

MICROBIOLOGY EXAM #2

Name _____

18 March 1998

Multiple Choice & True/False (2 pts each): Unless directed to do so, chose the ONE most appropriate answer from the choices given.

1. Lactic acid is produced during fermentation in many cells except:
 - a. Eukaryotic muscle cells
 - b. Eukaryotic neurons
 - c. Archeabacteria
 - d. Eubacteria
 - e. All can produce lactic acid

2. Photosynthetic bacteria can use the following molecules as electron donors **except**:
 - a. H₂S
 - b. H₂O
 - c. H₂
 - d. O₂
 - e. Organic molecules
 - f. Orgasmic molecules (please, please don't pick me)

3. Cells without rubisco . . .
 - a. Would be unable to fix carbon
 - b. Would be unable to produce water
 - c. Would be unable to produce energy
 - d. a & c are right
 - e. a & b are right
 - f. b & c are right

4. Determination of motility in bacteria using a hanging drop can involve the use of all of the following, EXCEPT . . .
 - a. Mounting a coverslip on Vaseline
 - b. compound scope
 - c. Wax pencil mark
 - d. Depression slide
 - e. Quebec counter

5. Which of the following is False:
 - a. Thermophiles can be found in compost heaps
 - b. Pathogens are mostly mesophiles
 - c. Most microbes have their temperature optima near the lower end of their temperature distributions
 - d. Psychrophiles can be found in refrigerated foods
 - e. Most mesophiles are generalists

6. pH is usually
- Higher inside photosynthetic bacterial cells
 - Lower inside photosynthetic bacterial cells
 - Equal on either side of bacterial cells
 - 1/Log of the hydrogen ion concentration
 - 2 times the Log of the hydrogen ion concentration
7. Leslie and Nikki are studying the molecular genetics of a mutant strain of *E. coli*. In lab, they decide to try to determine why this particular strain is not producing a normally-produced protein. They are able to determine that the gene itself is transcribed normally, but translation does not yield any protein product. When they insert the gene into another *E. coli* strain they find that the normal protein is produced. From the possibilities given below, which is the **most** likely explanation for their observations.
- The leader upstream of the gene is faulty
 - The leader downstream of the gene is faulty
 - The promoter upstream of the gene is faulty
 - The promoter downstream of the gene is faulty
 - The coding region is faulty
 - The terminator downstream is faulty
8. All of the following are, at least in part, directly produced by a gene, EXCEPT:
- t-RNA
 - r-RNA
 - Ribosome
 - Polysaccharide
 - Protein
 - Polypeptide
9. A _____ mutation is one that causes a change in amino acids sequence in the synthesis of the protein product.
- Consensual
 - Nonsense
 - Silent
 - Missense
 - None of the above
10. A *Bacillus megaterium* bacterium had a total of 4 glucose molecules, what is the **minimum** number of ATPs needed to produce 8 NADHs and a **net** of 2 ATPs in **glycolysis**?
- 2
 - 4
 - 8
 - 16
 - NADHs are only produced in the TCA cycle

11. True/False. Place a **T** or **F** in front of each statement (1 pt each):
- _____ a. Water activity is related to the partial pressure of water
 - _____ b. Pyruvate is used by some microbes to accept an electron from NADH
 - _____ c. The Citric acid cycle should be more appropriately called the Citrate cycle
 - _____ d. The Pentose Phosphate Pathway and glycolysis are not found in the same bacteria
 - _____ e. High water activity usually means high osmotic pressure.
 - _____ f. 1/100 of the relative humidity of a solution is approximately = to the water activity.
 - _____ g. Eukaryotic cells can function at water activities as low as 0.60
12. Photoreactivation involves the breakdown of _____ (3 pts).
13. If a solution has 15% absorbance, calculate the optical density (show work for partial credit; 4 pts)
14. Erin and Ben are working on trying to identify the sequence of genes on a Hfr strain of *E. coli*. They are interested in five genes: **Pla**⁺; **Rf**; **Rf**⁺; **Lac**⁺; and, **Glu**⁺. The only prior information they have on the sequence has been published by Boes & Baker, who showed that the **Rf**; **Rf**⁺; **Lac**⁺ genes are together (in that order). Because they had to go see their families during spring break, Erin and Ben only assay one set of bacteria which have been allowed to mate with the Hfr strain for 8 minutes. They find that the recipient strain of these bacteria have both the **Pla**⁺ and **Glu**⁺ genes. What can they conclude about the order of genes in *E. coli*? Explain your answer (5 pts).

15. Describe what a positive test look like and what the results mean for each of the following physiological tests (3 pts each):

a. Gelatin test

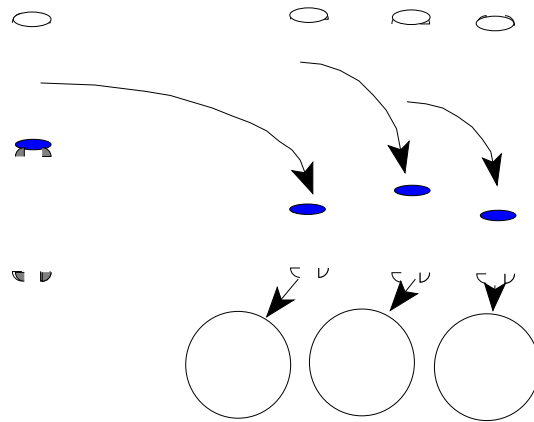
b. Indole test.

c. Klingler s Iron Agar

d. Catalase test

16. Using the **Log number of microbes** as the Y-axis and **Time** as the X-axis, draw a typical growth curve of a bacterial population and label carrying capacity and lag phase (4 pts).

17. Given the following dilution scheme:



A. What is the dilution factor for **tube 2** (4 pts; show work for partial credit)?

B. Plates A, B, C have 10,000, 800, and 48 colonies respectively. Which plate would you use to determine the initial concentration of the sample (3 pts)?

C. What is the concentration of the original culture (include units please and show work for partial credit; 6 pts)?

18. Describe 1 drawback of using spectrophotometers to estimate bacterial concentrations (4 pts).

19. David and Jim are conducting preliminary studies on a face cream. They are interested in determining if this face cream is mutagenic. They begin by conducting an Ames test. They find that the Ames test media allowed an average of 5 colonies of *Salmonella cholerasuis* per plate to grow. Even though five is a small number (e.g., aflatoxin produces 159 colonies/plate), they are still worried about that number (5 colonies/plate). They don't want to tell consumers that the cream is non-mutagenic when it really is.

A) Can you explain to them why it might be expected to have some colonies growing on the Ames test media (6 pts)?

B) Can you suggest a control that may put their fears at rest (i.e., what can be done to put their fears at rest? 5 pts).

C) If we removed the rat liver homogenate from the Ames test media we would likely see the number of colonies in the aflatoxin assay (3 pts)

- a. Decrease, because there would be no endonucleases to produce active aflatoxin metabolites
- b. Increase, because there would be no endonucleases to break up aflatoxin
- c. Decrease, because there would be no enzymes to produce active aflatoxin metabolites
- d. Increase, because there would be no enzymes to break up aflatoxin
- e. Neither (can't tell), duodenal homogenates (not liver) are used

20. Draw two diagrams one of a portion of an phylogenetically ancient prokaryotic cell that used cyclic phosphorylation AND another of portions of an evolutionary more recent prokaryotic cell that uses non-cyclic phosphorylation. In your drawings please label the following terms where appropriate: **electron, ATP, ADP, bilipid membrane, Transport Proteins, Chloroplasts, Photosystem I, Photosystem II, photons, protons, NADPH, NADP** and **water** (14 pts).

Extra credit: Oooops, I made a mistake in the question above, can you tell me which of the terms above does not belong and explain why (2 pts).