

Homework 1 (scores 6)

Deadline: Sept. 30, 2019

Some of the problems are not discussed in class. You are required to read Chapters 2, 5, 9 and 10 of *Neuroscience: Exploring the Brain* (3rd edition) by Bear, Connors, Paradiso, 2006. You may also need to search on the internet.

Problem 1 (score 1): Is the cell shown in Figure 1 a neuron? If yes, is it a stellate cell or pyramidal cell?

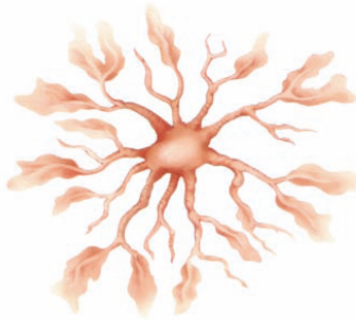


Fig. 1. A cell in the brain

Problem 2 (score 1): The organization of ganglion cell receptive fields suggests an explanation for the illusion shown in Figure 2. The central boxes are identical shades of gray, but because the surrounding area is lighter on the left, the left central box appears darker. ON-center receptive fields are shown on the left and right of the figure. Which would respond more?

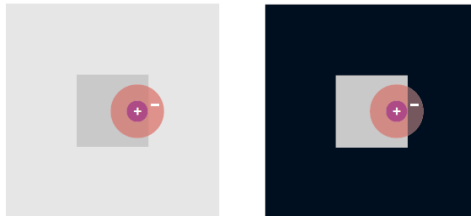


Fig. 2. The influence of contrast on the perception of light and dark.

Problem 3 (score 1): The cones in normal human retinas contain one of three opsins that give the photopigments different spectral sensitivities. Thus, we can speak of blue cones that are maximally activated by light with a wavelength of about 430 nm, green cones that are maximally activated by light with a wavelength of about 530 nm, and red cones that are maximally activated by light with a wavelength of about 560 nm (Figure 3). This is called trichromacy. Not every animal uses three independent channels for conveying color information. Do you know any animal that uses four independent channels for conveying color information? Give one example.

Problem 4 (score 1): What happens in the retina when you get used to the dark? Why can't you see color at night?

Problem 5 (score 1): There are neurons in the human cortex that respond selectively to human faces. In the following areas, which is most likely to be the areas that these neurons reside in? (a) V1. (b) V4. (c) IT (inferotemporal cortex). (d) MT.

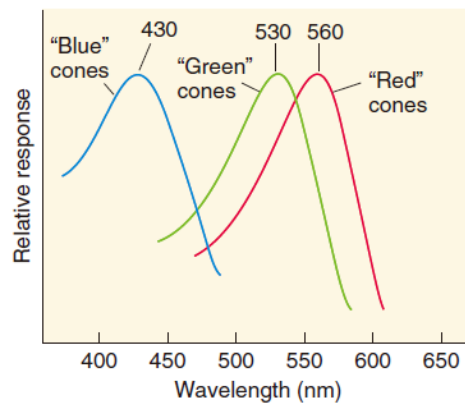


Fig. 3. The spectral sensitivity of the three types of cone pigments.

Problem 6 (score 1): In what ways is area MT more specialized for the detection of visual motion than area V1?