

**Microbiology 2400**  
**Study Guide #6**  
**Winter Semester 2008**  
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## **LABORATORY SECTION**

### **BACTERIAL GROWTH AND TEMPERATURE**

**The textbook reference for this set of questions is chapter 6**

**You should read the introductory material presented in your laboratory manual**

1. Bacterial organisms can be grouped into 3 different classes on the basis of their optimal growth temperatures. What are those classes? Define each on the basis of optimal growth temperatures.
2. What are the 3 cardinal temperatures shown by each bacterial species? Define each of these temperatures.
3. When you say a bacterial culture is growing, what does this imply about the culture?
4. Cite 1 explanation for the existence of thermophilic bacteria.
5. Cite 1 explanation for the existence of psychrophilic bacteria.
6. What are thermoduric bacteria?
7. Cite 2 natural environments where you would expect to find psychrophilic bacteria. In what industry would you expect psychrophilic bacteria to play a significant role?
8. Cite 2 natural environments where you would expect to find thermophilic bacteria.
9. Bacterial organisms that are capable of growing in and causing “problems” in the human body would be placed into which of the above- mentioned classes?

## LABORATORY CALCULATIONS:

The following represents the directions for the construction of Spirit Blue Agar, a medium to detect the hydrolysis of lipid by bacteria.

35g of Spirit blue agar  
35ml of lipase reagent  
1000ml of distilled water.

How would you construct 2.5 liters of this agar?

## LECTURE SECTION

### Chapter 5: Microbial Metabolism

1. You were introduced to two forms of enzyme inhibition. One of these was illustrated by the antimicrobial molecule, sulfanilamide. What type of inhibition was this material used to illustrate.
2. The sulfanilamide molecule closely resembles what molecule that is of great value for certain members of the genus, *Streptococcus*? In the normal situation, this molecule is converted by enzymes to folic acid, which is used construct \_\_\_ molecules. The argument is that when the enzyme that is susceptible to the sulfanilamide molecule comes into contact with sulfanilamide, its activity is then \_\_\_ and if enough of these enzymes are then inhibited, the Streptococci will then not have a source of \_\_\_ and eventually will die.
3. The other form of inhibition that you were introduced to was \_\_\_\_. This is also called by many individuals \_\_\_ inhibition. In this type of inhibition, the inhibitor does not bind to the active site of the enzyme but to another site. Binding of the inhibitor then results in a \_\_\_ change in the enzyme, which leads to its inactivation.
4. A special case of allosteric inhibition is that known as \_\_\_ inhibition. In this situation, the end product of a biochemical pathway can lead to the inhibition of an enzyme at the \_\_\_ of the pathway. The example that you were given to illustrate this type of inhibition involved the conversion of glutamic acid (a type of amino acid) to proline (another type or kind of amino acid)
5. What is the general goal of the respiratory processes of the cell?
6. What does the acronym, ATP stand for in the context of the cell's respiratory reactions?

7. You were introduced to two different ways in which ATP can be synthesized by cells. What were those two different means.
8. In substrate level phosphorylation, certain rather special molecules (remember, PEP) can directly donate their phosphate groups to \_\_\_\_, which then leads to the formation of ATP.
9. In oxidative phosphorylation, the generation of ATP is tied to the \_\_\_\_ of food molecules by living cells. This leads to the formation of reduced \_\_\_\_ such as  $\text{NADH}_2$  which are then regenerated via the use of \_\_\_\_\_. As electrons pass down these chains, \_\_\_\_ are pumped across membranes. Theory holds that the protons eventually cross the membranes through special protein channels referred to as \_\_\_\_ complexes. The movement of these protons through these channels leads to the construction of \_\_\_\_ from ADP and  $\text{P}_i$ . This concept is known as the chemiosmotic theory or proton \_\_\_\_ \_\_\_\_ idea.
10. A few comments were made in reference to the anatomy of the bacterial flagellum. This organelle is anchored into the \_\_\_\_ by a rather elaborate basal body. The motion of the organelle is generated via a mechanism that actually does not make use of ATP but rather derives its energy from the inward movement of \_\_\_\_ that occurs through channels in some of the membrane proteins that make up the basal body. Are bacterial flagella variant or invariant structures? Flagella are constructed primarily from what class of chemical substances? (lipid, carbohydrates, proteins, etc)?
11. Respiratory reactions can be grouped into 1 of 3 categories dependent on the nature of their final electron acceptors. What are those 3 groups. Define each in terms of final electron acceptor.
12. Many people are under the impression that when “fermentation” occurs you will get the production of Ethyl (drinking) Alcohol. You know that this is not the case. The example of a nonalcoholic fermentation that you were given in class involved the fermentation of carbohydrate into \_\_\_\_\_. This particular fermentation is of significance in the world of international politics (in the eyes of some) because of its role in supposedly influencing the wording of the \_\_\_\_\_. This document is of significance in the politics of what area of the world?
13. Aerobic respiration involves the use of \_\_\_\_ as a final electron acceptor. In this type of respiration one obtains a much more complete oxidation of the food molecules which leads to a much greater generation of \_\_\_\_ molecules when compared to the yield from a comparable amount of food via the fermentative route.
14. Oxidative phosphorylation requires the presence of an electron transport chain. In the eukaryotic microbial cell then chains are found within at least two different cellular organelles. What are they?. These chains are found in association with the \_\_\_\_ of the prokaryotic cell.

15. Anaerobic respiration differs from aerobic respiration in the type of \_\_\_ electron acceptor used in the process. In the example given in class, the final acceptor was \_\_\_. The complete reduction of this ion leads to the formation of \_\_\_. This conversion of nitrogen atoms is sometimes referred to as \_\_\_ and can lead to reduced levels of nitrogen availability and hence reductions in soil \_\_\_.

16. While denitrification of farm soils is generally viewed as not a good thing, this process may have uses in controlled situations as part of a process to reduced the size of “dead zones” that are found in the sea in the area near the mouths of rivers.

- a. What are these “dead zones”?
- b. How do the “dead zones” come about?
- c. You were introduced to a suggested approach to getting control of the above mentioned “dead zone” That involved nitrogen reduction in a controlled environment. You should briefly be able to explain what has been proposed.