QUIZ 08 - 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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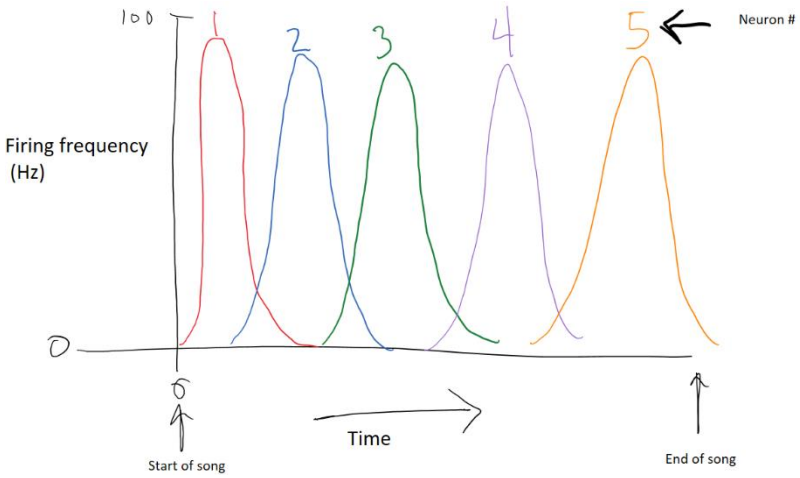
1. The following figure depicts the firing rate histograms for 5 separate neurons in a premotor area in a human. The figure was created using neural data during the playing of a short segment of a song. What does this data suggest about how these neurons might be connected?



a) In a half-center oscillator
b) In a synfire chain
c) By reciprocal inhibition
d) In a disinhibitory circuit
e) None of the above

Answer key: This looks very much like the example in class, where neurons fire in a precise time during a skilled motor action.

2. The subject later sustained a head injury in which the brain area in question 1 was damaged. Which of the following is the most likely symptom of this damage?

a) The song playing would become more precise and stereotyped.
b) The song playing would become less precise and stereotyped.
c) The song would slow down.
d) The song would speed up.
e) The song would get quieter.

Answer key: If you lose a brain area which contributes to the patterning of a motor action (like HVC in the songbird), you would negatively affect the pattern itself. If however, you lesioned a region which injects variability of the system (like LMAN in the songbird), you would get more stereotyped song.

3. Primary sensory afferent axons have widely varying diameters, and their size correlates with the type of receptor to which they are attached. Which of these axons are the smallest and the slowest? Choose the correct option.

   a) Proprioceptors of the skeletal muscles. (Aα fiber)
   b) Mechanoreceptors of the skin. (Aβ fiber)
   c) Pain and temperature (Aδ fiber)
   d) Temperature, pain, and itch. (C fiber)
   e) Both A and B.

Answer key: Check slide 39 of lecture 29.

4. Why is the sensory homunculus so distorted when compared to a real human body?
   a) The relative size of the cortex that is devoted to each body part is correlated with the density of the sensory input received from that part.
   b) It is a primitive representation of the earlier stages of evolution.
   c) The uneven surface of the cortex disrupts the representation of the body surface.
   d) The relative size of the cortex that is devoted to each body part varies widely among different individuals.
   e) None of the above.

Answer key: A.

5. Which of the following statements is false about the chemosensory and mechanosensory receptors?
   a) Mechanosensory receptors are sensitive to physical distortion
   b) Chemosensory receptors are chemically sensitive proteins that serve as sensory receptors
   c) Chemosensory receptors that sense salt and sour molecules mainly allow negatively charged ions to directly enter the taste cell through a pore in their structure.
   d) Taste receptors (T1Rs and T2Rs) use second messenger pathways to change membrane potential of taste cells.
   e) TRP channels detect temperature fluctuations.

Answer key: C is wrong because salt and sour receptors mainly allow cations enter the cell.

6. Of the below statements about mammalian olfaction, which of the following is FALSE? If all are true, choose answer E.

   a) Each odorant molecule activates only one type of olfactory receptor protein.
   b) In mammals, each olfactory sensory neuron randomly expresses one, and only one, olfactory receptor (OR).

c) A glomerulus in the olfactory bulb receives input from one type of olfactory sensory neuron.
d) Combinatorial activation of glomeruli generates an olfactory percept for a given odorant present in the environment.
e) All of the above are true.

Answer key: A is FALSE because a given odorant can activate several types of receptor proteins to differing amounts depending on the part of the odor molecule which can interact with the receptor and the affinity of the receptor to that part of the odor molecule.

7. What is a key difference between the olfactory system and other sensory systems such as gustation, hearing and touch?

a) The olfactory system does not create maps of stimulus quality.
b) The olfactory system projects to cortex without passing through the thalamus.
c) The olfactory system lacks feedback from higher brain centers.
d) The olfactory system is insensitive to stimulus intensity.
e) The olfactory system does not have the ability to adapt.

Answer key: both A and B are correct. Olfactory areas DO receive feedback projections, respond differentially to stimulus intensity. And olfaction can adapts pretty fast (you can't smell the perfume anymore after smelling it continuously for ~5 minutes).

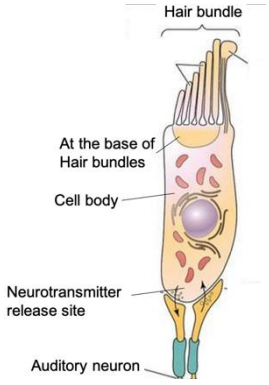
8. Transduction in auditory hair cells…:

a) Requires that Ca^{2+} ions flow through the ion channels opened by movements of the tip links that couple adjacent cilia.
b) Is triggered by Ca^{2+} ions flowing into the hair cell and depolarizing its membrane potential.
c) Is initiated by hair cell movements that open K^{+} channels that depolarize its membrane potential.
d) Involves closing K^{+} channels which depolarizes the membrane potential.
e) None of the above.

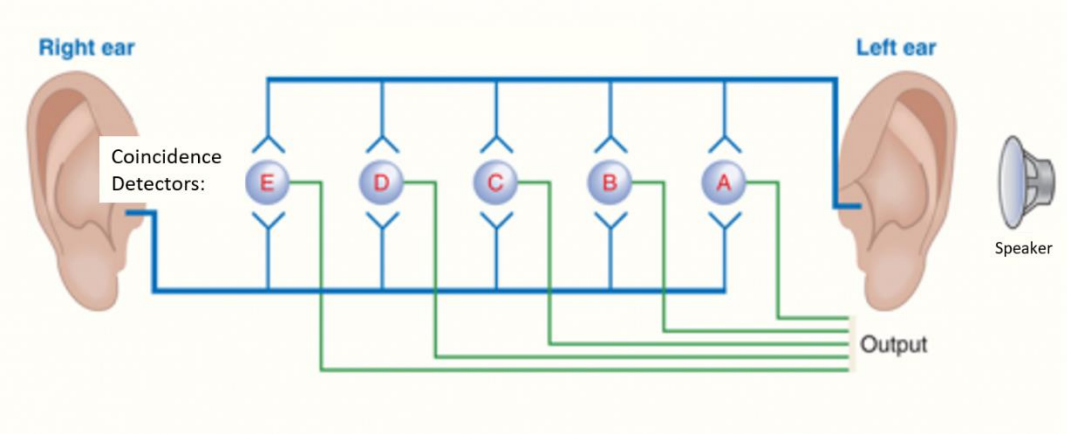
Answer key: Remember that this is a special case where K flows INTO the cell to depolarize the cell, since there is high external K in the cochlea.

9. Which location is the first action potential observed on the cochlear inner hair cell shown below?

a) Hair bundle
b) Base of the hair bundle
c) Cell body
d) Release site
e) Auditory neuron



10. Using the below figure depicting delay lines in the cochlear nucleus and what you learned in class about sound localization, which coincidence detector would be most likely to fire the MOST in response to a sound stimulus localized in the left side of your auditory field? Note: All the synapses (indicated by the black balls) are excitatory, and coincidence detectors fire the most when they receive inputs from left ear and right ear simultaneously.

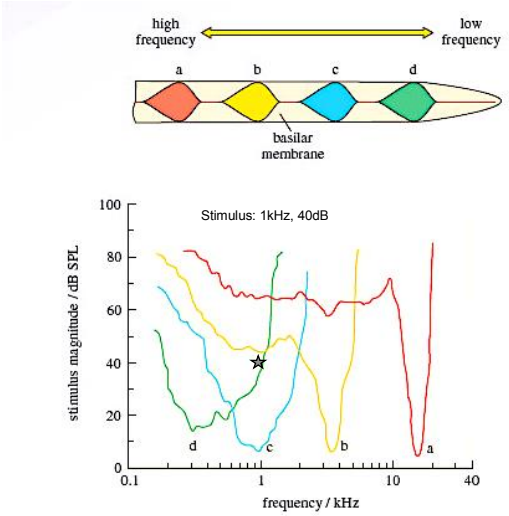


a) A
b) B
c) C
d) D
e) E

Answer key: The answer is cell E, the furthest to the right. This is because the sound will arrive at the left ear first, and will travel down the delay line further than the signal from the right ear, which is activated later by the time the sound takes to traverse the skull.

Thought question (ungraded):

11. **Thought question (ungraded):** The graph below shows tuning curves for four different auditory nerve fibers in a mammalian auditory nerve. The x axis shows the frequency of the tone. The y axis shows threshold intensity (in decibels, dB) to stimulate the nerve in each frequency. If pure tone sine waves of 1 kHz delivered to the ear at 40 dB sound intensity (loudness), which of these fibers will be stimulated? Star sign indicates the stimulus in the graph.



Answer key: c and d fibers will be activated because their threshold intensity is lower than 40dB at 1kHz frequency.