BIO-411 Week 5 Exercises Forward genetics 13 OCT 25

Questions 1- 4 pertain Konopka and Benzer, questions 5 - 8 to the lecture.

1) Can you think of the likely reason that led the authors to design a screen that enabled them to identify mutants only on the X chromosome (thus missing ~95% of the genome)?

2) On p. 2113, the authors explain how they performed complementation analyses between the three rhythm mutants, which allowed them to establish that they affect the same gene (later baptized "*per*").
a) Draw the cross corresponding to one such complementation analysis.
b) Explain why the presence of Bar on the FM 7 chromosome is useful for this analysis.
c) Would complementation analysis have been possible without it?

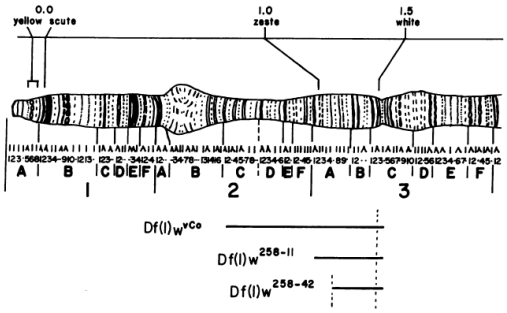
3) Explain how you would proceed in the 1970's and 1980's to identify the molecular nature of the *per* gene. And how about today?

4) *per* encodes a transcription factor. Given this, propose a molecular mechanism underlying the semi-dominance of the per^s mutant allele.

5) Working with Drosophila, you notice a spontaneous mutation in a male that exhibits very small eyes; you name the corresponding gene *tiny eye* and this mutant allele $tiny\ eyes^1$ You cross this male with a wild-type female, and find that all of the F1 progeny are wild-type. Assuming that $tiny\ eyes^1$ is a single point mutation:
a) Is the $tiny\ eyes^1$ mutation recessive or dominant?
b) What do you conclude regarding the chromosomal location of the *tiny eyes* gene?

6) Next, you cross brothers and sisters from the F1 generation of the above cross and analyze flies at the F2 generation. What fraction of females and what fraction of males do you expect to exhibit the very small eye phenotype?

7) Below is the same chromosome segment to which the *per* gene maps (see p. 2115 in Konopka and Benzer).
a) You generate females of genotype $tiny\ eyes^1/Df(I)w^{258\text{-}42}$ and find that they have wild-type eyes. What do you conclude?
b) Next, you try to generate flies of genotype $tiny\ eyes^1/Df(I)w^{258\text{-}11}$ and find that this genotype is absent from the population. What do you conclude?



8) A fellow Masters student in the lab tells you that the above information (questions 5-7) suggests that *tiny eyes* encodes a transcription factor that specifies the fate of cells in the Drosophila eye. Do you agree?