among individual molecules.
		b	Research can ultimately inform us about mind, intelligence, imagination, and consciousness.
		c	Curiosity leads us to unexpected but surprising discoveries that can benefit humanity.
	8. Fundamental discoveries promote healthy living and treatment of disease.	a	Experiments on animals play a central role in providing insights about the human brain and in helping to make healthy lifestyle choices, prevent disease, and find cures for disorders.
		b	Research on humans is an essential final step before new treatments are introduced to prevent or cure disorders.
		c	Neuroscience research has formed the basis for significant progress in treating a large number of disorders.
		d	Finding cures for disorders of the nervous system is a social imperative.