

WEEK 7 PROBLEMS

Problems From Chapter 7

7.1 What is the difference between a selected marker and a counterselected marker? Why are both necessary in an Hfr X F⁻ mating?

7.2 An Hfr strain transfers genes in alphabetical order, *abc*.

In an Hfr *a⁺ b⁺ c⁺ str^S* X F⁻ *a⁻ b⁻ C str-r* mating, do all *b⁺ str^R* recombinants receive the *a⁺* allele? Are all *b⁺ str^R* recombinants also *a⁺*? Why or why not?

7.3 Bacteriophage P1 transduction using a donor bacterial strain that has the wildtype alleles of the closely linked markers *a*, *b*, *c*, and *d* shows the following percentages of cotransduction:

<i>a-b</i> : 29	<i>a-c</i> : 2	<i>a-d</i> : 5
<i>b-c</i> : 0	<i>b-d</i> : 1	<i>c-d</i> : 50

What is the order of the genetic markers?

7.4 Bacterial cells of genotype *pur⁻ pro⁺ his⁺* were transduced with P1 bacteriophage grown on bacteria of genotype *pur⁺ pro⁻ his⁻*. Transductants containing *pur⁺* were selected and tested for the unselected markers *pro* and *his*. The numbers of *pur⁺* colonies with each of four genotypes were as follows:

<i>pro⁺</i>	<i>his⁺</i>	102
<i>pro⁻</i>	<i>his⁺</i>	25
<i>pro⁺</i>	<i>his⁻</i>	160
<i>pro⁻</i>	<i>his⁻</i>	1

Is *pur* closer to the *his* gene or the *pro* gene?

What is the co-transduction frequency between *pur* and *his*? between *pur* and *pro*?

Why can't the co-transduction frequency be determined between *pro* and *his* from this experiment?

7.5 An experiment was carried out in *E. coli* to map five genes around the chromosome using each of three different Hfr strains. The genetic markers were *bio*, *met*, *phe*, *his*, and *trp*. The Hfr strains were found to transfer the genetic markers at the times indicated here. Construct a genetic map of the *E. coli* chromosome that includes all five genetic markers, the genetic distances in minutes between adjacent gene pairs, and the origin and direction of transfer of each Hfr. Complete the missing entries in the table, which are indicated by question marks.

Hfr1 markers	<i>bio</i>	<i>met</i>	<i>phe</i>	<i>his</i>
Time of entry	26	44	66	?
Hfr2 markers	<i>phe</i>	<i>met</i>	<i>bio</i>	<i>trp</i>
Time of entry	?	26	44	75
Hfr3 markers	<i>phe</i>	<i>his</i>	?	<i>bio</i>
Time of entry	6	27	35	?

Problems From Chapter 10

10.1 Reverse transcriptase, like most enzymes that make DNA, requires a primer. Explain why, when cDNA is to be made for the purpose of cloning a eukaryotic gene, a convenient primer is a short sequence of poly(dT). Why does this method not work with a prokaryotic messenger RNA?

10.2 A DNA microarray is hybridized with fluorescently labeled reverse-transcribed DNA as described in the text, where the control mRNA (C) is labeled with a green fluor and the experimental mRNA (E) with a red fluor. Indicate what you can conclude about the relative levels of expression of a spot in the microarray that fluoresces:

- (a) Red
- (b) Green
- (c) Yellow
- (d) Orange
- (e) Lime green