QUIZ 06 - KEY

Instructions: Download the quiz from Blackboard (in Quiz Questions Folder), print a copy and use the paper copy to work through the various questions and problems. Mark the correct answers on it. When you are ready to **submit** your answers, you will see the quiz posted under Quiz Answer Sheets.

Click the quiz name to launch the quiz. Enter your answers to each of the corresponding numbered questions onto the **blank answer sheet** (the questions will not be repeated, simply a blank page for your answers). The quiz may be saved if you do not finish entering your answers in one sitting. When you are finished with the quiz, make sure to **submit** your answers and they will be recorded.

For each question, select the one **best answer** from among those given (multiple choice). Each question is worth one (1) point.

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1. Subject H.M. is renowned in neurology and cognitive science because:

    a) His case provided neurologists with a key insight: that memory was not a unitary functional entity but could be subdivided functionally but not anatomically.
    b) His case provided neurologists with a key insight: that memory was not a unitary functional entity but could be subdivided anatomically but not functionally.
    c) His case provided neurologists with a key insight: that memory was not a unitary functional entity and could be subdivided both functionally and anatomically.
    d) All of the above.

2. Patient H.M …

    a) Could learn to play video games and was aware of it.
    b) Could learn to play video games but was **un**aware of it.
    c) Could **not** learn to play video games and was aware of it.
    d) Could **not** learn to play video games and was **un**aware of it.

    Answer key: He had fine non-declarative, procedural memories, but no episodic memory of having learned it.

3. Which of the following is **FALSE** regarding Hebbian cell assemblies and the hypothesis that it suggests about memory traces? (You can see slide 12 of lecture 20 or figure 24.11 of your textbook for reference)

    a) Neurons that fire together based on a particular external event form a cell assembly will wire together.
    b) Destruction of part of the cell assembly after learning would eliminate the memory.
    c) After learning has occurred, activation of the whole assembly should elicit the memory.
    d) After learning has occurred, partial activation of the assembly should elicit the memory.

e) Both A and D are false.

Answer Key: B is false because part of the assembly is all that is necessary to keep the memory.

4. Long term memory for declarative memory and non-declarative memory are thought to…

a) Be stored in the within one brain area.
b) Be stored in different brain areas.
c) Both be unrelated to processing in the hippocampus.
d) Both be unrelated to processing in the basal ganglia and/or cerebellum.
e) All of the above.

Answer key: Memories are thought to be distributed among different brain areas. At least declarative memories require the hippocampus, and at least non-declarative memories may involve processing in the basal ganglia and cerebellum.

5. During awake, a group of hippocampus neurons activate at this sequence for most cases: cell A, cell B, cell C, cell D, cell E. What's the most possible sequence for them to activate during sleep?

a) Cell A, cell B, cell C, cell D, cell E.
b) Cell B, cell A, cell D, cell C, cell E.
c) Cell A, cell D, cell B, cell E, cell C.
d) Cell C, cell B, cell A, cell D, cell E.
e) Cell A, cell B, cell C, cell E, cell D.

Answer key: see slide 41 of lecture 20. During sleep, hippocampus cells tends to activate at the same sequence as they activate during awake.

6. You want to replicate the "creating false memories" experiment described in class, but using fruit flies instead of mice. However, the experiment does not work, and shining the blue light has no effect on the flies' behavior. Which of the following is a possible explanation for why the technique did not work?

a) Your light source was too weak and blue light didn't reach the neurons that were activated in the behavioral context.
b) ChR2 was not working because flies lack the light-absorbing molecule, present in the mouse, that is critical for the channel to work.
c) The virus you used to deliver the ChR2 is ineffective in flies.
d) ChR2 degrades faster in flies than in mice.
e) All of these are possible explanations.

Answer key: all above would be able to explain the result. B is actually most possible because flies really don't produce all-trans retinal by themselves, so in actual research, if

you want to do optogenetics with flies, you'll probably have to feed flies with all-trans retinal in advance.

7. You are simultaneously recording from two neurons, X & Y, which burst alternately in a rhythmic pattern (a simple 2-neuron CPG network). Which of the following experimental results would provide the ***best*** evidence that this CPG is ***pacemaker*** driven?

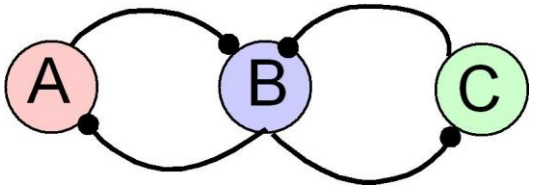
a) Holding X at the resting potential abolishes the rhythm in Y.
b) Clamping X at a hyperpolarized voltage activates a depolarizing inward current (Ih).
c) Stimulation of X affects activity in Y, but the reverse is not true.
d) Stimulation of X or Y affects activity in the other cell.
e) None of the above are evidence of a pacemaker-driven CPG.

Answer Key: A and D are consistent with the hypothesis that neither neuron is a pacemaker. B is incorrect because this current is not always sufficient to produce an intrinsically bursting cell. C is correct because this indicates that X synapses onto Y, but the reverse is not true. This means that there X must be the pacemaker if only these neurons are in the circuit. Of course, there are many CPGs that would fail this test and still be pacemaker driven, ex. when both X and Y are pacemakers and synapse symmetrically, but when this test is passed, it suggests that X is a pacemaker.

8. The I_h current (also called the hyperpolarization activated cation current) is an important current in many central pattern generating networks because:

a) It facilitates post inhibitory rebound bursting, which allows a neuron to be activated once an inhibitory input is terminated.
b) It facilitates inhibitory interactions between neurons
c) It is essential for action potential discharge
d) It facilitates release of acetylcholine at the neuromuscular junction
e) all of the above

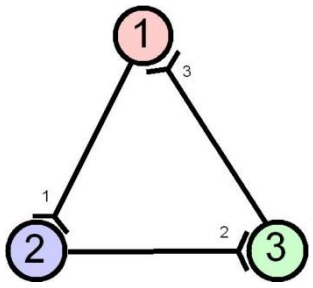
9. The diagram below shows three inhibitory neurons. A and B are connected via reciprocal inhibition. B and C are connected to each other via reciprocal inhibition. These neurons fire action potentials tonically unless they are inhibited. Assuming this is a rhythmic network, and A begins to fire first, which of the following firing patterns is most likely?



a) The network is rhythmic and the firing pattern is A then B then C.
b) The firing pattern is A and C together, alternating with B (AC, B, AC, B, etc.).
c) The firing pattern is A and B together, alternating with C (AB, C, AB, C, etc.).
d) The firing pattern is B and C together alternating with A (BC, A, BC, A, etc.).

Answer Key: A and B can't fire at the same time, since they inhibit each other. The same goes for B and C. When A fires, likely so does C, since C is disinhibited since B is not firing.

10. Which of the following synaptic and cellular properties of each neuron WOULD PERMIT the network pictured below to be a rhythmic, central-pattern-generating network? Assuming that Neuron 1 starts firing first to initiate activity in the circuit, and all neurons will rebound from release from inhibition, i.e. exhibit post-inhibitory rebound bursts.



a) synapse 1= excitatory, synapse 2 = excitatory, synapse 3 = excitatory -All cells fire tonically unless inhibited.
b) synapse 1= excitatory, synapse 2 = excitatory, synapse 3 = inhibitory -All cells are silent at rest and fire trains of action potentials when excited.
c) synapse 1= inhibitory, synapse 2 = excitatory, synapse 3 = inhibitory -All cells fire tonically unless inhibited
d) synapse 1= inhibitory, synapse 2 = inhibitory, synapse 3 = inhibitory -All cells fire tonically unless inhibited.
e) None of the features listed above can generate a rhythmic, central-pattern-generating network.

Answer Key:
A. Would not be rhythmic because they would all fire continuously since there is no inhibition.
B. If neuron 1 fires first, it would drive neuron 2 to drive neuron 3. Neuron 3 would then inhibit neuron 1 and all of them would fall silent.
C. Neurons 2 and 3 would end up firing tonically and neuron 1 would be silent (forever).
D. This could be rhythmic. Say neuron 1 is firing. It will inhibit neuron 2, and then neuron 3 would be disinhibited. Neuron 3 would then inhibit neuron 1 and stop it from firing. Then, neuron 2 would be disinhibited and start fire, inhibiting neuron 3 etc. etc.

11. **Thought question (ungraded):** Explain the concepts of associative and autoassociative memory. In your explanation, talk about/draw connectivity between neurons.

Answer key: Associative memory involves different aspects of the same synapse converging onto a downstream neuron, causing Hebbian-like plasticity. Auto associative memory function stores the representation of an item/memory within a specific brain area and allows to recall this information from incomplete or distorted input. The feedback excitatory synapses involved project between pyramidal cells within a brain area. The pattern of cell activity then encodes the stimulus.

12.**Thought question (ungraded):** Practicing a task helps make the task more likely to be recalled later on. If you are trying to memorize a poem to perform at a recital, what parts of working memory are you likely exercising and why?

Answer Key: The phonological loop because **recitation is an auditory/oral exercise**.