SQA - Highers - 2014			Nervous System Controls & Responds to Body Functions & Directs Behavior							_		1	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. Brai		oody's mo organ.	ost comp	olex 2			nunicate emical sig	_		s. Genetically determined circuits are foundation of the nervous system.	4. Life experiences change the nervous system.	brain r	igence a easons, es proble	rises as plans,	possi comm	in makes it ble to unicate ge through uage.	7. Human bra endows us wit natural curiosit understand how world works	the	8. Fundamental discoveries promote healthy living and reatment of disease.		
Topic	Learning Objective	Detail	а	b c	d	e	f a	a b	С	d	e f g	;	a b c d e f	a b c d e f g	а	b c	d	a	b	a b	c a	a b c d		
DNA and the Genome  1 The structure of DNA			•			Π		_																
2 Replication of DNA	(a) The phonetype is determined by the proteins produced	The genetic code used in transcription and translation is																						
3 Control of gene expression	extra-cellular environmental factors. Only a fraction of the genes in a cell are expressed.	found in all forms of life.	_																					
4 Cellular differentiation	(a) Cellular differentiation is the process by which a cell develops more specialised functions by expressing the genes characteristic for that type of cell. Differentiation into specialised cells from meristems in plants; embryonic and tissue (adult) stem cells in animals.  (b) Embryonic and tissue (adult) stem cells. Research and	Meristems are regions of unspecialised cells in plants that are capable of cell division.  Stem cells are unspecialised somatic cells in animals that can divide to make copies of themselves (self-renew) and/or differentiate into specialised cells.																						
	therapeutic uses of stem cells by reference to the repair of damaged or diseased organs or tissues.  Stem cell research provides information on how cell processes such as cell growth, differentiation and gene regulation work. Stem cells can be used as model cells to study how diseases develop or for drug testing. The ethical	cell types that make up the organism (are pluripotent). These cells don't self-renew in vivo, but can under the right conditions in the lab. It is then they are termed embryonic stem cells and are used as a source of stem cells in research Tissue (adult) stem cells are needed for growth, repair and renewal of tissues. They replenish differentiated cells that need to be replaced and give rise to a more limited range of cell types (are multipotent), eg blood stem cells found in the bone marrow produces the various blood cell types. Once a cell becomes differentiated it only expresses the genes that produce the proteins characteristic for that type of cell. The therapeutic uses of stem cells should be exemplified by reference to the repair of damaged or diseased organs, eg	<u>t</u> n. of ee																					
5 The structure of the genome		corneal transplants, and skin grafts for burns.																						
6 Mutations	(a) Mutations are changes in the genome that can result in no protein or an altered protein being expressed.					•							•	•										
7 Evolution	(a) Evolution — the changes in organisms over generations					•							•	•										
		A species is a group of organisms capable of interbreeding and producing fertile offspring, and which does not normally breed with other groups.  The formation of hybrid zones in regions where the ranges of closely related species meet.				•						,	•	•										
8 Genomic sequencing	(c) Comparison of genomes from different species.	Many genomes have been sequenced, particularly of																						
	Comparison of genomes reveals that many genes are highly	disease-causing organisms, pest species and species that are important model organisms for research.  The difficulties in distinguishing between neutral and				•						•	•	•										
	Pharmacogenetics Analysis of an individual's genome may lead to personalised medicine through knowledge of the genetic component of risk of disease and likelihood of success of a particular treatment. Difficulties with personalised medicine.	harmful mutations in both genes and regulatory sequences and in understanding the complex nature of many diseases					•						•							•	•	• • • •		
Metabolism and Survival  1 Metabolic pathways and their																								
control																								
<ul><li>2 Cell respiration</li><li>3 Metabolic rate</li></ul>																								
4 Metabolism in conformers and regulators	(d) Negative feedback control and thermoregulation in mammals including the role of the hypothalamus, nerves, effectors and skin).				•																			
	(e) Importance of regulating temperature for optimal enzyme controlled reaction rates and diffusion rates to maintain metabolism.				•																			
5 Metabolism and adverse 6 Environmental control of metabolism 7 Genetic control of metabolism																								
Sustainability and Interdependence 1 Food supply, plant growth and productivity																								
2 Plant and animal breeding 3 Crop protection																								
4 Animal welfare 5 Symbiosis																								
6 Social behaviour 7 Mass extinction and biodiversity																								
8 Threats to biodiversity																								

KEY			Description						
Nervous System Controls	1. The brain is the body's most	a	There are a hundred billion neurons in the human brain, all of which are in use.						
	complex organ.	b	Each neuron communicates with many other neurons to form circuits and share information.						
and Responds to Body	oempren ergann	C	Proper nervous system function involves coordinated action of neurons in many brain regions.						
Functions and Directs Behavior		d	The nervous system influences and is influenced by all other body systems (e.g., cardiovascular, endocrine, gastrointestina and immune systems).						
		0	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	2	Sensory stimuli are converted to electrical signals.						
	electrical and chemical signals.		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.						
		<u>с</u>	Electrical signals in muscles cause contraction and movement.						
		<u> </u>	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 circuits are foundation of the	a	Neuronal circuits are formed by genetic programs during embryonic development and modified through interactions with the internal and external environment.						
and Function are 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.						
<b>Genes and Environment</b>		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.						
		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.						
		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."						
		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	5. Intelligence arises as brain reasons, plans, and solves	а	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.						
		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	a	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						
<b>Essential Understanding</b>			among individual molecules.  Research can ultimately inform us about mind, intelligence, imagination, and consciousness.						
for Therapies	understand how the world works.	C C	Curiosity leads us to unexpected but surprising discoveries that can benefit humanity.						
	8. Fundamental discoveries	a	Experiments on animals play a central role in providing insights about the human brain and in helping to make healthy						
	promote healthy living and		lifestyle choices, prevent disease, and find cures for disorders.						
	treatment of disease.	D	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.						