

PRINTED NAME \_\_\_\_\_

BIO 226R    SPRING 05    DR BLINKOVA    EXAM 4

## **INSTRUCTIONS:**

**FILL IN NAME AND UTEID ON THE SCANTRON, NOW.**

**FILL IN NAME ON THIS PAGE, NOW.**

**READ THE INSTRUCTIONS BELOW, NOW.**

**Answers.** Answer on the answer sheet. 2.5 pts each.

**Read the questions carefully and choose the best answer.**

**Understanding the questions is part of the exam.** Therefore, no questions about the exam will be answered, unless some of the exam questions are ambiguous, in which case, the entire class will be interrupted and the same explanation made to everyone. If you think that a question is ambiguous, inform the TA or instructor.

**Several questions ask you to analyze lecture material and formulate an answer,** rather than just to repeat material from memory.

# **WAIT TO OPEN THE EXAM**

# **UNTIL THE BELL RINGS**

1. Generalized transduction is distinguishable from specialized transduction by the fact that

- a. generalized transduction may be used to move any gene, whereas specialized transduction moves only certain genes.
  - b. selective medium is required for generalized transduction, whereas selective medium is not required for specialized transduction.
  - c. donor DNA must be purified from the donor for generalized transduction, whereas specialized transduction involves movement of DNA by phages.
  - d. generalized transduction is possible in generally all organisms, whereas specialized transduction is possible only in special groups of organisms.
2. Generalized transducing particles
- a. are formed by packaging host chromosomal fragments after phage infection
  - b. are formed during growth of a phage in a bacterial host
  - c. carry donor genes to recipient cells
  - d. all the above
3. Generalized transduction:
- a. Requires bacteriophage replication and growth to form transducing particles.
  - b. Requires restriction enzymes to cut DNA at specific sites.
  - c. Requires phage repressors to form lysogens.
  - d. All the above.
4. The galactose operon of *Escherichia coli* is located near the attachment site for the lambda prophage. The galactose operon
- a. codes for enzymes which catabolize galactose
  - b. can be incorporated into specialized transducing phages
  - c. can be transferred by conjugation
  - d. all the above
5. Specialized transduction
- a. is possible only with virulent (also called lytic) phages.
  - b. depends on reverse transcription.
  - c. can transfer donor genes only if they are adjacent to prophages.
  - d. amplifies DNA.
6. Specialized transduction can be used to transduce the biotin operon from donor to recipient bacteria. Biotin is a vitamin required for all growth. Suppose that you have a generalized transducing phage preparation which had been grown on a wild-type biotin<sup>+</sup> donor, and a culture of a biotin-requiring mutant recipient. How would you select transductants?
- a. Plate the phage preparation on the recipient host in soft agar to select plaques.
  - b. Plate the phage preparation on glucose medium.
  - c. Plate the phage-infected recipient cells on glucose plus biotin medium.
  - d. Plate the phage-infected recipient cells on glucose without biotin medium.
7. Genes you would expect to find on the fertility factor include
- |                      |                       |
|----------------------|-----------------------|
| a. capsomer gene     | c. origin of transfer |
| b. DNA transfer gene | d. all the above      |
8. Plasmids
- |   |   |
|---|---|
| a. are extra-chromosomal (located in the cytoplasm) | c. can be cut by restriction enzymes in vitro |
| b. can be modified by modification enzymes in vivo  | d. all the above                              |
9. Plasmids and chromosomes are similar in that both
- |   |   |
|---|---|
| a. are double-stranded DNA                    | c. contain genes within their nucleotide sequence |
| b. can be cut by restriction enzymes in vitro | d. all the above                                  |

10. Decreasing from left to right in size (in numbers of nucleotide pairs) are:
- Bacteriophage lambda chromosome, Transposon, Insertion sequence.
  - Fertility factor, Bacterial chromosome, Bacteriophage lambda chromosome.
  - Fertility factor, Insertion sequence, Plasmid.
  - Bacterial gene, Human gene, Bacterial chromosome.
11. The simplest plasmid which could be found naturally occurring in bacteria [that is, the smallest plasmid which would be duplicated in each binary fission cycle and passed on to daughter cells] would consist of a circular:
- fragment consisting of any random chromosomal gene
  - fragment of DNA containing genes and sites necessary for plasmid replication
  - prophage consisting of the phage repressor gene and phage operators
  - fragment of DNA consisting of the plasmid transfer operon plus the origin of transfer
12. A primitive sexual means of exchanging genetic information between bacteria is
- integration/excision
  - conjugation
  - restriction/modification
  - transposition of mobile genetic elements
13. In nature, antibiotic resistance genes carried on plasmids
- can be transferred to other organisms by conjugation
  - are transcribed and translated
  - can confer a new phenotype on recipients which receive them
  - all the above
14. Conjugational transfer of chromosomal fragments includes the following steps, in order from left to right,
- complementary strand synthesis in the female, homologous recombination in the recipient
  - breaking one strand within the fertility factor, complementary DNA synthesis in the donor
  - breaking one strand within the fertility factor, complementary DNA synthesis in the recipient
  - all the above
15. Conjugation between Hfr type males and females can be distinguished from transduction by the fact that the former (that is, the first) depends on
- cell-cell contact whereas the latter (that is, the second) does not
  - lysogeny whereas the latter does not
  - restriction of foreign DNA whereas the latter does not
  - a phage chromosome whereas the latter does not
16. Bacterial conjugation which involves transfer of chromosomal fragments from Hfr males to females requires:
- Homologous recombination enzymes.
  - Breaking and rejoining DNA.
  - The Fertility Factor.
  - All the above.
17. Types of bacterial males which can transfer chromosomal genes to female cells are:
- F<sup>+</sup> and Hfr males
  - Hfr and F prime males
  - F prime and F<sup>+</sup> males
  - All the above
18. Properties of Insertion Sequences include:
- They are linear, double strand DNA molecules.
  - They carry genes for DNA transfer in conjugation.
  - They carry genes for antibiotic resistance.
  - all the above

19. Transposases are
- enzymes which catalyze movement of transposons from one location to another location
  - encoded by genes on integrons
  - enzymes which nick and catalyze transfer of linear single strands of plasmid DNA
  - all the above
20. Integrons might contribute to survival of a bacterial pathogen by acquiring genes which code for proteins to
- integrate the integrons into the host bacterial chromosome
  - inactivate bacterial resistance genes
  - provide drug (antibiotic) resistance to the host bacteria
  - provide attachment sites for prophages
21. Mobile genetic elements which consist of transfer genes, transposase genes, and antibiotic (drug) resistance genes are called
- prophages
  - plasmids
  - conjugative transposons
  - all the above
22. Genomic islands include
- sites for initiating and terminating replication
  - the transfer operon with genes for DNA transfer in conjugation
  - genes which code for enzymes and proteins which allow bacteria to survive in certain environments
  - genes which code for DNA replication proteins
23. Restriction and modification are related in the sense that
- both processes occur at the same nucleotide sequence
  - one gene codes for both enzymes
  - both enzymes transfer methyl groups
  - all the above
24. You would need for molecular cloning
- restriction enzyme
  - conjugation enzyme
  - modification enzyme
  - enzyme to nick (that is, to make a single strand break in) the origin of transfer
25. Molecular cloning is best done with a vector which
- has a gene which codes for a restriction enzyme
  - has a suitable restriction enzyme site
  - has a suitable origin of transfer
  - all the above
26. Molecular cloning steps in order include
- extraction of vector DNA, ligation of target DNA to vector DNA, restriction of target DNA
  - restriction of target DNA, ligation of cut (that is, restricted) target DNA to vector DNA which has already been cut, transformation of host cells
  - cutting target DNA, cutting vector DNA, amplifying target DNA
  - amplifying target DNA, ligating target DNA to cut vector DNA, homologous recombination of target vector DNA
- and
27. Plasmids can be used to transform bacterial cells, provided that
- Restriction enzymes are available.
  - The bacterial cells contain repressor molecules.
  - The plasmids can enter the cells through the cell wall and cytoplasmic membrane.
  - A phage preparation is available.

28. Enzymes necessary for the Polymerase Chain Reaction (PCR) include:
- Restriction enzyme, DNA ligase.
  - Primers, DNA polymerase.
  - DNA polymerase.
  - DNA polymerase, DNA ligase.
29. Molecular cloning steps in order include
- Extract target and vector DNA, Cut each with restriction enzyme, Mix and ligate
  - Transform donor with vector, Extract hybrid plasmid, Transform appropriate host cells
  - Infect donor with specialized transducing phage, Isolate lysogens, Induce, Transduce recipient cells
  - Inject restriction enzyme into donor cells, Cut donor chromosome, Ligate, Select transformants
30. Characteristics of the Polymerase Chain Reaction (PCR) include
- The primers are complementary to each other
  - The enzyme DNA ligase is required
  - Each cycle doubles the number of molecules in the reaction
  - The fragment or gene of interest must have appropriate restriction sites
31. Properties of Insertion Sequences include:
- They are linear, double strand DNA molecules.
  - They carry genes for DNA transfer in conjugation.
  - They carry genes for antibiotic resistance.
  - all the above
32. Transposases are
- enzymes which catalyze movement of transposons from one location to another location
  - encoded by genes on integrons
  - enzymes which nick and catalyze transfer of linear single strands of plasmid DNA
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33. Integrons might contribute to survival of a bacterial pathogen by acquiring genes which code for proteins to
- integrate the integrons into the host bacterial chromosome
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34. Mobile genetic elements which consist of transfer genes, transposase genes, and antibiotic (drug) resistance genes are called
- prophages
  - plasmids
  - conjugative transposons
  - all the above
35. Genomic islands include
- sites for initiating and terminating replication
  - the transfer operon with genes for DNA transfer in conjugation
  - genes which code for enzymes and proteins which allow bacteria to survive in certain environments
  - genes which code for DNA replication proteins
36. A library of chromosomal fragments of a given bacterium
- can be prepared by cloning those fragments into suitable vectors
  - is used for genomic sequencing
  - should contain at least one clone of each region of the chromosome
  - all the above

37. One of the goals of genomics is to identify every protein coding region of an organism. Assume that the complete sequence of a bacterial chromosome has been determined and that computational support is available to analyze the sequence. What criteria would be useful in finding the genes (protein coding regions) within the chromosome?
- Genes are expected to be interrupted by introns.
  - Protein coding regions should have a certain minimum number of contiguous codons.
  - Protein coding regions should be adjacent to promoters.
  - All the above are correct.
38. Genomics is used not only to determine the nucleotide sequence of every gene of an organism, but also to determine the function of every gene. The functions of genes discovered by sequencing can sometimes be done by comparing the deduced amino acid sequence of the gene product to the amino acid sequences of known proteins because proteins of similar function often have similar amino acid sequences. Two proteins of very similar amino acid sequence are said to be
- Orthologous if they are produced by different organisms.
  - Paralogous if they are produced by the same organism.
  - Homologous
  - All the above are correct.
39. DNA microarrays can be used to study gene expression of all the genes of a certain organism under various growth conditions. This method
- quantitates mRNAs (directly or after conversion into cDNAs) from each gene, or protein coding region.
  - requires knowledge of the nucleotide sequence of each protein coding region.
  - involves amplifying a DNA fragment corresponding to each protein coding region.
  - involves all the above.
40. An enzyme which could be used to synthesize fluorescent-labelled DNA strands complementary to messenger RNAs extracted from cultures is
- |                   |                          |
|-------------------|--------------------------|
| a. DNA primase    | c. reverse transcriptase |
| b. DNA polymerase | d. RNA polymerase        |