

Biology 305 Genetics
Problem Set 3

Name _____

By printing your name above you acknowledge that while there may have been group discussions of these problems, the work below is yours.

I want to encourage you to work together on these problems, but make sure you understand how to solve each problem on your own. Show all of your work. No credit will be given for answers without work. If a question requires you to determine a genotype show how you obtained it. Please write neatly. If I can't read it, I can't grade it. The homework is due Wednesday, March before class begins. If it is handed in after class has started there is a 5-point deduction and a further 5 points for each day it is late.

1. Five *Hfr* Strains A through E are derived from a single F^+ strain of *E. coli*. The following chart shows the entry times in minutes of the first five genes from *Hfr* strains into an F^- strain when each is used in an interrupted-conjugation experiment:

Strain A	Strain B	Strain C	Strain D	Strain E
<i>mal</i> ⁺ (1min)	<i>ade</i> ⁺ (13 min)	<i>pro</i> ⁺ (3 min)	<i>pro</i> ⁺ (10 min)	<i>his</i> ⁺ (7 min)
<i>str</i> ^s (11 min)	<i>his</i> ⁺ (28 min)	<i>met</i> ⁺ (29 min)	<i>gal</i> ⁺ (16 min)	<i>gal</i> ⁺ (17 min)
<i>ser</i> ⁺ (16 min)	<i>gal</i> ⁺ (38 min)	<i>xyl</i> ⁺ (32 min)	<i>his</i> ⁺ (26 min)	<i>pro</i> ⁺ (23 min)
<i>ade</i> ⁺ (36 min)	<i>pro</i> ⁺ (44 min)	<i>mal</i> ⁺ (37 min)	<i>ade</i> ⁺ (41 min)	<i>met</i> ⁺ (49 min)
<i>his</i> ⁺ (51 min)	<i>met</i> ⁺ (70 min)	<i>str</i> ^s (47 min)	<i>ser</i> ⁺ (61 min)	<i>xyl</i> ⁺ (52 min)

- Draw ONE map of the F^+ strain's chromosome, indicating the positions of all of the genes and their distances apart in minutes.
- On the chromosome map, show the insertion point and orientation of the F plasmids in each *Hfr* strain.

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2. Some forms of red-green colorblindness are caused by the deletion of an opsin gene required for color perception. The deletions occur on the X chromosome where there are two almost exact copies of the opsin genes (one for green color and one for red color) repeated in tandem.

Diagram a mechanism that would produce a chromosomal deletion of one of the opsin genes by recombination *between* homologous chromosomes. Show the following things in your diagram:

- The original chromosomes
- The orientation of the red and green genes
- The final recombination products
- Label the chromosome that would produce colorblindness

Would you expect the genomic rearrangement that you diagrammed in part A to occur only in males, only in females, or in both males and females? Explain.