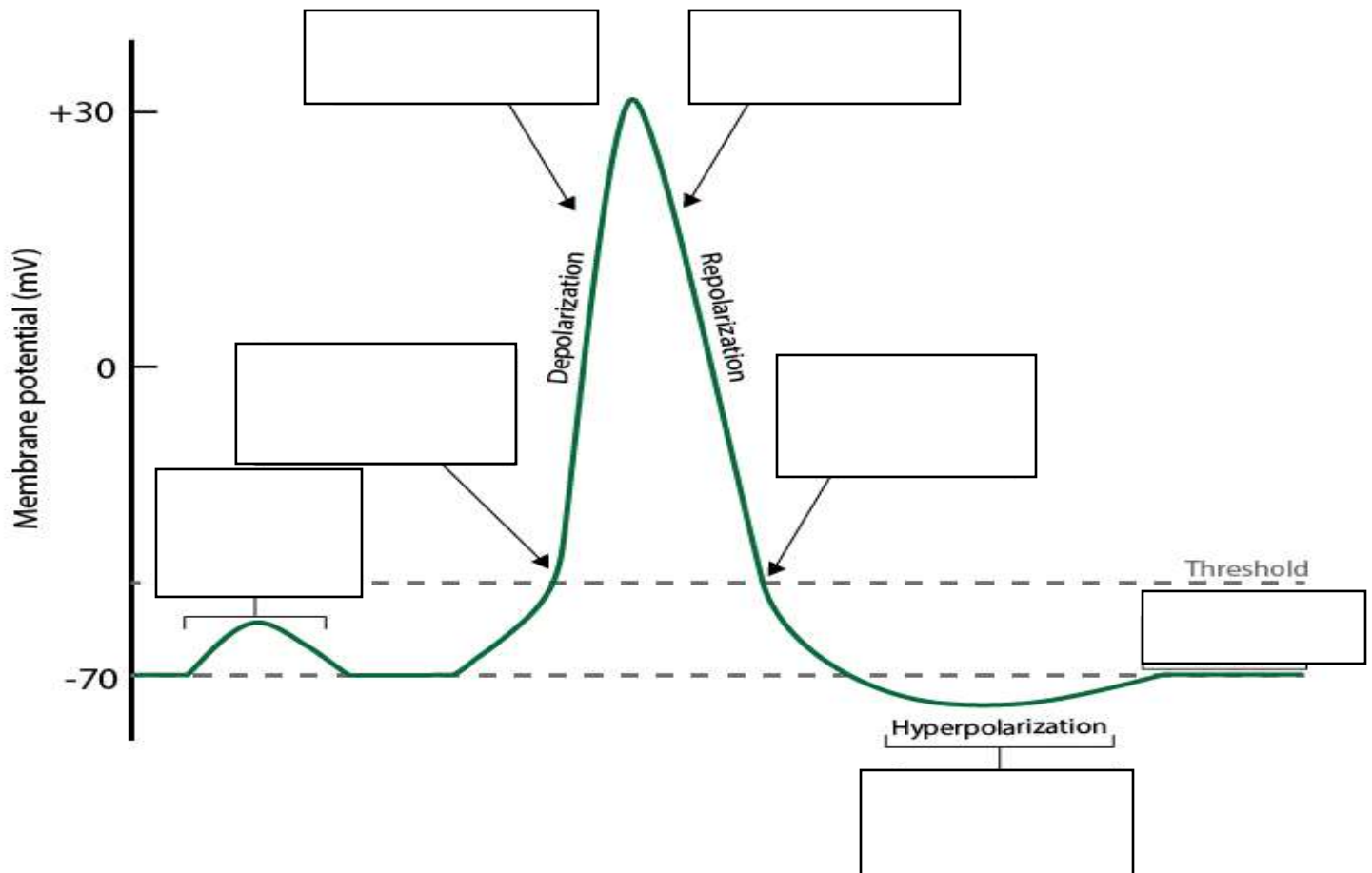


## Action Potential

EQ: Explain how an Action Potential is an all or nothing response.

- I. Nerve Impulses
  - a. How To Produce an Action Potential or...how to think!
- II. Resting Membrane Potential
  - a. All cells in the body maintain a voltage difference across the cell membrane called a resting membrane potential.
  - b. The inside of the cell is more negatively charged in comparison to the outside of the cell – this is shown by a negative sign in front of voltage, (ex., -70 mV)
  - c. The big players here are sodium and potassium ions
  - d. How this Resting Potential is Maintained
    - i. Na<sup>+</sup> / K<sup>+</sup> pump in the cell membrane pumps sodium out of the cell and potassium in
    - ii. However, more potassium ions leak out of the cell.
    - iii. The inside of the membrane builds up a net negative charge relative to the outside.
- III. An Action Potential
  - a. Depolarization is the beginning of “thought” or the start of an action potential.
  - b. An action potential sweeps down (nerve impulse) an axon to the junction of another neuron or muscle
  - c. Depolarization is brought about by a sudden change in the permeability of the membrane to Na<sup>+</sup>.
  - d. Pores in the membrane open up and let Na<sup>+</sup> pore in. This only lasts a brief time and the pores close up.
  - e. After the depolarization wave passes. K<sup>+</sup> pores open up and K<sup>+</sup> leaves the neuron setting up a negative charge again. This resets the neuron, called repolarization.



- IV. All-Or-None-Response
  - a. The action potential either fires completely or not at all.
  - b. It won't go part way down an axon – it's all or nothing
  - c. So, you either notice something or you don't
- V. Speed of an Impulse
  - a. The speed of an impulse has to do with 2 things:
    - i. The diameter of the axon
    - ii. If the axon is surrounded by myelin.
  - b. These can be very fast – 120 m/s (432 km/h)
  - c. When myelin is present you get saltatory conduction.
  - d. Impulse “jumps” from Node of Ranvier to node.
- VI. The Synapse
  - a. Nerve pathway - nerve impulse travels from neuron to neuron
  - b. To complete the signal, a NEUROTRANSMITTER is released at the gap to signal the next neuron
  - c. Types of Neurotransmitters
    - i. Acetylcholine - stimulates muscle contraction
    - ii. Monoamines - Norepinephrine & Dopamine (sense of feeling good, low levels = depression)
    - iii. Serotonin (sleepiness) and mood
    - iv. Endorphins (reduce pain, inhibit receptors)
  - d. Drugs that Affect Synapses and Neurotransmitters
    - i. Curare - poison made from frog skin
    - ii. Strychnine poisoning can be fatal to humans and animals
    - iii. Cocaine, morphine, alcohol, ether, chloroform and Ecstasy
    - iv. Antidepressants
      - 1. Zoloft is part of a class of drugs called selective serotonin reuptake inhibitors, or SSRI for short.
      - 2. SSRIs act on a specific chemical within the brain known as serotonin.