Passive Neuronal Membrane

Computational Neuroscience by University of Washington

The following Python code models a passive neuronal membrane as an RC-circuit. (Remember that in the membrane model, the resistor and capacitor are in parallel.)

Python (all versions):

membrane.py

This code demonstrates how a membrane responds to a constant current input that is turned on for a fixed time interval and then turned off.

Part A

What if the current were not turned off? What would the steady state voltage of the membrane be? Use the values given in the script to compute your answer (C = 0.1 nF, R = 100 MΩ, I = 10 nA). You should give your answer in mV. Do not include units in your answer.

Part B

Change the values for the membrane's resistance and capacitance (R and C), and find out how this influences the response of the membrane. Does it reach a stable value more quickly or more slowly after multiplying R by 5?

Part C

Does it reach a stable value more quickly or more slowly after dividing C by 10?

Part D

Does it reach a stable value more quickly or more slowly after multiplying R by 10 AND dividing C by 10?