

Edexcel - A-Level Biology B - 2015

Topic		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.										
		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	c	d	a	b
1.0 Biological Molecules																															
1.1 Carbohydrates																															
1.2 Lipids																															
1.3 Proteins																															
1.4 DNA and protein synthesis																															
1.5 Enzymes																															
1.6 Inorganic ions																															
1.7 Water																															
2.0 Cells, Viruses and Reproduction of Living Things																															
2.1 Eukaryotic and prokaryotic cell structure and function		v. Know the ultrastructure of eukaryotic cells and the functions of organelles, including: nucleus, nucleolus, 80S ribosomes, rough and smooth endoplasmic reticulum, mitochondria, centrioles, lysosomes, Golgi apparatus, cell wall, chloroplasts, vacuole and tonoplast.																													
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		vi. Know how magnification and resolution can be achieved using light and electron microscopy.																													
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2.2 Viruses																															
2.3 Eukaryotic cell cycle and division		vii. Understand how non-disjunction can lead to polyploidy, including Down's syndrome, and monosomy, including Turner's syndrome.																													
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2.4 Sexual reproduction in mammals																															
2.5 Sexual reproduction in plants																															
3.0 Classification and Biodiversity																															
3.1 Classification		vi. Understand the role of scientific journals, the peer review process and scientific conferences in validating new evidence supporting the accepted scientific theory of evolution.																													
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3.2 Natural selection																															
3.3 Biodiversity																															
4.0 Exchange and Transport																															
4.1 Surface area to volume ratio																															
4.2 Cell transport mechanisms		iv. Know that large molecules can be transported into and out of cells through the formation of vesicles, in the processes of endocytosis and exocytosis.																													
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4.3 Gas exchange																															
4.4 Circulation		iv. Understand myogenic stimulation of the heart, including the roles of the sinoatrial node (SAN), atrioventricular node (AVN) and bundle of His.																													
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		ix. Understand the stages that lead to atherosclerosis, its effect on health and the factors that increase the risk of its development.																													
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4.5 Transport of gases in the blood																															
4.6 Transfer of materials between the circulatory system and cells																															
4.7 Transport in plants																															
5.0 Energy for Biological Processes																															
5.1 Aerobic respiration																															
5.2 Glycolysis																															
5.3 Link reaction and Krebs cycle																															
5.4 Oxidative phosphorylation																															
5.5 Anaerobic respiration																															
5.6 Photosynthetic pigments																															
5.7 Photosynthesis																															
6.0 Microbiology and Pathogens																															
6.1 Microbial techniques																															
6.2 Bacteria as pathogens																															
6.3 Action of antibiotics																															
6.4 Antibiotic resistance																															
6.5 Other pathogenic agents																															
6.6 Problems of controlling endemic diseases																															
6.7 Response to infection																															
7.0 Modern Genetics																															
7.1 Using gene sequencing																															
7.2 Factors affecting gene expression																															
7.3 Stem cells		i. Understand what is meant by a stem cell, including the differences between totipotent, pluripotent and multipotent stem cells.																													
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		ii. Understand that pluripotent stem cells from embryos provide opportunities to develop new medical advances although there are ethical considerations.																													
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		iii. Understand how epigenetic modifications can result in totipotent stem cells in the embryo developing into pluripotent cells in the blastocyst and finally into fully differentiated somatic cells.																													
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		v. Understand why the use of iPSC stem cells may be less problematic than the use of embryonic stem cells.																													
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7.4 Gene technology		iv. Understand how 'knockout' mice can be used as a valuable animal model to investigate gene function.																													
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		vi. Understand why the widespread use of genetic modification of major commercial crops and other transgenic processes have caused public debate of their advantages and disadvantages.																													
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8.0 Origins of Genetic Variation																															
8.1 Origins of genetic variation																															
8.2 Transfer of genetic information																															
8.3 Gene pools																															
9.0 Control Systems																															
9.1 Homeostasis		i. Know that homeostasis is the maintenance of a state of dynamic equilibrium.																													
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		ii. Understand the importance of maintaining pH, temperature and water potential in the body.																													
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		iii. Understand what is meant by negative feedback and positive feedback control.																													
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9.2 Chemical control in mammals		i. Understand the principles of mammalian hormone production by endocrine glands and their mode of action involving receptors on target cells.																													
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9.3 Chemical control in plants																															
9.4 Structure and function of the mammalian nervous system		i. Know that the mammalian nervous system is composed of the central and peripheral nervous systems.																													
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		ii. Know the structure of the spinal cord.																													
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		iii. Know the location and main functions of: • medulla oblongata – controls breathing and heart rate • cerebellum – controls balance and coordination of movement • cerebrum – initiates movement • hypothalamus – temperature regulation and osmoregulation.																													
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		iv. Know that the peripheral nervous system is divided into autonomic and voluntary systems.																													
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		v. Understand why the autonomic nervous system is divided into sympathetic and parasympathetic systems, which act antagonistically.																													
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9.5 Nervous transmission		i. Understand how the properties of the axon membrane and the transport of Na ⁺ ions and K ⁺ ions result in a resting potential.																													
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		ii. Understand how an action potential is formed and how it is propagated along an axon.																													
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		iii. Understand why the speed of transmission along myelinated axons is greater than along non-myelinated axons, including the role of saltatory conduction.																													
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		iv. Understand the structure and function of a synapse, including the role of transmitter substances limited to acetylcholine and noradrenaline.																													
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		v. Understand the formation and effects of excitatory and inhibitory postsynaptic potentials.																													
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9.6 Effects of drugs on the nervous system		i. Understand how the effects of drugs can be caused by their influence on synaptic transmission, including: • atropine (mimicking effects of acetylcholine) • lidocaine (blocking voltage gated Na ⁺ ion channels) • cobra venom (blocking acetylcholine receptors).																													
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9.7 Detection of light by mammals		i. Know the structure of the human retina.																													
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		ii. Understand the role of the rhodopsin in initiating action potentials.																													
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		iii. Understand how the distribution of human rod and cone cells maintain vision in different light intensities.																													
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9.8 Control of heart rate in mammals		i. Understand how the autonomic nervous system controls heart rate including: • aortic and carotid baroreceptors and chemoreceptors • cardiac centre in the medulla oblongata • sympathetic nerve stimulated to release noradrenaline at the SAN • parasympathetic nerve stimulated to release acetylcholine at the SAN.																													
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		ii. Understand the role of the autonomic nervous system in causing the release of adrenaline to increase heart rate.																													
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9.9 Osmoregulation and temperature regulation		iv. Understand how the pituitary gland and osmoreceptors in the hypothalamus, combined with the action of antidiuretic hormone (ADH) bring about negative feedback control of mammalian plasma concentration.																													
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		vii. Understand how an endotherm is able to regulate its temperature through behaviour, and also physiologically through the autonomic nervous system, including the role of thermoreceptors, hypothalamus and the skin.																													
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10.0 Ecosystems																															
10.1 The nature of ecosystems																															
10.2 Energy transfer through ecosystems																															
10.3 Changes in ecosystems																															
10.4 Human effects on ecosystems																															

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.