SQA - National 5s - 2014

			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**	**Detail**	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
Cell Biology																																									
1 Cell structure	Cell ultrastructure and functions to include: cell wall, mitochondrion, chloroplast, cell membrane, cytoplasm, vacuole, nucleus, ribosome and plasmid using examples from typical plant, animal, fungi and bacterial cells. Cell wall structure in fungal and bacterial cells is different from plant cells, ie not cellulose.	Functions of structures exemplified later in this Unit. Fungal structure in terms of similarity to plant and animal cells but with a different cell wall structure.Bacterial structures only to include absence of organelles and a different cell wall structure to plant and fungal cells. Chemical composition of cell walls for fungi and bacteria not required.		•							•																							•							
2 Transport across cell membranes	f. Active transport requires energy for membrane proteins to move molecules and ions against the concentration	Appropriate examples for active transport could include sodium and potassium in nerve cells, or iodine in seaweeds.		•					•	•	•	•					•	•		•																				
3 Producing new cells																																									
4 DNA and the production of																																									
5 Proteins and enzymes																																									
6 Genetic engineering	Genetic information can be transferred from one cell to another naturally or by genetic engineering. Stages of genetic engineering to include: identify section of DNA that contains required gene from source chromosome, extract required gene, extract plasmid from vector/bacterial cell, insert required gene into vector/bacterial plasmid, insert plasmid into host cell and grow modified cells to produce a genetically modified (GM) organism. Use of enzymes in this process.	DNA can be transferred naturally between cells either by bacterial plasmids or viruses. Details of these processes not required. Names of particular enzymes are not required. Links with Life on Earth Unit.						•								•						•											•				•			•	•	•	•
7 Photosynthesis																																									
8 Respiration																																									
Multicellular Organisms																																									
1 Cells, tissues and organs	Specialisation of cells, in animals and plants, leads to the formation of a variety of tissues and organs. Groups of organs which work together form systems.	Multicellular organisms have more than one cell type and are made up of tissues and organs. Organs perform different functions. The cells in organs are specialised for their function. Specialisation can be applied to all named tissues in this Unit.	•	•	•	•										•																									
2 Stem cells and meristems	a. Stem cells in animals can divide and have the potential to become different types of cell. Stem cells are involved in growth and repair.																						•	•																
3 Control and Communication	a. Nervous control (i) Nervous system consists of central nervous system (CNS) and nerves. CNS consists of brain and spinal cord. Structure and function of brain to include cerebrum, cerebellum and medulla. Neurons are of three types, sensory, relay and motor. Receptors detect sensory input/stimuli. Electrical impulses carry messages along neurons. A synapse occurs between neurons. Chemicals transfer these messages across synapses. (Investigate examples of where communication pathways are used, eg pain receptors.)	Internal communication is required for survival of a multicellular organism. Cells in multicellular organisms do not work independently. Sensory neurons pass the information to the central nervous system. The CNS processes the information from our senses which needs a response. Motor neurons enable a response to occur, which can be a rapid action from a muscle or a slower response from a gland.	•	•	•				•	•	•						•			•	•																			
	(ii) Structure and function of reflex arc.(Investigate examples of human reflex activities, eg blinking, iris reflex, response to pain.)	Internal communication is required for survival of a multicellular organism. Cells in multicellular organisms do not work independently. Sensory neurons pass the information to the central nervous system. The CNS processes the information from our senses which needs a response. Motor neurons enable a response to occur, which can be a rapid action from a muscle or a slower response from a gland.		•					•	•	•	•					•	•																						
	b. Hormonal control (i) Endocrine glands release hormones into the blood stream. Hormones are chemical messengers. Target tissues have cells with receptor proteins for hormones, so only some tissues are affected by specific hormones.				•	•																																		
	ii) Blood glucose regulation including the role of insulin, glucagon, glycogen, pancreas and liver.	Insulin production when blood glucose levels are higher than normal and production of glucagon when levels are below normal. Detail of negative feedback is not required.			•	•																																		
4 Reproduction																																									
5 Variation and Inheritance																																									
6 The need for transport																																									
7 Effects of lifestyle choices on human transport and exchange systems																																									
Life on Earth																																									
1 Biodiversity and the distribution of life																																									
2 Energy in ecosystems																																									
3 Sampling techniques and measurement of abiotic and biotic factors																																									
4 Adaptation, natural selection and the evolution of species																																									
5 Human impact on the environment																																									

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.