

Describe how resting membrane potential is created and maintained

Transmembrane potential- is the electrical potential of a cell's interior relative to its surroundings.

Resting potential- the transmembrane potential of an undisturbed cell.

Resting membrane potential is created by the difference in concentration between extracellular sodium ions and intracellular potassium ions. Resting potential is normally -70 microvolts. It is maintained by the sodium-potassium exchange pump that requires energy to work against the sodium gradient outside the cell. It's job is to pump excess sodium ions out of the cell, so the potential can remain as stable as possible.

Describe the events involved in the generation and propagation of an action potential

Action potentials- Nerve impulses, changes in the transmembrane potential that, when initiated, affect the entire excitable membrane.

There is an 'all-or-none' principle when generating an action potential, a stimulus either triggers an action potential or does not produce one at all.

Generation of Action Potential

1. *Depolarisation to threshold*: Sodium channel opens slightly to let some sodium ions into the cell, bringing the potential down to -60 microvolts.
2. *Activation of Sodium Channels and Rapid Depolarisation*: Sodium channel opens completely allowing extracellular sodium ions to flood in, creating a charge of +10 mV.
3. *Inactivation of Sodium Channels and Activation of Potassium Channels* Sodium channels close, and potassium channels open, so potassium ions flood out of the cell, creating a charge of +30mV.
4. *Closing of potassium channels*, creates charge of -90mV. Potassium ions can no longer flow in or out.
5. *Return to resting potential (-70mV)*

Refractory Period

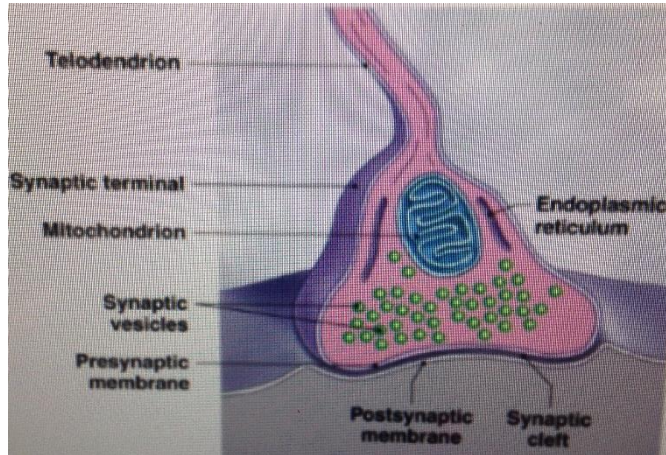
After action potential begins until normal resting potential is stabilised once again, the membrane does not respond normally to additional depolarising stimuli.

The *Generation of Action Potential* occurs in the axon hillock, where the local current depolarises the adjacent portion of the membrane. This occurs over and over, and the action potential is 'propagated' through the whole excitable membrane (axon). The action potential only moves forward, because the previous segment of the axon is in refractory period.

List the factors that affect the speed of action potentials

The presence of myelin increases speed, and axon diameter (large=faster) (small=slower).

Describe the structure of a synapse



Distinguish between an electrical and a chemical synapse

- Chemical synapses (abundant) involves a neurotransmitter
- Electrical synapses (rare) involves direct physical contact between cells (gap junctions)

Lecture 13 CNS: Brain and Spinal Cord

List the structures that support and protect the central nervous system

Bones of the Cranium: (Most similar with lobes of brain)- Frontal, Parietal, Occipital, Temporal. Also the Sphenoid and Ethmoid.

The Meninges: Covers the brain itself, encloses and protects the blood vessels that supply the brain, acting as a 'safety belt and an air bag.' Consist of three layers, the *Dura mater*, *Arachnoid mater* & the *Pia Mater*.

Cerebrospinal Fluid: Circulates in space between the CNS and the meninges. The brain is suspended in this fluid, so that gravity is not making the brain push down on itself. Also, contains abundant nutrients for the brain because the blood brain barrier does not allow the nutrients to cross from the bloodstream. So it essentially provides cushioning, support and transports nutrients, chemical messengers and waste products.

Blood Brain Barrier: Protects brain from general circulation, creates a layer of capillaries that aren't 'leaky.' There are no spaces between cells in the capillaries, so anything that crosses the barrier must cross through the cells. Astrocytes also play an important role as star shaped support cells that wrap around the capillary, adding another layer things must cross through. *There are four regions where the BBB is open: hypothalamus and capillaries around posterior pituitary (hormone diffusion), pineal gland (secretions into blood stream) and the choroid plexus (capillaries very permeable).*