Dendritic Integration 2
Problem Set

Name:_____

1. Please circle the correct mechanisms underlying the activation of neurons.

   Simultaneous inputs on multiple parallel dendrites of the same neuron induce action potential, while each input alone is not sufficient to induce the activation (temporal/spatial summation).

   Multiple stimuli are applied to the same location in rapid succession and evoke action potentials at soma (temporal/spatial summation).

2. True or False.
   A. Action potentials always travel from soma/axon to dendrites of other neurons.
   (True False)

   B. Spines have very high input resistance that leads to a large amplitude local synaptic potential for a given input.
   (True False)

   C. Spines have high capacitance that slows down the information transmission thus contributes to dendritic integration.
   (True False)

   D. Adjacent synaptic inputs tend to sum more linearly than electronically separated inputs.
   (True False)

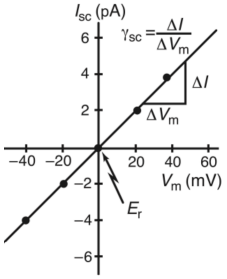
3. What is the ion/ion channel responsible for the generation of bAPs?

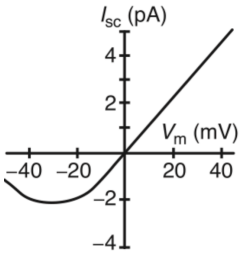
   A. Na^+/Na^+ channels
   B. NMDA/Cl^- ions
   C. Ca^{2+}/Ca^{2+} channels

4. What is the difference between dendritic bAPs and axonal APs in terms of amplitude and attenuation? What membrane properties result in the difference?

5. Explain how bAP functions to generate self-inhibition in mitral/granule neurons.

6. Circle the I-V relationship for NMDA channels. Explain why NMDA channels have such a linear/non-linear I-V property along with different voltage.





7. You have a neuron that may have heterogeneous postsynaptic composition of receptors: AMPAR or NMDAR or both. Please make two different designs to determine which receptor(s) are present at postsynapses of this neuron.