

Biology 212 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 Tuesday, March 31st 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.

Answer the following questions.

1. You are doing complementation studies with several rII mutants you have isolated from the phage T4. To determine what mutations are alleles of one another, you co-infect *E.coli strain K* with pair-wise combinations of your mutants. Your initial complementation crosses yield the following results: (15 points)

Mutant Crosses	Results (+ = lysis, - = no lysis)
1 x 2	+
1 x 3	+
1 x 4	-
1 x 5	-

In the following table, predict the results for the following crosses:

Mutant Crosses	Results (+ = lysis, - = no lysis)
4 x 5	
2 x 4	
3 x 5	

You decide to determine the recombination frequency between rII mutants 4 and 5 from the previous problem. You co-infect *E.coli strain B* with mutants 4 and 5 and plate equal amounts of the resulting progeny on either *E.coli strain K* or *E.coli strain B*. The results are listed below:

Bacterial Host	# of Plaques
<i>E.coli strain B</i>	200,000
<i>E.coli strain K</i>	50

What is the recombination frequency between the 2 mutants?

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2. 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 a 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.