nanoHUB-U Introduction to Bioelectricity
Dr. Pedro Irazoqui
Homework 5

For this assignment, complete the reading “Direct-Current Electrical Field Guides Neuronal Stem/Progenitor Cell Migration” by Lei Li, et. al. to answer the following questions.

5a. Which of the following summarizes the authors’ work as reflected in the paper?

a) Describing the cellular and molecular mechanisms by which N-methyl-D-aspartate receptors exert changes on the growth of muscle fibers.
b) Demonstrating the presence of endogenous electric fields in mammals
c) Demonstrating the presence of endogenous electric fields in amphibians
d) Recording changes in endogenous electric fields during neurogenesis
e) **Demonstrating the ability of externally applied electric fields to guide neuronal growth**

5b. How would you expect the downregulation of guanine nucleotide exchange factors to affect nervous system regrowth following a traumatic brain injury?

a) Increase the rate of repair
b) **Inhibit successful remodeling**
c) Decrease inflammatory reaction of support cells
d) Increase inflammatory reaction of support cells
e) Increase the amplitude of the resulting direct current electric field

5c. Endogenous electrical fields are typically observed in which of the following environments?

a) Nerve sprouting towards wounds in the eye
b) Damaged axons following traumatic injury
c) Throughout the nervous system during neurogenesis
d) **All of the above**
e) None of the above
5d. Which of the following is an appropriate negative control for the electric field application study described in the paper?

   a) A cell culture taken from a rat embryo after the embryo had been exposed to an electric field
   b) A cell culture exposed to 300mV/mm for 3 hours
   c) A cell culture with no exposure to electric fields
   d) A cell culture exposed to 30mV/mm for 24 hours
   e) A cell culture exposed to a constant magnetic field

5e. Why are three different stains used in Figure 1B?

   a) To determine the number and type of cells migrating from the explant
   b) To image various intracellular structures
   c) To increase contrast between the cell membranes and the cell nuclei
   d) All of the above
   e) None of the above

5f. Which of the following is NOT true regarding the observations made by the authors in this paper?

   a) Explant culture cells grow preferably towards the cathode of an applied electric field
   b) Electric fields applied at physiological strengths significantly impact the direction and speed of neuron
   c) Most of the cells that migrate in response to an applied electric field are immature neurons
   d) Most neuronal stem/progenitor cells did not express N-methyl-D-aspartate receptors
   e) Altering the activity of membrane channel proteins can inhibit the effects of applied electric fields on cell migration

5g. Externally applied electric fields are able to affect the intracellular actin cytoskeleton and aid overall migration of the cell through a transduction process that includes all of the following EXCEPT

   a) DAPV
   b) Rac1
   c) Tiam1
   d) Pak1
   e) N-methyl-D-aspartate receptors