Discussion Week 7

Animal Physiology
Discussion Questions and Reading Assignments

Reading assignment: Withers skim chapter 6 (read about Donnan equilibrium pg 203, skim rest of chapter focusing on concepts below) or HWA Ch. 12 Neurons.

Neurons

Know:

- ☐ Membrane potentials — resting and equilibrium, what is involved & how they work
- ☐ Nernst Equation and Goldman-Hodgkin-Katz potential
- ☐ The primary determinants that affect conduction velocity and signal transduction
- ☐ Action Potentials, graded responses
- ☐ Electrical and Chemical Synapses, inhibitory and excitatory signals

Discuss:

1. Explain how the resting potential of a cell is set up. What links the chemical and electrical potentials? How is each set up and how can they be degraded (make sure to include the molecular mechanisms)?

2. How is an action potential fundamentally different from a graded potential? What are the key events involved in an action potential? Go through the Hodgkin cycle and explain how the movement of ions contributes to changes in the voltage and chemical potential and why the AP moves down the axon (and explain mechanistically which direction it moves in). Why doesn't the AP degrade over time or distance? Why is there an absolute and relative refractory period?

3. Define each term of the Nernst equation and state in your own words what it describes. Which parameters can change in a biological situation? What would result? What is the Goldman equation? Given the Nernst equation, do you believe that the small modification to make the Goldman equation make sense? Why?

Discussion Week 7

Animal Physiology
Discussion Questions and Reading Assignments

Signal Propagation and Integration

Know: Electrical and Chemical Synapses, inhibitory and excitatory signals

4. What properties of neurons can be modified to speed up signal propagation for action potentials, graded potentials, or both types of signal?

5. Why are both action potentials and graded potentials needed in a nervous system? In what way can a nervous system be described as an alternating series of analog and digital signals?

6. Why do animals have both electrical and chemical synapses? What do they share in common and how do they differ? If you were designing an animal, in what situations would you use each? Would they be used in combination? Why?

7. What are some design features that help animals respond appropriately to stimuli? How are signals amplified, or suppressed? (discuss excitatory post synaptic potentials, inhibitory post synaptic potentials, and spatial and temporal summation). Can you give examples?