February 1, 2016

Introduction to Neuron Models, Course Software

Keep in mind: Class participation important
Expect assignments on time
Review Course policies on Blackboard
Review “Expectations”

Aspects of electrical activity in a neuron explained by understanding some very basic electrical concepts

1. Voltage attenuation from a source of current injection
2. Distortion of voltage with distance and time
3. Greater AP conduction speed of large axons
4. Greater AP conduction speed of myelinated axons
5. Repolarization of APs at nodes of Ranvier without IKv
6. Synaptic Integration- Why we can think!

What are the biological representations of the relevant electrical parameters of a neuronal membrane?

Current across membrane with hyperpolarizations

Biological representations of the relevant electrical parameters of a neuronal membrane.

How do we categorize ion channels? What open or closes them? What is their selectivity? What other important properties can differentiate channels that have the same activators?
Other important properties that differentiate channels.

- Inactivation kinetics
- Activation kinetics
- Opening probability
- Conductance

All can be changed by neuromodulators

Once a channel is open, what Law does it obey?

Only a few equations needed in Neurobiology:

The separation of unlike charge results in a tendency for an electrical current flow. The extent of current flow depends on the conductance (or its reciprocal, resistance) of the medium separating the charges.

What law is this?

Ohm’s Law

\[ V = IR \]

The separation of unlike charge results in a tendency for an electrical current flow. The extent of current flow depends on the conductance (or its reciprocal, resistance) of the medium separating the charges.

Since \( R = \frac{1}{G} \)

\[
\begin{align*}
I &= \frac{V}{R} \\
V &= \frac{I}{G} \\
R &= \frac{V}{I} \\
G &= \frac{I}{V}
\end{align*}
\]

How does a separation of specific types of charges occur across a cell membrane?

Membrane barrier, ion pumps, channel permeability
What is a capacitor? \[ C = \frac{Q}{V} \]

What makes a capacitor stronger or weaker?

How does capacitance affect a voltage change?

How does capacitance add in series and in parallel?

How is capacitance relevant to Neurobiology?
This week
First Lab: Model Neuron: Membrane resistance, Oscilloscope primer, Time constant, A/D software tutorial - Lab Chart

[Image of Lab Chart]