1a.

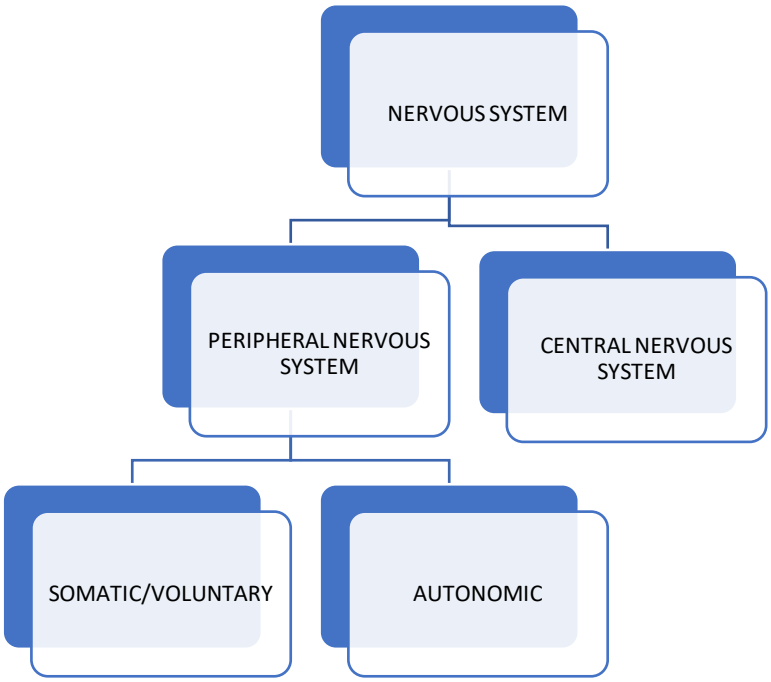
Ans: A sensor is a vital system for the detection of changes in the internal as well as external body environment. Thus a sensory receptor is a major cell or a tissue that has a vital part in sensing the change in the stimulus as well as physiological variable. This has an integral part in maintaining homeostasis as well as controlling body mechanisms as the control centre responds to the changes in the stimulus which are received from the sensor as it sends the signal to the effector organ. Also, the sensory receptor proves input to the control centre. The receptors pass on the signal to the integrating centre also known as the control center and then the initiation of response for maintaining homeostasis.

For example, peripheral chemoreceptors (Smith et al., 2015) which are helpful for detecting blood oxygen alterations.

These are found in the carotid i.e. carotid sinus as well as aortic bodies mainly the aortic arch which then extends into blood vessels and then help in the detection of the alterations in chemical concentrations. These monitor the homeostasis by detecting the changes in arterial blood oxygen as well as initiate reflexes which are vital for maintaining homeostasis during arterial hypoxemia and then stimulate breathing. Thus they detect changes in CO_2 as well as oxygen ultimately affecting homeostatic breathing.

1b.

Ans:



Central nervous system maintains the metabolic homeostasis and maintain energy homeostasis and contain the integrative as well as control centres and maintains sensory as well as motor homeostasis along with maintaining the temperature in the body such as heat-producing muscular shivering controlled by parts of the brain and spinal cord.
The Peripheral nervous system majorly controls and contains motor neurons for controlling internal organs by connecting with the CNS and it contains the centres for muscular and cardiac homeostasis.
The somatic nervous system is linked with voluntary control of the body movements through the use of skeletal muscles and regulate homeostasis (Mai et al., 2011) and also regulates reflex arcs.
The autonomic nervous system (Janig, 2008) has a sympathetic system that controls the heart as well as increases heart rate and causes constriction of blood vessels as well as dilation of bronchioles in the lungs it resulted in the body actions during exercise whereas the parasympathetic system reduces heart rate and maintains homeostasis while at rest.

2a.

Ans: Hypothalamus is a majorly affected part in case of fever. Mammalian thermoregulation is majorly regulated by the hypothalamus present in the forebrain. This is because the mammals have the tendency to maintain a constant body temperature and a core temperature deviation affects the hypothalamus which is designated as thermostat regulating heating as well as cooling of the body and helping in maintaining homeostasis. Also, fever occurs in the human body when the hypothalamus activates its heat-promoting centre. This centre contains the sympathetic nerves which have a role in constricting blood vessels. Also when lymphocytes are produced, it activates leukocytes which in turn releases

endogenous pyrogen (Prajitha et al., 2018) and these chemical substances are carried via the bloodstream to the brain. Then they alter the functioning of the hypothalamus. Also, these pyrogens inhibit heat-sensing neurons in the hypothalamus.

2b.

Ans: The autonomic nervous system is responsible for such an alteration in heart rate. Majorly the sympathetic nervous system increases heart rate during exercise as a cardiovascular response as it releases hormones known as catecholamines which are epinephrine and norepinephrine and thus accelerate the heart rate. Also,
the sympathetic nervous system releases norepinephrine increases the heart rate, this stimulation by the sympathetic system accelerates heart rate as well as myocardial contractility. But after the exercise, the parasympathetic nervous system (Lakin et al., 2018) is a responsible part of the autonomic nervous system which releases hormonal chemicals known as acetylcholine responsible for the recovery period and heart rate reduces to normal.

3a.

Ans: In the case of multiple sclerosis, the myelin sheath is damaged and demyelination occurs which ultimately disrupts nerve impulses. After the damage to myelin, the axons and nerve cells are also damaged that disrupts the smooth flow of nerve impulses. In absence of MS, the myelin increases the speed for action potential to travel down a neuron. Also, in MS, the failure or reduced axonal action-potential conduction is reported. In addition to this, the lack of myelin increase membrane leakiness and doesn't prevent open channels. Lack of myelin reduces the conduct of electrical impulse across an axon along with increased time for travel of action potential will travel down an axon, ultimately neuron's affecting conduction velocity. Also, this neurodegenerative disease affects CNS and inhibits neural communication which does not allow nerve impulse generation and inhibition of conduction of nerve impulses. The demyelination disables the axons due to the absence of myelin and does not allow them to conduct stimuli rapidly and also decreases effectiveness.
Thus, the nerve impulses disruption occurs due to a lack of speed in electrical signal travel across nerves and resulting in leak out between the damaged myelin and demyelinated axons conduct impulses very slowly as less as 50 times than normal myelinated axon.

3b.

Ans:The messages which are transmitted via neurons are known as nerve impulses. In the case of a normal human, a nerve impulse is generated due to a change in a neuron's membrane and there is an alteration in chemical signals due to binding with a neighbouring neuron cell. Also, the nerve impulses travel quickly due to electrical impulses and the presence of myelin.

In the case of normal individuals who do not have multiple sclerosis, these neurons contain myelin which helps in the smooth flow of impulse as well as propagation across the neural system. Also, the propagation velocity and impulse transmission are 50 times faster in myelinated axons (Adamczyk et al., 2020).
The nerve impulse propagation occurs by reaching the end of an axon which then releases neurotransmitters. The neurotransmitters easily transmit the nerve impulse across the synapse as the myelin acts as an insulating layer around the nerves, which allows electrical impulses to transmit quickly as well as improved efficiency along with the normal nerve cells. Then the myelin protects the membrane of the dendrite as well as axon and transfer of impulse after binding to help the nerve impulse travel via the receiving neuron.

4a.

Ans: Serotonin acts as a neurotransmitter as it is helpful in propagating messages from one in various parts of the brain. Also due to the widespread distribution of its cells, it influences a wide variety of psychological functions. Thus it is a hormonal neurotransmitter that binds to the receptor proteins within the postsynaptic cell and ultimately results in alteration in the electrical state of the cell. Also, the Serotoninergic neurons present in the brain synthesize as well as store serotonin which ultimately released as well as interacts with cell-surface receptors on adjacent neurons and help in nerve impulse conduction.
In the case of depression, the synaptic transmission is affected as lack of serotonin causes imbalances in the brain synaptic cleft as regulates sleep as well as mood. The two nerve cells i.e. synapse (Wu et al., 2019). Communicate with each other by utilizing the communication with neurotransmitters which is packaged up as well as released from the end (axon) of a presynaptic cell. But in depression the size of the brain reduces and the production of serotonin reduces which do not allow electric transmission in a normal way and thus the serotonin receptors in the brain cannot communicate effectively with each other on postsynaptic cells.

4b.

Ans: The use of Tubocurarine as an anaesthetic agent competes with acetylcholine and majorly blocks the nicotinic receptors which are present at the neuromuscular junction of skeletal muscles. This inhibits the action of acetylcholine which ultimately blocks neural transmission (Weisenhaus, 2018). Also, there is no depolarization of the postsynaptic membrane. Thus, it is a non-depolarizing neuromuscular blocking agent which has a competitive antagonist action at nicotinic acetylcholine receptors on the motor endplate of the neuromuscular junction. Thus majorly this causes flaccid paralysis which initiates within a minute by impacting causing the relaxation of skeletal muscle. Also, the ultimate result of this relaxation of skeletal muscle is paralysis.

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