

## Exam III

December 9 1996

## Microbial Genetics

Your Name:

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1. What is a polar mutation? How (be specific) do insertion sequence elements cause polar mutations?

2. Indicate with a labeled diagram the result you would expect from heteroduplex analysis with *gal* and *lac* DNA that contains the identical insertion sequence element. (Do *not* describe heteroduplex analysis.)

3. Diagram the process of conservative transposition, using two replicons (labeled A and B). Include boxes to indicate target sequence(s).

4. Fill in the following table, answering either Y(es) or N(o).

	Trans-formation	Conju-gation	Generalized Transduction
Inhibited by DNase?			
Prevented by U-tube?			
Discovered by Lederberg?			
Mediated by P1?			

5. The transformation frequency of gene *a* is  $10^{-3}$ , and for gene *b* is  $5 \times 10^{-2}$ . If these genes were located at opposite ends of a genome, what would you predict to be the frequency of the *ab* (i.e. double) transformant? What would be the frequency of the double transformant if the two genes were within 10 kb of each other on the chromosome?

6. In a mating between Hfr and  $F^-$  cells, the recipient usually remains  $F^-$ . What would have to occur, and how long would it take, for the recipient to become  $F^+$ ?

7. An Hfr strain with the genotype  $Str^s his^+ leu^+$  is mated with a  $Str^r his^- leu^-$  recipient. After mating for several hours, the mixture is plated on minimal media containing streptomycin and either histidine or leucine. The number of colonies per plate are: histidine plus streptomycin, 500; leu plus str, 150.

- a) Which gene entered first, *his* or *leu*?
- b) What is the purpose of the streptomycin?

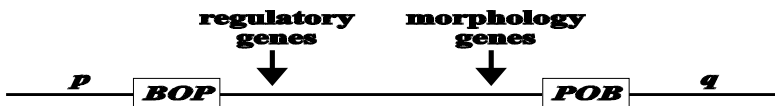
8. *Briefly*, distinguish between an  $F^+$ , Hfr and  $F'$ . Which of these can transfer chromosomal markers?

9. What are the activities and roles of RecA in the homologous recombination process?

10. What are two general requirements that must be met by a temperate bacteriophage in order for it to establish and maintain lysogeny? Describe how bacteriophage lambda meets these requirements.

11. Briefly, how does the P1 prophage differ from the lambda prophage?

12. Given the following prophage, which gene (*p* or *q*) is more likely to be carried on a defective specialized transducing phage. Explain.



13. What difference between Type I and Type II restriction endonucleases makes the Type II enzymes much better for practical applications?

14. A circular DNA molecule is digested with restriction endonucleases, and the following results are obtained: EcoRI, 12 kb; PstI, 9 kb, 3 kb; HindIII, 12 kb; EcoRI/PstI, 9, 2, and 1 kb; EcoRI/HindIII, 11 and 1 kb; PstI/HindIII, 9 kb and 3 kb. Given the EcoRI and HindIII sites below, map the PstI site(s).

