

BMT-72106 Cellular Biophysics

Exercise 4, 12.4.2019

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Exercise 1.

Explain following phenomena:

- Driving force of an ion species
- Voltage-gated ion channel
- Can action potential travel backwards? Justify.
- Complementary functions of ion channels and ion pumps
- Equivalent circuit of a cell membrane
- Intra- and extracellular recording

Exercise 2.

- What is the difference between permeability and conductance (in the context of membrane properties)?
- How does the charge inside the cell membrane compare to the outside? Why is this?

Exercise 3.

Gap junctions and synapses are both used in the communication between cells. Compare gap junctions and synapses: similarities and differences, "advantages" and "disadvantages".

Exercise 4.

A Na^+ -selective channel population has a constant conductance at membrane potential levels more negative than -50 mV. When the membrane is depolarized from -50 mV to -20 mV, there is a gradual 5-fold increase in conductance, and at potentials above -20 mV the conductance remains constant (see figure 1). The equilibrium potential of Na^+ is $+60$ mV.

- Sketch the current voltage plot of this channel population to the provided template in figure 2 (note that there is no scale for I_m , only the shape of the curve as a function of voltage is important).
- What happens to the current if you apply tetrodotoxin (TTX)?

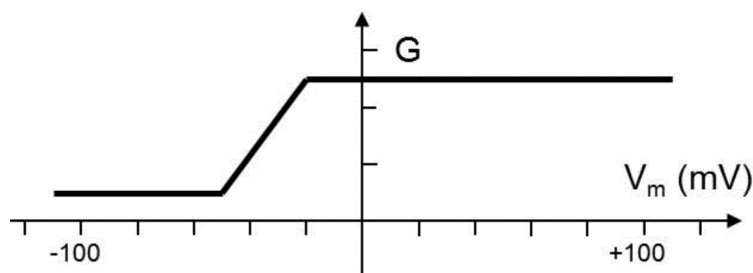


Figure 1: Na^+ -selective channel population conductance as a function of voltage.

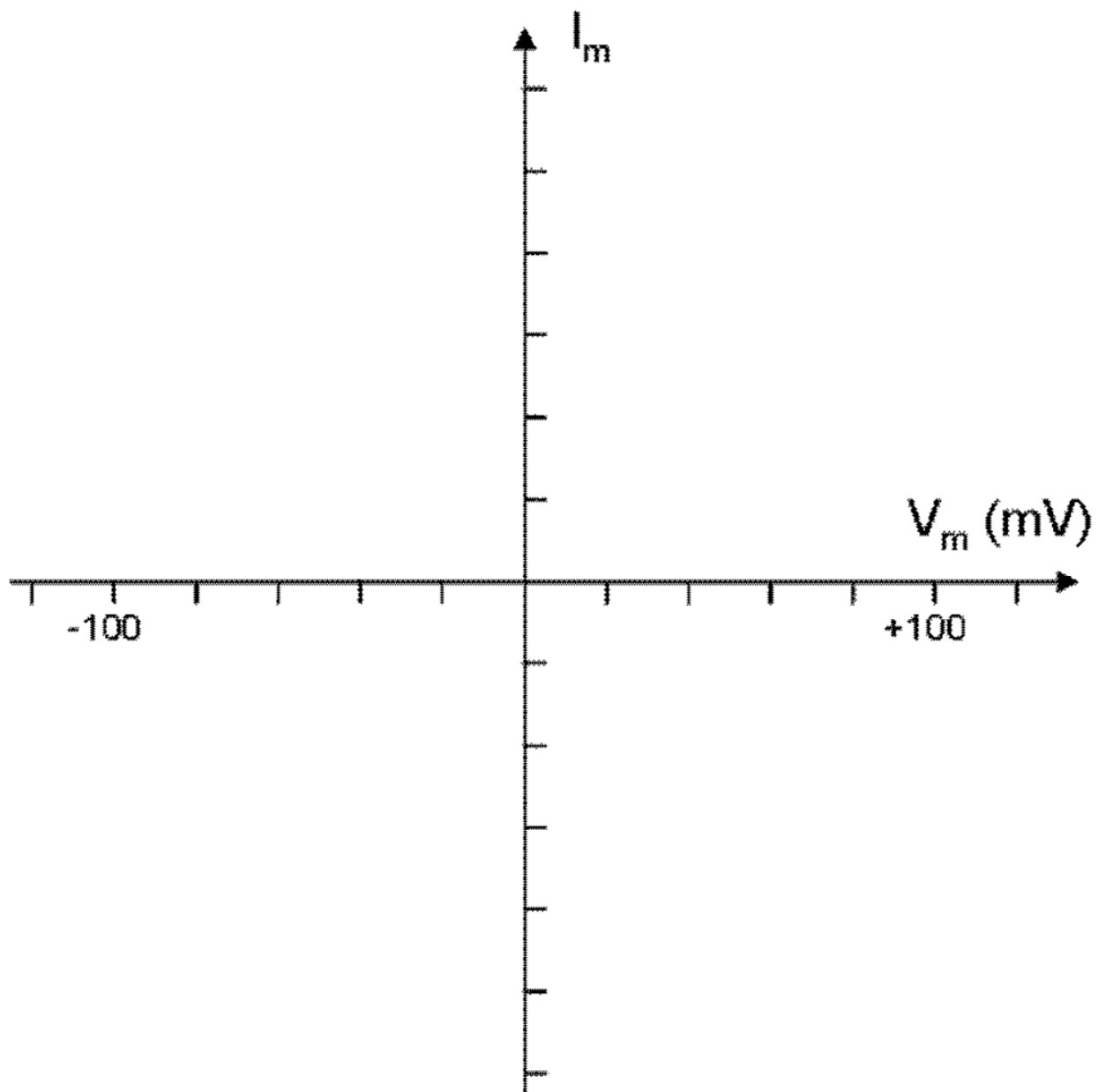


Figure 2: Current voltage plot template.