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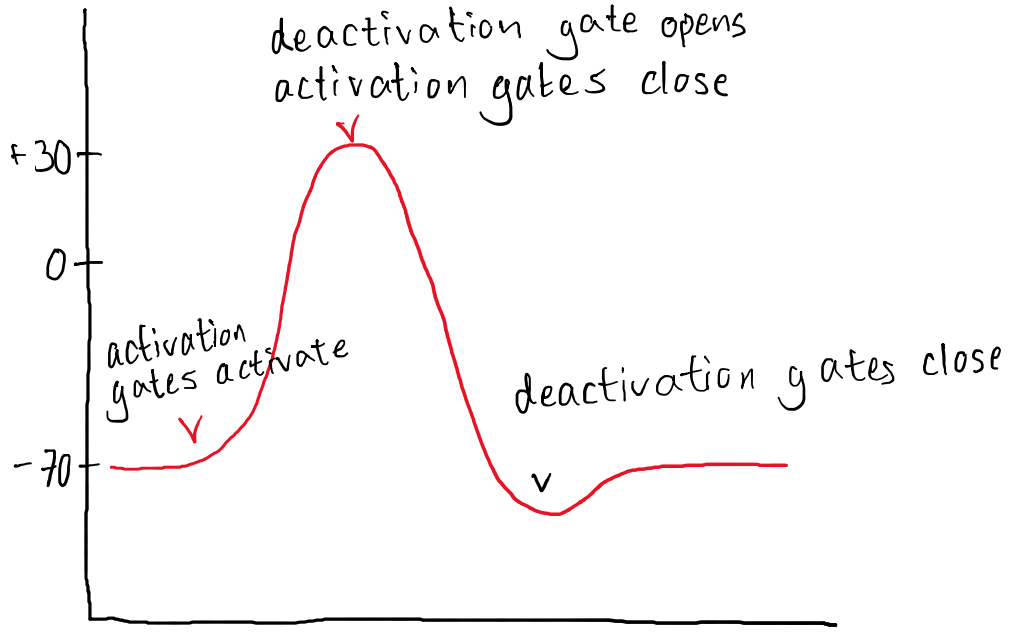
Part I: Defining Concepts

1. Explain the difference between activation and inactivation gate. Include a sketch as appropriate.

Activation gates and inactivation gates are subunits of ion channels. Only when all the subunits of the ion channel, inactivation gates included, are activated will the channel be open. Activation gates tend to open with when the membrane is depolarized. Deactivation gates tend to open when the membrane is hyperpolarized.



2. Define the leak current and explain the origin of its name.

The leak current represents the amount of potassium that leaks out of the neuron due to the potassium leakage channels.

4. An ion channel comprises 5 independent subunits, 3 activation gates and 2 inactivation gates. How many games must be open for the channel to open?

For a channel to be open, all 5 subunits must be activated. Contrary to the name, inactivation gates do not present channel from opening, rather it only closes at high polarization to bring the membrane potential down.

6. Is the Hodgkin-Huxley model a deterministic or stochastic model? Explain.

It is deterministic. Section 3.1.1 staties that this model is fully deterministic as there are no stochastic elements within the equation. Variables like m^3h and n^2 may look like a probability variable but instead represents the amount of ions that goes through the channels as a function of membrane voltage.

9. True or False: "The ion pumps are responsible for the repolarization of the membrane after an action potential". Justify your answer

False, repolarization of the membrane is caused by an outward potassium current facilitated by passive ion channels. This is due to the current differential that allows ions to flow from an area of high concentration within the cell to an area of low concentration outside of the cell.

Part II: Applying Concepts

3. $\dot{p} = \beta p_2 - 4\alpha p_1$

$p_1 = (1-n)^4$

$p_2 = 4n(1-n)^3$

$\dot{p} = \beta(4n[1-n]^3) - 4\alpha(1-n)^4$

$\dot{n} = 4n\beta(1-n)^3 - 4\alpha(1-n)^4$

2. $\dot{p} = ???$