WJEC - A-Level Bio	Nervous System Controls & Responds to Body Functions & Directs Behavior					N	-				& Function Are Determined By conment Throughout Life			B y	The Brain is the Foundation of the Mind		Research Lea Understandin					
		1. Brain is the body's most cor organ.	mplex	2. Neu			ate using electr al signals.			-		d circuits are ous system.	4. Life e	experience sy	s change tl stem.	ne nervo		. 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.	discoverie	amental es promote living and of disease
Topic Unit 1: BASIC BIOCHEMISTRY AND CELL ORGANISATION	Learning Objective	a b c d e	f	а	b	c (d e f	g a	b	с	d	e f	a b	с	d e	f	g	a b c d	a b	a b c	a b	c d
1.0 Chemical elements are joined together to form biological compounds																						
	(c) cell theory and the similarities and differences in the cell structures of eukaryotes (animal and plant) and prokaryotes and of viruses, including the examination of a range of electron micrographs of prokaryote and eukaryote cells to show structure.	•				•														•		
3.0 Cell membranes and transport4.0 Biological reactions are regulated																						
by enzymes 5.0 Nucleic acids and their functions 5.0 Genetic information is copied and	ا																					
Dassed on to daughter cells Jnit 2: BIODIVERSITY AND PHYSIOLOGY OF BODY SYSTEMS																						
heir evolutionary history	(n) the different types of adaptations of organisms to their environment including anatomical, physiological and behavioural adaptations.	•						•					•									
.0 Adaptations for gas exchange .0 Adaptations for transport .0 Adaptations for nutrition																						
Init 3: ENERGY, HOMEOSTASIS AND THE ENVIRONMENT .0 Importance of ATP																						
.0 Photosynthesis uses light energy o synthesise organic molecules .0 Respiration releases chemical																						
nergy in biological processes .0 Microbiology																						
.0 Population size and ecosystems .0 Human impact on the nvironment																						
.0 Homeostasis and the kidney .0 The nervous system	 (g) the role of antidiuretic hormone. (a) the components of a nervous response; from the detection of internal and external stimuli by receptors to 	•		•	•	•	•		•	•		•										
	the response by the effector. (b) the main areas of the spinal cord, including examination of T.S. spinal cord.	• •			•	•	•		•	•	•				•							
	(c) the basic pattern of spinal nerves in relation to the spinal cord including the dorsal root and ventral root.	• •			•	•	•		•	•	•				•							
	 (d) the simple reflex arc as the basis for rapid, protective, involuntary actions. (e) the structure of a nerve net in Cnidaria and be able to 	•		•	•	•	•		•	•		•										
	draw comparisons with the nervous systems in more complex organisms. (f) the structure of a motor neurone including drawing and	•		•	•	•	•		•	•		•								•		
	labelling of diagram. (g) the nature and transmission of the nerve impulse.	••		•	•		• • •	•	•	•	•	•			•					•		
	 (h) how to analyse oscilloscope traces showing the passage of an action potential. (i) factors affecting speed of conduction of a nervous 	•		•	•	•	•••	•	•			•										
	impulse in other organisms.(j) the structure and role of a synapse.(k) the process of synaptic transmission.	•				•	•••						•		•			•		• •		
	(I) the effect of chemicals e.g. organophosphates and psychoactive drugs on the transmission of impulses.	•		•	•	•	• • •	•	•			•								•		
ND OPTIONS 0 Sexual reproduction in humans						-			_													
0 Sexual reproduction in plants 0 Inheritance	(f) gene mutation as illustrated by sickle cell anaemia and		•										•								• •	•
.0 Variation and evolution	 <u>chromosome mutation as illustrated by Down's syndrome.</u> (k) Darwin's theory of evolution that existing species have arisen through modification of ancestral species by natural 	•											•				Т					
0 Application of reproduction and enetics	<u>selection.</u> (a) the Human Genome Project and its extension to the 100K Genome Project.																					
	(b) the ethical issues surrounding the use of this knowledge and its application to the screening of embryos for genetic disorders e.g. cystic fibrosis, Huntington's disease,		•					•					•								• •	•
	thalassaemia. (g) the advantages and disadvantages of using gene therapy																					
	for the treatment of disease as illustrated by musculardystrophy.(h) the use of genomics and its possible impact on		•				•						•							•	• •	•
	healthcare in the future.(i) the issues surrounding the use of stem cells for replacing damaged tissues and organs.	•	•					•					•				•			•	• •	•
ption A: IMMUNOLOGY AND ISEASE .0 Disease																						
2.0 Antibiotics 3.0 Immune response																						
Option B: HUMAN /IUSCULOSKELETAL ANATOMY 0 Skeletal tissues	(i) the sliding filament theory to include structure of the thin																					
.0 Structure and function of human	filaments (actin with two accessory proteins, tropomyosin and troponin) and thick filaments (myosin).						•															
keleton .0 Joints Option C: NEUROBIOLOGY AND																						
EHAVIOUR .0 The Brain	(a) the structure of the human brain – the position of the	• • •																				
	 <u>cerebrum, hypothalamus, hippocampus, cerebellum and</u> <u>medulla oblongata.</u> (b) the main functions of the cerebrum, hypothalamus, 			•	•	•	•		•		•	•			•		۲	• • • •				
	cerebellum and medulla oblongata.(c) the role of the sympathetic and parasympathetic nervoussystems.	• • •			•	•	•															
	(d) the hypothalamus as the link between nervous and endocrine regulation. (e) the role of the sensory areas and motor areas of the	••																				
	<u>cortex.</u> (f) the relationship between the sizes of the relevant parts	•••		•	•	•	•		•		•											
	of the cerebrum and the complexity of innervation of the different parts of the body as illustrated by the sensory homunculus and the motor homunculus.	•••		•	•	•	•		•		•											
.0 Neuroscience	 (g) the role of the areas of the cerebrum involved in language comprehension and speech. (a) the different techniques used for studying the brain 	• • •		•	•	•	•		•		•								•			
	without invasive neurosurgery including functional magnetic resonance imaging (fMRI), computerised tomography (CT), positron emission tomography (PET) and	• •						•			•	•								• •	• •	•
	electroencephalography (EEG). (b) how the brain develops and that there are critical																					
	periods for certain aspects of human learning and language acquisition. (c) neuroplasticity; changes in neural pathways which							•					• •				•					
	 enable the brain to respond to changes in the environment and to compensate for injury or disease. (d) how the expression of genes can affect brain 	• • •					• •	• •						•	•	•	•					
	development and the impact this may have on an individual's behaviour.	•						•					• •				•		•			
	(e) how altered gene expression in childhood could predispose adults to an increased risk of mental illness.	•						•					• •				•		• •		• •	• •

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 electrical and chemical signals.	a	Sensory stimuli are converted to electrical 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		a	Neuronal circuits are formed by genetic programs during embryonic development and modified through interactions with						
and Function are	circuits are foundation of the	b	the internal and external environment. Sensory circuits (sight, touch, hearing, smell, taste) bring information to the nervous system, whereas motor circuits send						
Determined by Both	nervous system.	a	information to muscles and glands.						
Genes and Environment		с	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.						
, C		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 nervous system.	а	Differences in genes and environments make the brain of each animal unique.						
		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	a	The nervous system can be studied at many levels, from complex behaviors such as speech or learning, to the interactions						
Essential Understanding	with a natural curiosity to		among individual molecules.						

for Therapies	understand how the world	b	Research can ultimately inform us about mind, intelligence, imagination, and consciousness.							
	for inerapies	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.						