

Problem Set 6

1. (2) What molecular genetic technique would you use
 - a. To visualize expression of mRNA within an embryo?
 - b. To “knock-down” a gene product?
 - c. To visualize protein levels?
 - d. To “ectopically” expressed a transcript?

The genes A, B and C are involved in the control of cells determined to make gut, and their gene products work together in a pathway that can be diagrammed as:



2. (.5) Expression of gene A will
 - i) stimulate gut fate
 - ii) inhibit gut fate
3. (.5) A mutant animal lacking gene B, the embryo will
 - i) lack a gut
 - ii) have too much gut
4. (.5) In an animal with a gain of function mutation in A, the embryo will
 - i) lack a gut
 - ii) have too much gut
5. (.5) In an animal with a loss of function mutation in C, the embryo will
 - i) lack a gut
 - ii) have too much gut

The gene *mom-1*, required for normal development in the *C. elegans* early embryo, was discovered in screens for strict maternal-effect embryonic lethal mutations. This gene is required for specification of muscle: mutant dead embryos have a recognizable phenotype (lack of muscle).

6. (1) You begin a *C. elegans* experiment by mating a *mom-1/+* male to a *mom-1/+* hermaphrodite. What do you expect to see in the F1 progeny? List the possible genotypes, their proportions, and whether they are alive or dead.

7. (1) Another gene that is required for development in *C. elegans* is called *pha-4*. It is required for pharynx development, and is transcribed during neurulation. In a loss of function mutant strain, homozygotes die due to a lack of pharynx. If you conduct the same experiment (*pha-4/+* male mated to a *pha-4/+* hermaphrodite), what will you expect to see in the F1 progeny?

8. Use the following information to answer questions 8-11. In normal *C. elegans* hermaphrodite development, either of two adjacent precursor cells in the developing gonad can become the *anchor cell* (AC). This cell then sends a signal to help the egg laying apparatus (the vulva) develop. The cell that does not become the AC becomes the “VU” cell. This choice of fate is mediated by the *lin-12* gene, which encodes a Notch homolog.

- (0.5) In animals homozygous for a *lin-12(lf)* mutation, how do you predict these cells will develop?
 - 1) Both cells will develop as ACs.
 - 2) Both cells will develop as VUs
 - 3) One cell will develop into an AC, the other into a VU.
 - 4) Neither cell will differentiate.

9. (0.5) Given your knowledge of Notch-Delta signaling, does the *lin-12* gene act within the cell that makes it, or does it act on an adjacent cell?

- 1) within cell (autonomously acting)
- 2) on another cell (non-autonomously acting).

10. (0.5) In animals carrying a *lin-12(gf)* mutation (in which the mutant Notch homolog sends its normal signal to the nucleus regardless of whether the Delta homolog is complexed to it), how do you predict the two cells will develop?

- 1) Both cells will develop as ACs.
- 2) Both cells will develop as VUs
- 3) One cell will develop into an AC, the other into a VU.
- 4) Neither cell will differentiate.

11. (0.5) In animals homozygous for a *lf* mutation in the gene for the Delta homolog (gene not yet identified) that normally interacts with LIN-12, how do you predict the two cells will develop?

- 1) Both cells will develop as ACs.
- 2) Both cells will develop as VUs
- 3) One cell will develop into an AC, the other into a VU.
- 4) Neither cell will differentiate.

12. You generate 3 transgenic *C. elegans* strain by hooking GFP sequence to the coding sequence of *lin-3*, *let-23* and *apx-1*(the *C. elegans* Delta homolog). You look at the transgenic animals at two stages of development

- a. when the gonad is forming
- b. when the vulva is forming

(1)At stage a, in which strains will you see GFP in the larva, and where?

(1)At stage b, in which strains will you see GFP in the larva, and where?