QUIZ 09 - 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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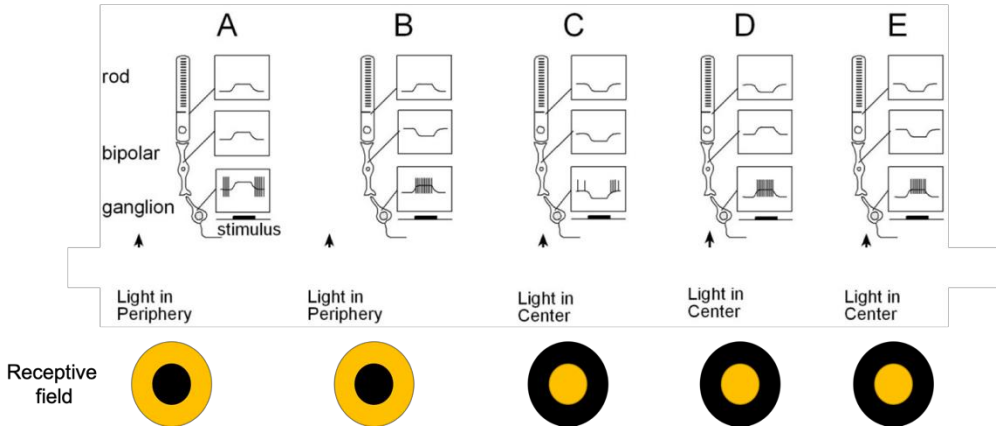
1. Which of the following diagrams correctly shows intracellular voltage recordings from a *rod*, an "**on-center, off surround**" *bipolar cell,* and an "**on-center, off surround**" *ganglion cell* stimulated with light as indicated by the arrows? (In this case, we assume each rod is innervated by only one bipolar cell and each bipolar cell is innervated by only one ganglion cell)

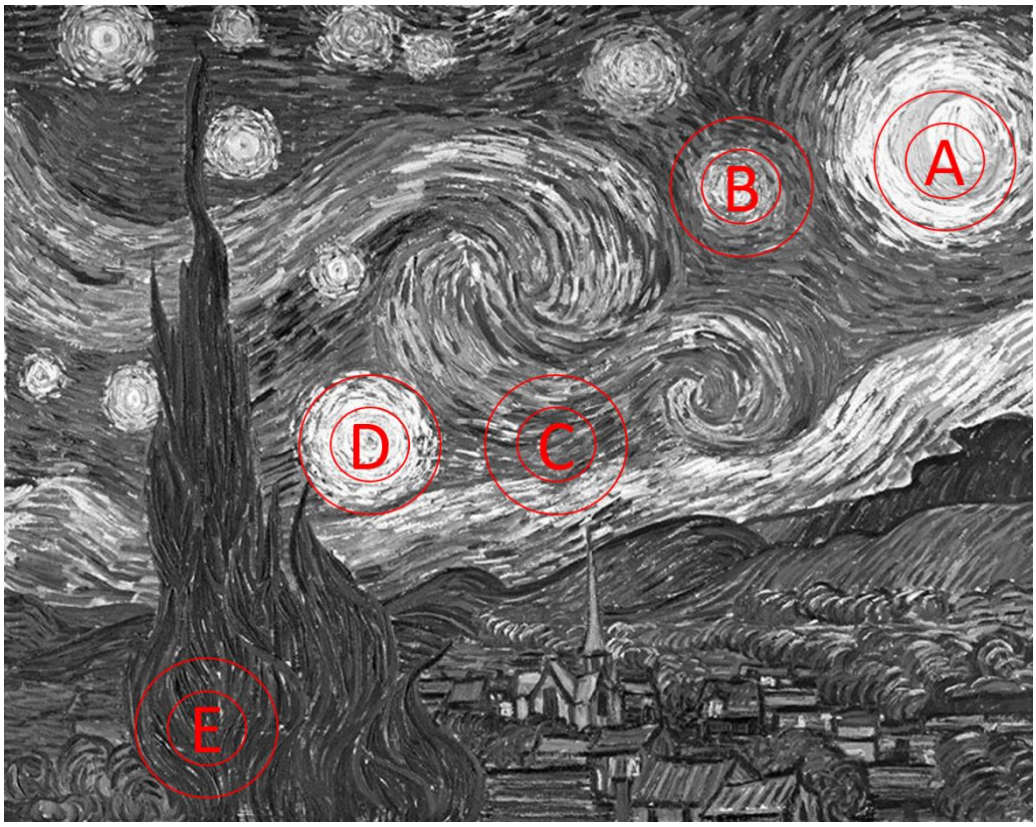


a) A
b) B
c) C
d) D
e) E

Answer key: Remember that **photoreceptors** (cones and rods) are slightly depolarized when they don't receive any photon (their "resting potential" in the dark is ~-40mV) and they ALWAYS **hyperpolarize** when they receive photon (in this case, when light is shining at the center). Also, due to mutual inhibition among photoreceptors, the hyperpolarization, or say, activation of their surrounding photoreceptors will inhibit them, causing them to depolarize. So the photoreceptor responses are all correct here.

Next, if the bipolar cells are on-center, then A, C, and E are wrong because these responses should be opposite to those of the photoreceptors (which actually have off-center, on-surround receptive fields). The ganglion cells should also have the opposite responses to the photoreceptors, but the same direction of responses as bipolar cells. D is the only one that meets all these criteria.

2. On the image below, we have depicted receptive fields for **OFF-center, ON-surround** *retinal ganglion cells*. Which of these cells is likely to **increase** its firing rate the **MOST**?



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

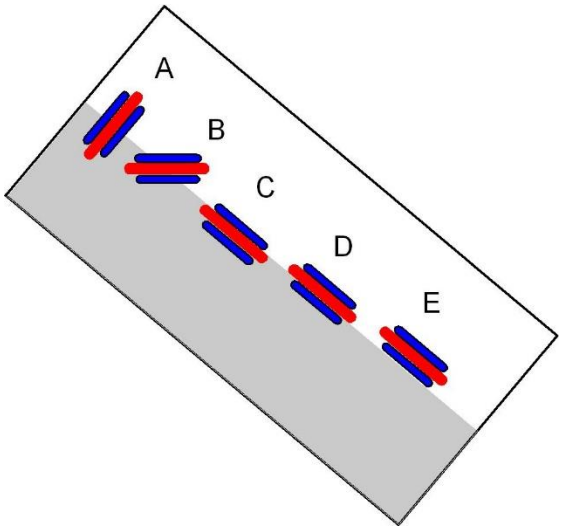
Answer key: Since these are OFF-center, ON-surround cells, to get an increase in firing rate you are looking for something where the surround is activated by light (relatively brighter), and the center is relatively less activated by light (darker). C is the only one that works here.

3. Using the above picture again, which of the following is likely to **decrease** its rate the **MOST?**

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

Answer key: Since these are OFF-center, ON-surround cells, to get a decrease in firing rate you are looking for something where the surround is less activated by light (relatively darker), and the center is relatively more activated by light (lighter). B is the only one that works here.

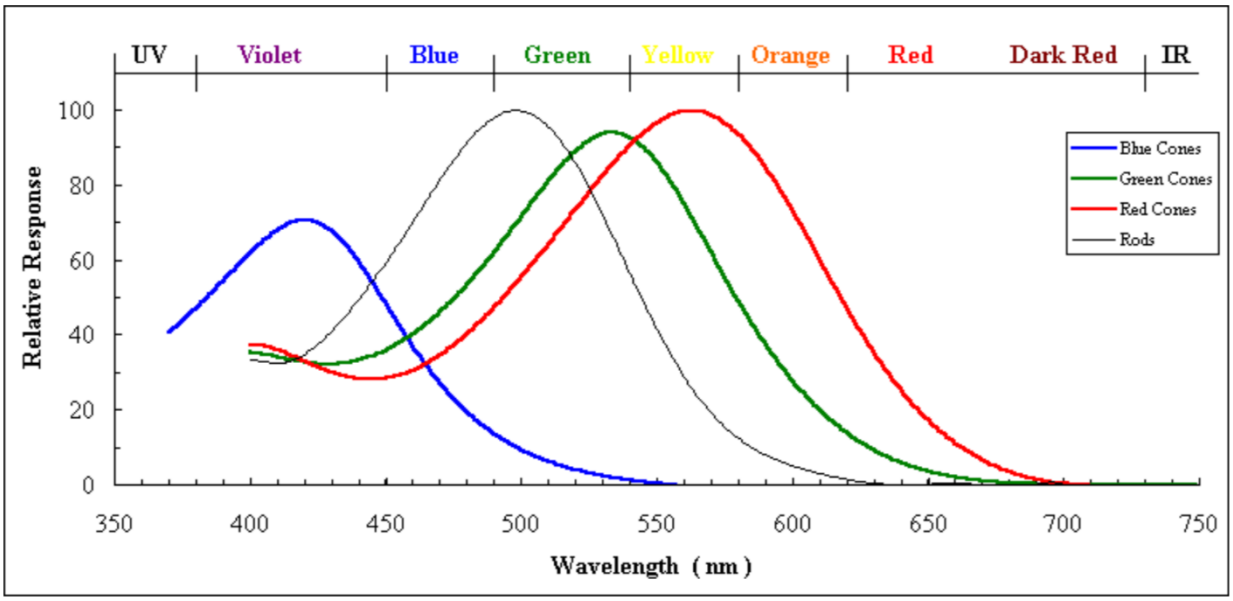
4. The figure below shows the receptive fields of 5 simple cells in the visual cortex, V1. Simple cells respond to bars of light at a particular location and orientation. The regions of receptive fields that cause excitation by light are indicated in red; the receptive fields causing inhibition by light are shown in blue. Which of these five cells will fire most strongly to the grey and white pattern projected on the screen in front of the animal?



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

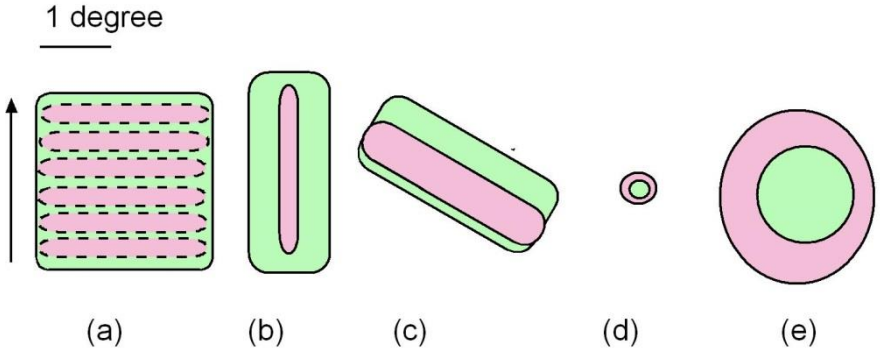
Answer key: The entire center is illuminated in D and E (producing maximal level of excitation in the cell), but some of the surround is NOT illuminated in D, so D has less inhibition than E and would therefore produce the biggest increase in firing rate. C is only activated in the surround, so this cell would be inhibited. A and B have half the surround and half the center activated, so these would both be (about) equally excited and inhibited, like E, and certainly less excited than D.

5. According to the figure below, what wavelength of excitation light is presented to the retina when we observed these relative responses in cones and rods: Blue cones: 10, Green Cones: 60, Red cones: 50, Rods: 100



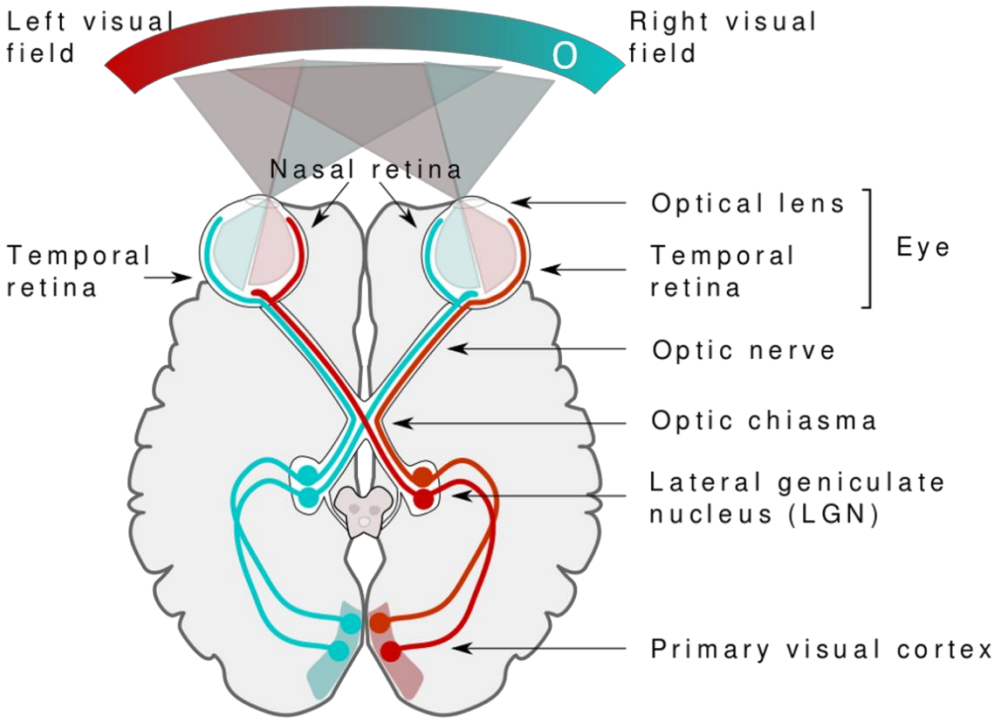
a) 420nm
b) 470nm
c) 500nm
d) 550nm
e) 580nm

6. The figure below shows receptive fields of six different cells from various places in the visual system of a primate. Areas in pink indicate areas inhibited by light green areas indicate areas excited by light. Areas in pink enclosed by dashed lines are alternative regions that cause responses when the stimulus is moving in the direction of the arrow. Which receptive field is from a complex cell in the area V1 of the visual cortex?



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

7. An object (marked by "O") shows up at the very end of the right visual field (as shown below), describe the pathway this image will be transferred from the retina to the V1?



a) Right nasal retina -> Left Primary visual cortex
b) Right temporal retina -> Left Primary visual cortex
c) Left nasal retina -> Left Primary visual cortex
d) Left temporal retina -> Left Primary visual cortex
e) Both A and C

8. Which of the following statements about nicotine receptors is INCORRECT?

a) Nicotine is not the neurotransmitter. It is a drug that binds to this cholinergic receptor and stimulates the effect of acetylcholine.
b) They are found in the postganglionic parasympathetic and sympathetic neurons.
c) When stimulated, they may cause stimulation or inhibition according to the type of receptor present on the target organ.
d) They are found in the vagus nerve.
e) They are ligand gated cation channels.

Answer key: nicotine receptors are ligand-gated cation channels so they cannot cause inhibition of neurons.

9. Ninety percent of all the preganglionic parasympathetic fibers are found in the _____.

   a) trigeminal nerve
   b) oculomotor nerve
   c) vagus nerves
   d) facial nerve
   e) glossopharyngeal nerve

10. Which of the following does NOT secrete acetylcholine?

   a) somatic motor neurons
   b) sympathetic preganglionic neurons
   c) parasympathetic postganglionic neurons
   d) sympathetic postganglionic neurons
   e) parasympathetic preganglionic neurons

11. **Thought Question (ungraded)**: Most fishes have side-facing eyes. This means that the right eye sees only the right visual field and the left eye sees only the left visual field.

   A) Should primary visual cortex (or the equivalent in fishes) have ocular dominance columns in visual cortex?
   No

   b) Should these animals have good stereovision?

   No

   For part B, why or why not?

   Here, you would have input from only the left eye in right visual cortex and vice

   versa. This means you don't have (and can't compare) two different images for a given part of the visual field, and therefore can't have stereovision.

12. **Thought question (ungraded):** Many sensory systems have lateral inhibition (activation of one neuron will result in the inhibition of its adjacent neurons) at some level of processing, either peripherally (as in vision) or more centrally. Describe a possible effect of lateral inhibition on perception for each of the following senses: vision, audition, olfaction, touch, and taste. In your answer, describe what variable you will look at (for

example, for vision it could be location in space, color etc.), and how processing of that variable could change via lateral inhibition.

Answer key: Vision: sharpening edges of the visual field, responding more preferentially to a certain color band of light etc. Audition: sharpening auditory tuning curves; increasing amplitude more preferentially towards the center of your receptive field. Touch; being able to discriminate location of a stimulus more accurately. Chemical senses; being more sensitive to chemicals which you respond to the best