BIOL3833 Fall 2014 Exam 1 **Name: ____**

Question 1. (5 points) At any given moment during an action potential, what determines the magnitude of the sodium current across the membrane?

Question 2. (5 points) Briefly explain the potassium equilibrium potential.

Question 3. (10 points) Tell me what you know about the *structure* of voltage-gated ion channels.

Question 4. (10 points) Explain three ways that calcium channels help to shape action potential rate and/or patterning.

Question 5. (10 points) To function properly our sensory systems have to *encode the intensity* of stimuli in the environment and they also must preferentially *respond to changes in the environment*. Explain how neurons can encode the intensity of a stimulus and how neurons can preferentially respond to changes in the environment.

Question 6. (10 points) Explain the neuron's resting potential using these terms:
a) intracellular K^+ concentration
b) extracellular K^+ concentration
c) intracellular Na^+ concentration
d) extracellular Na^+ concentration
e) ENa
f) EK
g) K^+ leak conductance
h) Na^+ leak conductance.

Question 7. (10 points) This question is based on the data shown below. The researchers recorded from neurons taken from the brains of normal mice (Wild type / WT) or mice with a mutation (R6/2) that produces the symptoms of Huntington's Disease as the mice grow older. Panel A shows a series of negative, then positive current injections at the bottom. At the top are membrane voltage response for cells from WT and R6/2 mice. Panel B shows images of a neuron from a WT mouse and the same type of neuron from a R6/2 mouse.

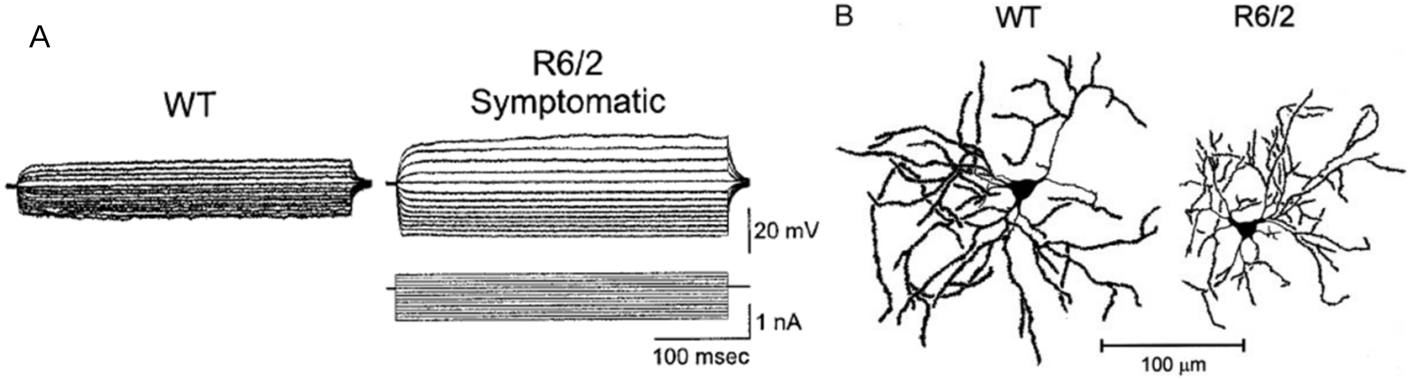

Table 1. Passive membrane properties (asterisks indicate values different from Wild-type).

	Wild-type	**R6/2 Symptomatic**
Resting Potential (mV)	-81.0 mV	-67.3 mV **
Membrane resistance (MΩ)	26.7 MΩ	48.0 MΩ **
Time constant (ms)	15.6 ms	11.0 ms **

How can the data shown in Panels A and B help to account for the differences shown in Table 1?