Molecular Genetics BSCI410 Lectures 18-23. Model Organisms

This homework is due **Dec. 13** but homework turned in on **Dec. 8** will be returned on Dec. 13

The final exam will be given on Thursday, **December 15 at 8:00 am**

HOMEWORK 5

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1. (3 points) You have isolated a new recessive lethal mutation in *Drosophila*. You tentatively call the mutation (and the gene it's in) *cyclops*, or simply *cy* (because of the phenotype of the dead embryos, which have a single eye disc primordium). You have mapped *cy* to the X chromosome, and wish to refine it's map position further. To do this, you cross *cy / FM7* females to *cv ct* males, and then allow the resulting phenotypically wild-type heterozygous F1 females (which are *cy / cv ct*) to mate with their *FM7* male brothers. The male F2 progeny from this cross fall into the following phenotypic categories.

crossveinless cut wings	691
wild-type wings	1
cut wings with normal veins	32
crossveinless wings without cuts	23

Examine the Drosophila genetic map (see pg. 132 of Hartwell, Fig. 5.15, or flybase: http://flybase.bio.indiana.edu/) and determine the position of *cyclops* on the **genetic** map.

2. (1 point) Approximately where does your gene reside on the **cytological** map? (You will probably need to visit flybase to correlate the two maps)

3. (1 points) Name one candidate gene that maps in this region.

4. (2 points) *Drosophila* larvae that were heterozygous for a null mutation of the *white* gene (*w)* and its wild-type allele (w^+*)* were irradiated with X rays and then reared to adulthood. When the adults emerged from the pupal cases, a few had white patches in their otherwise red eyes. These patches were otherwise normal in every other way. What caused these patches to develop? Given this observation, do you think it more likely that the product of the *white* gene acts in pigment deposition or in the metabolic pathway for pigment synthesis? Explain.

5. (2 points) You repeat this experiment using the same protocols, but this time with *Drosophila* larvae that are heterozygous for mutations in the linked genes *cinnabar* (*cn*) and *brown* (*bw)* and derived from a cross between wild-type and *cn bw* parents. Together, these mutations cause a white eye (you can read about these genes on flybase). Again, larvae were irradiated with X rays and then reared to adulthood. When the adults emerged from the pupal cases, a few had brown patches in their otherwise red eyes, but no white or cinnabar patches were observed. Explain your observations.

6. (1 point) Which comes first, a mutant ES cell line or a mutant mouse?

a) The cell line is derived from the mouse.

b) The mouse is derived from the cell line.

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7. (3 points) For each of the following, indicate whether or not it is homozygous at all or nearly all loci:
a) a mouse from a congenic strain
b) a mouse from a recombinant inbred line
c) a mouse from an inbred line
d) an F1 mouse from a cross between two inbred lines
e) Fruit flies from a wild-type strain.
f) *C. elegans* worms from a wild-type strain

8. (3 points) For each of the following, indicate whether the individuals are all genetically identical:
a) a mouse from a congenic strain
b) a mouse from a recombinant inbred line
c) a mouse from an inbred line
d) an F1 mouse from a cross between two inbred lines
e) Fruit flies from a wild-type strain.
f) *C. elegans* worms from a wild-type strain

9. (2 points) Is it possible to exclude paternity by examination of a single locus (examination of the same single locus in the two individuals, one of which is conjectured to be the father of the other)? Explain (if so, how? if not, why not?).

10. (2 points) Is it possible to exclude the possibility that two people are siblings by examination of a single locus (examination of the same single locus in the two individuals that may be siblings)? Explain (if so, how? if not, why not).

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