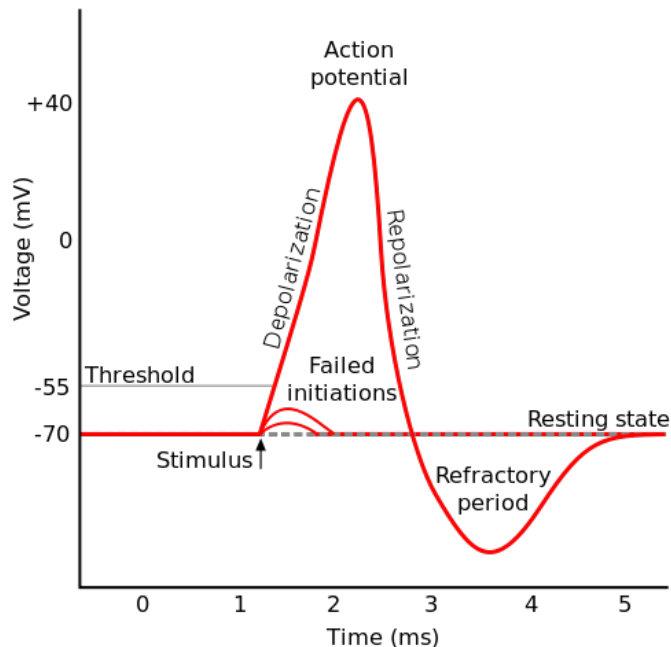


LECTURE 3

NEURAL COMMUNICATION

- If nerve inactive, membrane potential = unchanged
- Action Potential:



- AP propagated along axon as Na^+ & K^+ channels open along Nodes of Ranvier along the axon
- Depolarisation of presynaptic terminal causes Ca^{2+} influx
- Ca^{2+} required for vesicle function and release
- Neurotransmitters \rightarrow neurones communicate
- In nerve cell, channels open to allow ions to flow through are 'gated'
- Binding of transmitter \rightarrow change in voltage/phosphorylation \rightarrow open/close gates
- Channel opening \rightarrow flow of +ive ions
- Input arriving at dendrites is transmitted passively to axon hillock and AP may be initiated

SYNAPTIC INTEGRATION

- Neurone transmission affected by:
 - o No# of connections received
 - o Type of neurotransmitter/receptor/current flow
 - o Size of response in post-synaptic cell
- AP in presynaptic neurone requires integration of all inputs it receives
- Neurone receives depolarised/hyperpolarised currents
 - o Excitatory post-synaptic potential (EPSP)
 - o Inhibitory post-synaptic potential (IPSP)

- Type of current depends on the type of ion channel gated by neurotransmitter
- Synapses on cell body often inhibitory
- Temporal (time) summation of EPSPs also moves membrane potential closer to threshold
- Need more impulses or impulses closer to axon hillock (spatial summation – 2 charges together allowing AP to occur)
- Neurone can synapse at the dendrite, cell body or axon
- Is postsynaptic neurone will discharge depends on:
 - o Amplitude and sign of postsynaptic potential
 - o Location of synapse relative to axon hillock

PERSISTENT INWARD CURRENTS (PICs)

- Dendrites contain metabotropic receptors for serotonin and noradrenaline
- Called monoamines: released by presynaptic neurones emanating from the brainstem
- 5-HT and Na^+ → second messengers open voltage-gated Ca^{2+} and Na^+ channels → long-lasting inward currents called PICs

NEUROMODULATION

- 5-HT dependent activity occurs during repetitive motions & increase with contraction force e.g. walking → running
- No need for fear/arousal
- Activity through these systems is needed for low levels of motor output required for posture
- Need for ‘regulatory’ system
- **With SCI:**
 - o Complete SCI = reduced motor neurone excitability; almost complete loss of reflex response
 - o After a period of time → spasticity develops

PRESYNAPTIC INHIBITION

- **H-reflex:**
 - o Sensory afferents synapse onto efferents
 - o Influence reflex activity
 - o Pain, pressure and other sensory inputs can produce pre-synaptic inhibition
 - o These factors can reduce our capacity to produce force
 - o Electrical stimulation of nerves activates afferent/efferent tracts
 - o Afferent returns through the reflex arc to the muscle
 - o Get both motor and reflex wave
 - o Less inhibition