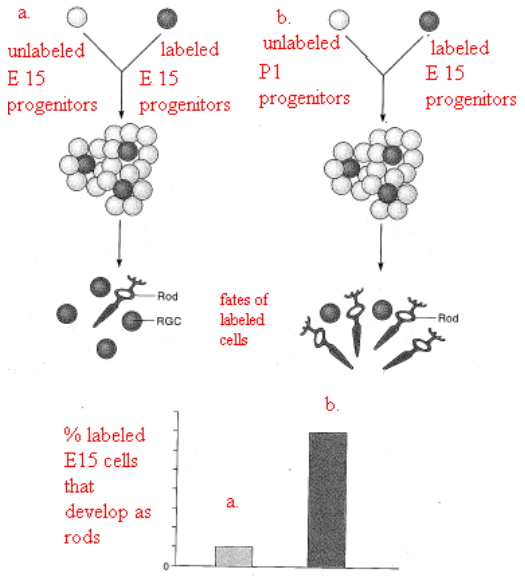
MCDB 4650 Problem Set 5

1. (1) Given the experiments on cortical progenitor cells discussed in class, what is the "default" fate of cortical progenitor cells?
    a. deep layer
    b. superficial layer

2. (1) Explain the evidence that supports your answer to the above question.

3. (2) Explain the most reasonable conclusion(s) from the experiment shown below regarding retinal progenitor cells, similar to one of the experiments described in class



4. (1) Neural crest cells originate just dorsal to the neural tube, but migrate all over the body, taking on both neural and non-neural fates. Neural crest cells in the brain region make cranial nerves. Neural crest cells from the spinal cord regions make (among other things) the dorsal root ganglia that contain sensory neurons. Which kind of experiment (s) below would allow you to determine whether these two populations of neural crest cells are committed?
    a. Transplantation of each type of crest cell progenitor into a new location along the A-P axis of the animal.
    b. Transplantation of each type of crest cell progenitor into a different stage of developing animal, but in the same location.
    c. Labeling the neural crest progenitors at an early stage of development and seeing where they are located and what their fates are after migration
    d. Isolating the neural crest cell progenitors in culture with no contacts to other cells.

5. (1)Which of the following two experiments demonstrates <u>most convincingly</u> that eyes, no matter how different they look in different species, develop using the same master regulatory eye gene?
    a. Pax-6 homologs exist in all species.
    b. Loss of function mutations in pax-6 homologs cause failure of eye development in all species.
    c. Pax-6 is expressed in the developing optic area in all species.
    d. Ectopic expression of Drosophila pax-6 transcript generates additional eyes in Drosophila
    e. Expression of the mouse pax-6 transcript in Drosophila can induce functional, Drosopihla eyes.

6. (2) The hand skeletons of humans and bats (and many other vertebrates) share a pattern of five fingers and the same kinds of bones in the forearm as well.

    a. Would you expect the shared 5 finger pattern to be established by molecules relatively early or relatively late in hand development?

    b. Would you expect the differences in finger length and shape between humans and bats to be established by molecules relatively early or relatively late in hand development?

    Explain your reasoning for both a and b.

7. (2) A gene duplication event in which a region of a chromosome is replicated and retained either as part of that chromosome, or translocated onto another chromosome usually (initially) generates two redundant gene copies. This could have an advantage for an organism: for example, if one copy of the gene acquired mutations that rendered it non-functional, the other copy might still be undamaged. However, mutations could also occur that do not render the protein product of a gene non-functional. Explain how mutations in two <u>different areas</u> of a gene and surrounding sequences could lead to two different outcomes in how that gene functions.