

HSC Biology

Communication

Focus 7:

 Signals from the eye and ear are transmitted as electro-chemical changes in the membranes of the optic and auditory nerves.

Identify that a nerve is a bundle of neuronal fibres.

- Neurone:
 - Basic structure which makes up the nervous system.
 - 3 types:
 - Sensory.
 - Motor.
 - Interneurones.
 - No 2 are exactly alike.
 - Each neurone has 3 common characteristics.
 - Cell body.
 - Forms grey matter.
 - Contains nucleus.
 - Dendrites.
 - Conduct impulses to cell body.
 - Axon.
 - White matter of CNS.
 - Conduct impulses away from cell body.
 - Covered by insulating myelin sheath (made of lipids).

- Sensory neurones:
 - Transmit impulses from sense organs to other neurons in the CNS.
- Motor neurones:
 - Transmit impulses from CNS to muscles & glands (effectors).
- Interneurones:
 - Connect sensory neurones with motor neurones.
 - Usually in brain / spinal chord
- Cell bodies usually situated in brain / spinal chord.
 - Some occur outside CNS in clusters called *ganglia*.
 - Coordinate impulses.
- Nervous system mad up of millions of neurones.
 - Gathered into bundles called nerves.
 - Held together by connective tissue.
- Nerves = bundles of axons bound together.

Identify neurones as nerve cells that are the transmitters of signals by electro-chemical changes in their membranes.

- Nerve impulses transmitted in the form of electricity along neuronal.
 - Chemicals used to pass message from one neurone to the next
- Nerve impulses created in the plasma membrane of neurones.
 - Human body is neutrally charged.
 - Almost equal positive charges as negative charges.
 - Potential difference (difference in voltages) occurs on either side of the membrane.
 - Cytoplasm side is negative.
 - Extracellular fluid is positive.
 - Differences result in cellular voltage.
 - Resting membrane potential (-70mV).
 - Indicates inside cell is negative.
 - Membrane is said to be polarised, creating an electrical current.
 - Inside becomes more negative.
- Neurones contain ions in an electrolyte solution.
 - In extracellular fluid & cytoplasm.
- Cell membranes impermeable to proteins & most organic phosphates.
 - Remain inside cytoplasm.
- Membranes selectively permeable to Na^+ , K^+ , & Cl^- because of *ion channels*.
 - Ion channel pores open, allowing ions to move from one side of the membrane to the other.
 - Each channel specific to 1 type of ion.
- Electrical current created by the flow of Na^+ into the neurone.
 - K^+ ions then move outside cell to repolarise it.
 - Ions then pumped back through sodium-potassium pump.

Define the term threshold and Explain why not all stimuli generate an action potential.

- Nervous impulse known as 'all or nothing response'.
 - Either maximum current or none at all.
- Threshold:
 - Amount of positive change in membrane potential required to produce an action potential.
 - Minimum current created by a graded response to cause an action potential to occur.
- Intensity of stimulus determines number of neurones involved in creating impulse.
- If magnitude of graded response not high enough when reaching trigger site (nodes of Ranvier) action potential will not occur.
 - Threshold not reached.

Identify those areas of the cerebrum involved in the perception and interpretation of light and sound.

- Cerebrum:
 - Cortex of brain responsible for perception & thought.
 - Convolutions triple surface area of the brain.
 - Most activities occur on outer surface (grey matter).
- Vision:
 - Optical nerves carry impulses to *occipital lobe*.
 - About half of all optical nerves cross over to form *optic chiasma*.
 - Crossing over provides each visual cortex with the same image from a slightly different angle.
 - Parts of visual cortex process images from different parts of the retina.
- Sound:
 - Impulses travel through the *vestibulocochlear* nerve to the *temporal lobe*.
 - From organ of Corti to *auditory cortex* of temporal lobe.
 - Different parts of cortex perceive sounds of different frequencies.

Explain using specific examples, the importance of correct interpretation of signals by the brain for the coordination of animal behaviour.

- Environment surrounding an organism is constantly changing.
 - Stimuli received must be transmitted to the brain & accurately interpreted before a response can be given.
- Short circuits:
 - Can cause an incorrect or lack of response to a situation.
 - Lack of stimulus.
 - Cataracts blocking eyes.
 - Trauma.
 - Damage to nerves.
 - Lack of O₂.
 - Drug reaction.
 - Illicit drugs / prescription drugs.
 - Disease.
 - Autoimmune.
 - Pollution.
 - Noise, chemicals.
 - Age related damage / deterioration.
- When things go wrong:
 - *Multiple sclerosis*.
 - Autoimmune disease.
 - Body attacks myelin proteins.
 - Myelin sheaths destroyed.
 - Impulses short circuit.
 - *Neurofibromatosis (elephant man disease)*.
 - Causes tumours to grow along nerves.
 - *Alcohol / anaesthetics*.
 - Block nerve impulses by decreasing permeability of plasma membrane.
 - *Age related damage*.
 - Neurones die, not replaced.
 - May be caused by a build up of Ca (neurotoxic).

Perform a first-hand investigation using stained prepared slides and/ or electron micrographs to Gather Information about neurones and nerves.

- Microslide viewer used to view, draw & label:
 - Nerves.
 - Axons.
 - Capillaries.
 - Connective tissue.

 - Neurones.
 - Dendrites.
 - Cell body.
 - Axons.

Perform A First-Hand Investigation to Examine an appropriate mammalian brain or model of a human brain to Gather information to Distinguish the cerebrum, cerebellum and medulla oblongata and locate the regions involved in speech, sight and sound perception.

- Dissection of a sheep's brain:
 - Instruments:
 - Probe.
 - Scalpel.
 - Tweezers.
 - Scissors.

 - Identified structures:
 - Cerebrum.
 - Cerebellum.
 - Medulla oblongata.
 - Nerves.
 - Grey matter.
 - Fissure of Rolando.
 - Frontal lobe.
 - Parietal lobe.
 - Occipital lobe.
 - Temporal lobe.

 - Cut in half.
 - Identified white matter.

- Wore gloves to prevent infection.
 - Washed hands with detergent after.