OCR - A-Level Biology A - 2015

		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	a	b	c	d	e	f	g	a	b	c	d	a	b	a	b	c	a	b	c	d
Module 2: Foundations in biology																																										
2.1 Foundations in biology																																										
2.1.1 Cell structure	(a) the use of microscopy to observe and investigate different types of cell and cell structure in a range of eukaryotic organisms.To include an appreciation of the images produced by a range of microscopes; light microscope, transmission electron microscope, scanning electron microscope and laser scanning confocal		•							•																									•							
	(g) the ultrastructure of eukaryotic cells and the functions of the different cellular components. To include the following cellular components and an outline of their functions: nucleus, nucleolus, nuclear envelope, rough and smooth endoplasmic reticulum (ER), Golgi apparatus, ribosomes, mitochondria, lysosomes, chloroplasts, plasma membrane, centrioles, cell wall, flagella and cilia.		•							•																									•							
2.1.2 Biological molecules																																										
2.1.3 Nucleotides and nucleic acids																																										
2.1.4 Enzymes																																										
2.1.5 Biological membranes																																										
2.1.6 Cell division, cell diversity and cellular organisation	(h) how cells of multicellular organisms are specialised for particular functions.	•	•			•				•					•						•			•	•		•														
	(j) the features and differentiation of stem cells. To include stem cells as a renewing source of undifferentiated cells.	•					•								•						•						•							•				•	•	•	•
	(m) the potential uses of stem cells in research and medicine. To include the repair of damaged tissues, the treatment of neurological conditions such as Alzheimer's and Parkinson's, and research into developmental biology.	•					•								•						•						•							•				•	•	•	•
Module 3: Exchange and transport																																										
3.1 Exchange and transport																																										
3.1.1 Exchange surfaces																																										
3.1.2 Transport in animals																																										
3.1.3 Transport in plants																																										
Module 4: Biodiversity, evolution and disease																																										
4.1 Communicable diseases, disease prevention and the immune system																																										
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4.2 Biodiversity																																										
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4.2.2 Classification and evolution	(e) the evidence for the theory of evolution by natural selection. To include the contributions of Darwin and Wallace in formulating the theory of evolution by natural selection AND fossil, DNA (only genomic DNA at AS level) and molecular evidence.					•									•						•																				
Module 5: Communication, homeostasis and energy																																										
5.1 Communication and																																										
5.1.1 Communication and homeostasis	(c) the principles of homeostasis. To include the differences between receptors and effectors, and the differences between negative feedback and positive feedback.			•	•																																				
5.1.2 Excretion as an example of homeostatic control	(d) the control of the water potential of the blood. To include the role of osmoreceptors in the hypothalamus, the posterior pituitary gland, ADH and its effect on the walls of the collecting ducts.		•	•	•				•	•	•																														
5.1.3 Neuronal communication	(a) the roles of mammalian sensory receptors in converting different types of stimuli into nerve impulses. To include an outline of the roles of sensory receptors (e.g. Pacinian corpuscle) in responding to specific types of stimuli and their roles as transducers.		•					•	•	•						•	•		•																					
	(b) the structure and functions of sensory, relay and motor neurones. To include differences between the structure and function of myelinated and non-myelinated neurones.		•					•	•	•	•					•	•		•																					
	(c) the generation and transmission of nerve impulses in mammals. To include how the resting potential is established and maintained and how an action potential is generated (including reference to positive feedback) and transmitted in a myelinated neurone AND the significance of the frequency of impulse transmission.		•					•	•	•	•					•	•		•																					
	(d) the structure and roles of synapses in neurotransmission. To include the structure of a cholinergic synapse AND the action of neurotransmitters at the synapse and the importance of synapses in summation and control.		•							•		•	•									•															•				
5.1.4 Hormonal communication	(a) endocrine communication by hormones. To include secretion of hormones into the blood, transport by the blood, and detection by target cells or tissues.			•	•																																				
	(d) how blood glucose concentration is regulated. To include the action of insulin and glucagon as an example of negative feedback, and the role of the liver AND the control of insulin secretion, with reference to potassium channels and calcium channels in the beta cells of the pancreas.			•	•																																				
5.1.5 Plant and animal responses	(g) the organisation of the mammalian nervous system. To include the structural organisation of the nervous system into the central and peripheral systems AND the functional organisation into the somatic and autonomic nervous systems.	•	•	•	•	•		•	•	•	•			•	•	•	•	•	•	•	•	•			•		•									•							
	(h) the structure of the human brain and the functions of its parts. To include the gross structure of the human brain AND the functions of the cerebrum, cerebellum, medulla oblongata, hypothalamus and pituitary gland.	•	•	•	•	•		•	•	•	•			•	•	•	•	•	•	•	•	•			•		•									•							
	(i) reflex actions. To include knee jerk reflex and blinking reflex, with reference to the survival value of reflex actions.		•					•	•	•	•					•	•		•																					
	(j) the coordination of responses by the nervous and endocrine systems. To include the 'fight or flight' response to environmental stimuli in mammals AND the action of hormones in cell signalling (studied in outline only) with reference to adrenaline (first messenger), activation of adenylyl cyclase, and cyclic AMP (second messenger).		•		•			•	•	•	•					•	•		•																					
	(k) the effects of hormones and nervous mechanisms on heart rate.			•	•																																				
	(l) (i) the structure of mammalian muscle and the mechanism of muscular contraction.									•						•																									
5.2 Energy for biological processes																																										
5.2.1 Photosynthesis																																										
5.2.2 Respiration																																										
Module 6: Genetics, evolution and ecosystems																																									
6.1 Genetics and evolution																																										
6.1.1 Cellular control																																										
6.1.2 Patterns of inheritance																																										
6.1.3 Manipulating genomes	(g) the ethical issues (both positive and negative) relating to the genetic manipulation of animals (including humans), plants and microorganisms. To include insect resistance in genetically modified soya, genetically modified pathogens for research and 'pharming' i.e. genetically modified animals to produce pharmaceuticals AND issues relating to patenting and technology transfer e.g. making genetically modified seed available to poor farmers.						•								•						•															•				•	•	•	•
	(h) the principles of, and potential for, gene therapy in medicine.To include the differences between somatic cell gene therapy and germ line cell gene therapy.						•								•						•															•				•	•	•	•
6.2 Cloning and biotechnology																																										
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6.3 Ecosystems																																										
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6.3.2 Populations and sustainability																																										

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	Neuronal circuits are formed by genetic programs during embryonic development and modified through interactions with the internal and external environment.
		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.	a	The brain makes sense of the world by using all available information, including senses, emotions, instincts, and remembered experiences.
		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.