CIE - A-Level Biology - 2016			Nervous System Controls & Responds to Body Functions & Directs Behavior							N	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. B	Brain is	the bo	ody's m	nost cor	mplex	2. Neuro	ns comm	unicate (using ele	ectrical a	and 3. G	enetica	lly determined o	circuits are	4. Life ex	perience	s chang	e the ne	rvous	5. Intelligence arises as brain reasons, plans,	6. The bi it pos comm	rain makes ssible to nunicate	7. Human k endows us v natural curio	orain with a sity to	8. Fundamental discoveries promote
Tonic	Learning Objective	a	h		ngan.	ρ	f	a	b c		gnais.	f	g a	h		e f	ah	Sy	d	e f	σ	solves problems.	knowled lang	ge through guage.	understand h world wo	ow the rks.	treatment of disease.
1.0 Cell structure 1.1 The microscope in cell studies	An understanding of the principles of microscopy shows why	<u>а</u>											5 a								6		a				
1.2 Cells as the basic units of living organisms	Ingrt and electron microscopes have been essential in improving our knowledge of cells. a) describe and interpret electron micrographs and drawings of typical animal and plant cells as seen with the		•						•																•		
	electron microscope. b) recognise the following cell structures and outline their functions:	F											t														
	 cell surface membrane nucleus, nuclear envelope and nucleolus rough endoplasmic reticulum 																										
	 smooth endoplasmic reticulum Golgi body (Golgi apparatus or Golgi complex) mitochondria (including small circular DNA) ribosomes (80S in the cytoplasm and 70S in chloroplasts) 		•						•																•		
	 <u>and mitochondria</u>) <u>lysosomes</u> centrioles and microtubules 																										
	 chloroplasts (including small circular DNA) cell wall plasmodesmata 																										
2.0 Biological molecules	• large permanent vacuole and tonoplast of plant cells																										
2.2 Carbohydrates and lipids2.3 Proteins and water3.0 Enzymes																											
3.1 Mode of action of enzymes3.2 Factors that affect enzyme act4.0 Cell membranes and transport	on t																										
4.1 Fluid mosaic membranes4.2 Movement of substances into and out of cells	a) describe and explain the processes of diffusion, facilitated diffusion, osmosis, active transport, endocytosis and	<u>b</u>	•						•	•	•	•													•		
5.0 The mitotic cell cycle	<u>exocytosis (no calculations involving water potential will be</u> <u>set).</u>																										
and cells 5.2 Chromosome behaviour in 6.0 Nucleic acids and protein																											
synthesis 6.1 Structure and replication of D 6.2 Protein synthesis																											
 7.0 Transport in plants 7.1 Structure of transport tissues 7.2 Transport mechanisms 																											
8.0 Transport in mammals 8.1 The circulatory system 8.2 The heart	d) explain how heart action is initiated and controlled (reference should be made to the singertial node, the																										
9.0 Gas exchange and smoking	atrioventricular node and the Purkyne tissue, but not to nervous and hormonal control).		•	•	•				• •	•																	
9.1 The gas exchange system9.2 Smoking10.0 Infectious disease																											
10.1 Infectious diseases10.2 Antibiotics11.0 Immunity																											
 11.1 The immune system 11.2 Antibodies and vaccination 12.0 Energy and respiration 																											
 12.1 Energy 12.2 Respiration 13.0 Photosynthesis 13.1 Photosynthesis as an energy 																											
transfer process 13.2 Investigation of limiting facto 13.3 Adaptations for photosynthe	rs is																										
14.0 Homeostasis14.1 Homeostasis in mammals	a) discuss the importance of homeostasis in mammals and explain the principles of homeostasis in terms of internal		•	•	•				• •	•				•													
	<u>and external stimuli, receptors, central control, co-</u> <u>ordination systems, effectors (muscles and glands).</u> <u>b) define the term negative feedback and explain how it is</u>		•	•	•				• •	•																	
	<u>c) outline the roles of the nervous system and endocrine</u> system in co-ordinating homeostatic mechanisms, including thermoregulation, osmoregulation and the control of blood	-	•	•	•				• •	•				•													
	glucose concentration. g) describe the roles of the hypothalamus, posterior pituitary, ADH and collecting ducts in osmoregulation.		•	•	•				• •	•																	
	h) explain how the blood glucose concentration is regulated by negative feedback control mechanisms, with reference to insulin and glucagon.	L 0	•	•	•				• •	•																	
14.2 Homeostasis in plants	reference to the stimulation of liver cells by adrenaline and glucagon.		•	•	•				• •	•																	
15.0 Control and co-ordination 15.1 Control and co-ordination in mammals	a) compare the nervous and endocrine systems as communication systems that co-ordinate responses to		•		•			•	• •	•				•	•	•											
	<u>changes in the internal and external environment.</u> b) describe the structure of a sensory neurone and a motor neurone.		•					•	• •	•				•	•	•											
	c) outline the roles of sensory receptor cells in detecting stimuli and stimulating the transmission of nerve impulses in sensory neurones (a suitable example is the shomeroceptor cell found in human tasts huds)		•					•	• •					•	•	•											
	 d) describe the functions of sensory, relay and motor neurones in a reflex arc. e) describe and explain the transmission of an action 		•					•	• •	•				•	•	•											
	potential in a myelinated neurone and its initiation from a resting potential (the importance of sodium and potassium ions in impulse transmission should be emphasised).		•					•	• •	•				•	•	•											
	f) explain the importance of the myelin sheath (saltatory conduction) in determining the speed of nerve impulses and the refractory period in determining their frequency.	<u>t</u>	•					•	• •	•				•	•	•											
	 g) describe the structure of a cholinergic synapse and explain how it functions, including the role of calcium ions. h) outline the roles of synapses in the nervous system in 		•						•		•	•					•		•			•			•		
	allowing transmission in one direction and in allowing connections between one neurone and many others (summation, facilitation and inhibitory synapses are not		•						•		•	•					•		•			•			•		
	i) describe the roles of neuromuscular junctions, transverse system tubules and sarcoplasmic reticulum in stimulating		•						•		•	•	Т				•		•			•			•		
	k) explain the sliding filament model of muscular contraction including the roles of troponin, tropomyosin, calcium ions and ATP.									•				•													
15.2 Control and co-ordination in plants 16.0 Inherited change																											
16.1 Passage of information from parent to offspring16.2 The roles of genes in												T															
16.3 Gene control 17.0 Selection and evolution																											
17.2 Natural and artificial selection 17.3 Evolution 18.0 Biodiversity, classification ar																											
consorvation	nd																										
18.1 Biodiversity 18.2 Classification	Image: Control of the second secon																										
18.1 Biodiversity 18.2 Classification 18.3 Conservation 19.0 Genetic technology 19.1 Principles of genetic technolog	n n ed gy b) explain that genetic engineering involves the extraction of genes from one engineering involves the extraction																										
18.1 Biodiversity 18.2 Classification 18.3 Conservation 19.0 Genetic technology 19.1 Principles of genetic technolog	n d b) explain that genetic engineering involves the extraction of genes from one organism, or the synthesis of genes, in order to place them in another organism (of the same or another species) such that the receiving organism expresses the gene product.																										

KEY			Description
Nervous System Controls	1. The brain is the body's most	а	There are a hundred billion neurons in the human brain, all of which are in use.
and Responds to Body	complex organ.	b	Each neuron communicates with many other neurons to form circuits and share information.
Functions and Directs		с	Proper nervous system function involves coordinated action of neurons in many brain regions.
Behavior		d	The nervous system influences and is influenced by all other body systems (e.g., cardiovascular, endocrine, gastrointestinal and immune systems).
		е	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	a	Sensory stimuli are converted to electrical signals.
	electrical and chemical signals.	b	Action potentials are electrical signals carried along neurons.
		с	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.
		е	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	3. Genetically determined	a	Neuronal circuits are formed by genetic programs during embryonic development and modified through interactions with
and Eurotion are	circuits are foundation of the	-	the internal and external environment.
Determined by Both	nervous system.	b	Sensory circuits (sight, touch, hearing, smell, taste) bring information to the nervous system, whereas motor circuits send information to muscles and glands.
Genes and Environment	nes and Environment		The simplest circuit is a reflex, in which sensory stimulus directly triggers an immediate motor response.
Throughout Life		d	Complex responses occur when the brain integrates information from many brain circuits to generate a response.
		е	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	a	Differences in genes and environments make the brain of each animal unique.
	nervous system.	b	Most neurons are generated early in development and survive for life.
		с	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."
		е	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	5. Intelligence arises as brain reasons, plans, and solves	a	The brain makes sense of the world by using all available information, including senses, emotions, instincts, and remembered experiences.
Foundation of the Mind	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.
		с	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	а	Languages are acquired early in development and facilitate information exchange and creative thought.
	to communicate knowledge through language.	b	Communication can create and solve many of the most pressing problems humankind faces.
Research Leads to	7. The human brain endows us	а	The nervous system can be studied at many levels, from complex behaviors such as speech or learning, to the interactions among individual molecules.
Essential Understanding			

for Therapies	understand how the world	b	Research can ultimately inform us about mind, intelligence, imagination, and consciousness.								
	works.	c	Curiosity leads us to unexpected but surprising discoveries that can benefit humanity.								
	8. Fundamental discoveries	а	Experiments on animals play a central role in providing insights about the human brain and in helping to make healthy								
	promote healthy living and treatment of disease.		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.								
		С	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.								