Neurons

Use the following video link as a study tool and to complete Parts A - C:

http://www.youtube.com/watch?v=7EyhsOewnH4

A. Structure

1. Draw a neuron. Label your diagram with the following parts and explain the function of each part of the neuron: **dendrites, axon terminals, nodes of Ranvier, myelin sheath, nucleus, cell body, axon**

B. Resting Potential

2. Use the Action Potential video to explain cellular resting potential:

a. Define **resting potential**:

b. In a resting neuron, Na^+ ion concentration is high_____ while K^+ ion concentration is high _____.

c. What role does the Na^+-K^+ pump play in establishing the resting potential?

d. Which ions can cross the membrane in an unstimulated neuron: sodium ions or potassium ions?

e. Draw a diagram showing where the K^+ and Na^+ ions are in a resting neuron.

f. What happens when the resting potential is made significantly less negative?

C. Action Potential

3. Use the Action Potential video (from question 1) to explain action potentials. Pay attention to where the ions are moving and the charge inside and outside the cell.

Define:

Action potential:

Depolarization:

Repolarization:

Hyperpolarization:

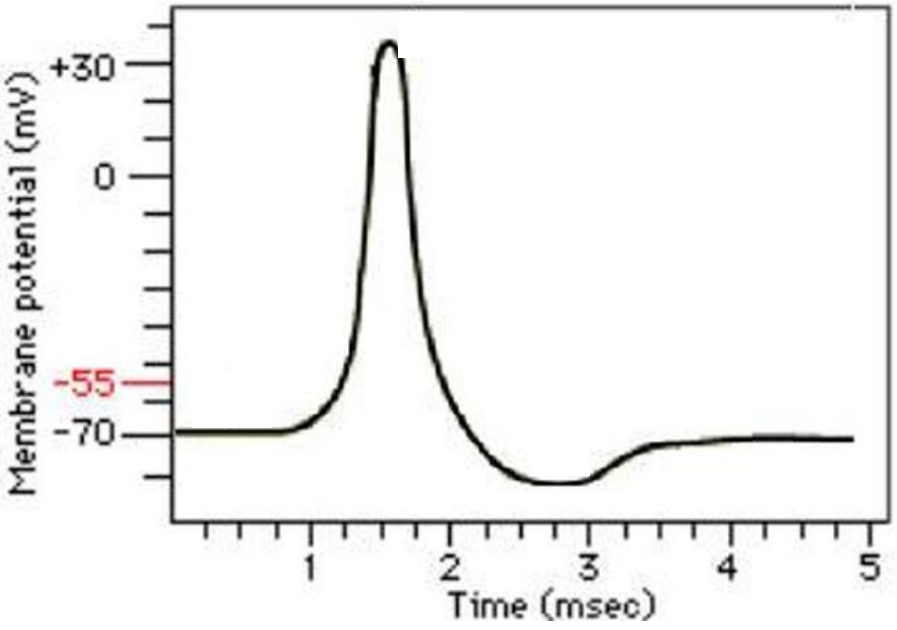
Refractory Period:

4. Modeling:

a. Use the poster board models and ions and channels provided to model an action potential moving down an axon.

b. After opening & closing the channels in your 2D model, sketch an example of an action potential moving down an axon. Include ion movement and whether channels are open or closed, and the charge inside and outside the membrane.

5. Label the graph below using the following terms: Na^+ channels open, K^+ channels open, Na^+ channels close, K^+ channels close, resting potential, depolarization, repolarization, hyperpolarization, refractory period, action potential



D. Signal Transmission

6. Put the following events in order. Use the animation "Transmission across a Synpase" (link below) if you need assistance:

http://highered.mheducation.com/sites/0072495855/student_view0/chapter14/animation__transmission_across_a_synapse.html

_____ Na+ channels in the next dendrite open

_____ Neurotransmitters bind receptors in dendrites

_____ An action potential is arrives at the nerve terminal

_____ Voltage-gated calcium channels open

_____ Neurotransmitter-containing vesicles fuse with the axon terminals and released into the synapse

_____ The action potential is generated in the next neuron

7. Add numbers to the diagram below to show the sequence of events you listed in the previous question.

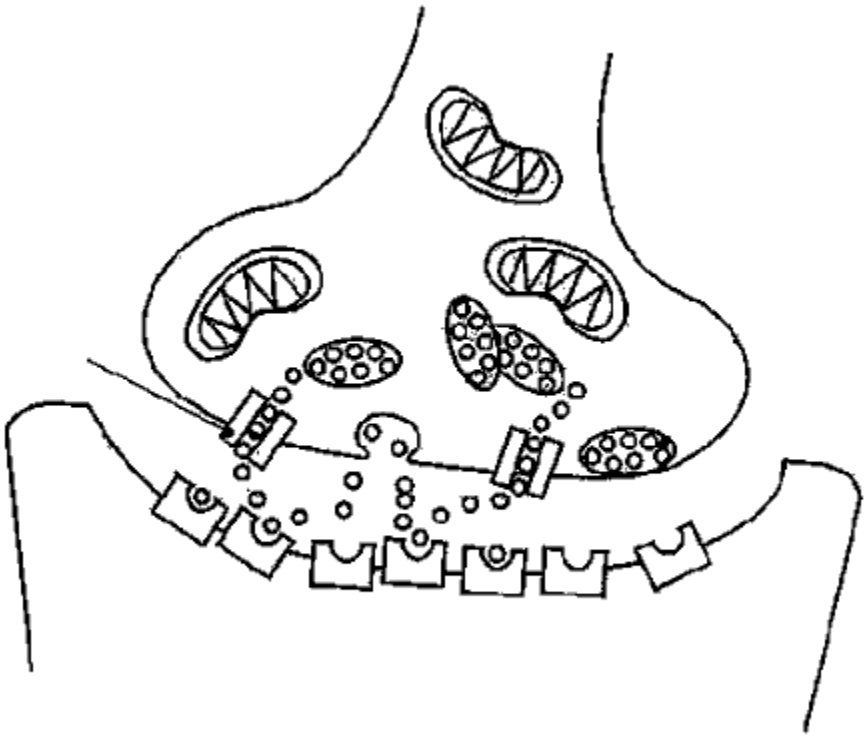


Diagram retrieved 11/18/2012
http://www.smccd.net/accounts/merrill/Psy100/brain%20coloring%20book%20pages_files/image003.gif

Additional Review:

Animation from Garland Science: sodium channels and action potentials. This video explains how an action potential is passed down an axon. The explanation is in terms of the sodium channels only. You will also need to know the role of potassium channels in propagating an action potential. Pay particular attention to the charge inside and outside of the nerve as the action potential is passed along the axon.

http://www.youtube.com/watch?v=ifD1YG07fB8&feature=related

Teaching Tips for Peer Mentors

1. Remind students that if they did not do well on exam 1 or 2, they should be setting up a study schedule to apply all the study techniques we have shared to their studying for the cumulative final.

2. Students should work in groups of 3 – 4 to complete this activity.

3. Show the Action Potential video: http://www.youtube.com/watch?v=7EyhsOewnH4 . (4 minutes, you may need to increase the volume in the YouTube window as well as on the speakers.) **Part A**, Structure: Circulate among the groups to make sure each person is drawing a neuron, but encourage them to share answers within their group. Have someone draw the neuron on the board. Have other students come up and label the listed structures. Pull students from each group.

4. **Part B**, Resting Potential: Tell students to answer the questions about resting potential while they watch the video. Show the part of the video that describes resting potential again. Give students a few minutes to work in groups to try to complete 2a - f. Go over the answers.

5. **Part C**, Action potential. Again, tell students to jot down notes defining each term as they watch the action potential portion of the video. Show the just the part of the video describing generation of an action potential. For Question 4, make sure students use the 2D ion channels and poster boards to model physically the sequence of ion channel opening and closing and ion flow. **DON'T SKIP THIS STEP**. For many students this is the most useful part of the recitation. Have students try to complete Question 5 without looking at any resources, then check themselves, using either their lecture notes or textbook.

6. **Part D,** Signal Transmission. Show the McGraw-Hill video on signal transmission and have students put the events in order. Project the image in Question 7 on the white board and ask students to come to the front to add numbers to the diagram indicating the sequence of events.

7. Point out the video link listed under additional review for them to complete during their personal study time.

Notes to Faculty

This activity is difficult to complete in a 50 minute session. Parts A – C can be completed in 50 minutes. You may wish to have students do Part D separately, either as part of another recitation period, as group work during the lecture period or as a pre-lecture or post-lecture homework assignment.

Video links:
Both video links are different from the animations used during lecture to illustrate resting potential, action potential, and signal transmission. We intentionally use different versions of the explanations to help students practice synthesizing information from multiple sources. You may wish to choose your own videos or to make your own.

Video for Parts A - C: The Action Potential by biopodcast is 4 minutes long. The entire video can be played in one showing as a review of the mechanisms creating the resting and action potentials in neurons or you may want to show it in short portions. The link was functional when accessed on 7/29/2015 http://www.youtube.com/watch?v=7EyhsOewnH4

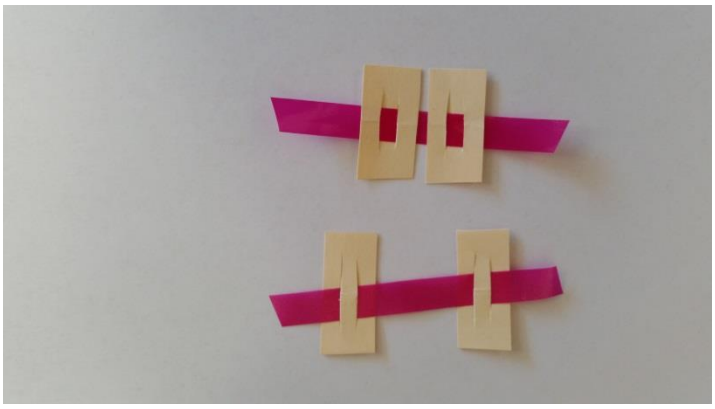
Video link for part D: Transmission across a synapse by McGraw-Hill is 45 sec long. The link was functional when accessed on 7/29/2015.
http://highered.mheducation.com/sites/0072495855/student_view0/chapter14/animation__transmission_across_a_synapse.html

Video link for Additional Review by Garland Science. The link was functional when accessed on 7/29/2015. http://www.youtube.com/watch?v=ifD1YG07fB8&feature=related

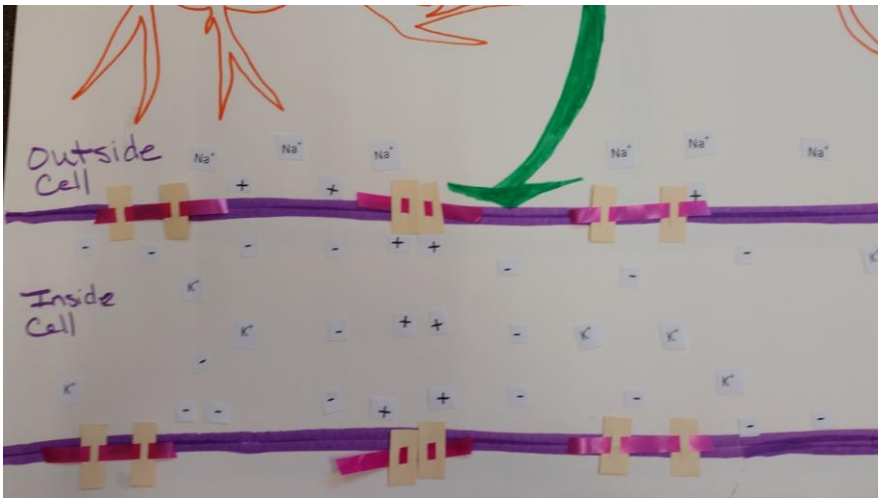
If neuron function is taught late in the semester, you may wish to emphasize Item 1 under the Teaching Tips for Peer Mentors to your peer mentors. If you teach this topic at a different point in the semester, you may wish to delete this point.

Creating the poster board models:
We created a poster as shown below for each student group. Sending the boards to a copy center for laminating will extend their life span.

To create the ion channels, we used tag board (heavy weight paper). Cut out rectangles and then cut two slits in the rectangle. Slide flat curling ribbon through the slits. The channels can be open and closed by moving the rectangles apart along the ribbon as shown below.



To sketch the action potential, students manipulate the channels and the location of the ions. The peer facilitators usually circulate around the room and have each group explain the process to be sure they understand.



Templates for the potassium and sodium ions and charge are below (next pages) for convenience.

K^+	K^+	K^+	K^+	K^+
K^+	K^+	K^+	K^+	K^+
K^+	K^+	K^+	K^+	K^+
K^+	K^+	K^+	K^+	K^+
K^+	K^+	K^+	K^+	K^+
K^+	K^+	K^+	K^+	K^+
K^+	K^+	K^+	K^+	K^+
K^+	K^+	K^+	K^+	K^+
K^+	K^+	K^+	K^+	K^+
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K^+	K^+	K^+	K^+	K^+
K^+	K^+	K^+	K^+	K^+
K^+	K^+	K^+	K^+	K^+
K^+	K^+	K^+	K^+	K^+

D. Pattison, A.O. Cheek, & A.I. Medrano, Department of Biology & Biochemistry, University of Houston

Na^+	Na^+	Na^+	Na^+	Na^+
Na^+	Na^+	Na^+	Na^+	Na^+
Na^+	Na^+	Na^+	Na^+	Na^+
Na^+	Na^+	Na^+	Na^+	Na^+
Na^+	Na^+	Na^+	Na^+	Na^+
Na^+	Na^+	Na^+	Na^+	Na^+
Na^+	Na^+	Na^+	Na^+	Na^+
Na^+	Na^+	Na^+	Na^+	Na^+
Na^+	Na^+	Na^+	Na^+	Na^+
Na^+	Na^+	Na^+	Na^+	Na^+
Na^+	Na^+	Na^+	Na^+	Na^+
Na^+	Na^+	Na^+	Na^+	Na^+
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Na^+	Na^+	Na^+	Na^+	Na^+