Study Guide to Midterm 1

Disclaimer: Not ALL of the questions on the midterm will necessarily be found on this document. The Study Questions you have been answering for each chapter are the basis for the midterm questions, but in order to phrase a logical multiple choice question, i.e. how the question is asked, it may be worded differently – the answer will remain the same.

This is intended to help focus your revision for the upcoming midterm- it is NOT a substitute for answering the chapter by chapter Study Questions.

Chapter 1

What makes sourdough sour? What is name the organism that is responsible for making sourdough sour. Which type of microbe is it? Which metabolic process is responsible for the sour taste and what chemical end product is detected by the taste buds as ‘sour’?

List and briefly describe 5 different types of organisms that are generally referred to as ‘microbes’?

Briefly explain how Louis Pasteur’s experiments disproved the prevailing theory of spontaneous generation. Illustrate your answer with a diagram of his experimental setup.
Describe Koch’s four postulates and their purpose in modern medicine.

Discuss the hypothesis developed by Ignaz Semmelweis following observations made while working in an obstetrics ward in 19th century Austria. Describe how he tested his hypothesis and how these insights are still in use today.

Name the three domains of life identified by Carl Woese in 1978. What features did he use to differentiate between the three domains?

Describe the observation made by Edward Jenner in 1796 regarding immunity of milkmaids to smallpox and describe how he applied this knowledge in the first successful vaccination trial.

Compare the theory of spontaneous generation, and the theory of biogenesis. Which theory was supported by the research of Francesco Redi?
Who established the system of nomenclature used to name organisms? Provide an example of a correctly written scientific name for a bacterium of your choice. Indicate the Genus name and the species name. Explain the protocol for when, and how a scientific name can be abbreviated without losing effectiveness.

Chapter 2

Provide a definition of an acid. The concentration of which ion is measured by the pH scale? In terms of ion concentration how does a solution of pH 5 differ from a solution of pH 3? Why do acids have lower numbers than bases?

In the following Redox reaction molecule A is oxidized, and molecule B is reduced. Describe what has happened to the electrons in the reaction.

Glucose is a monosaccharide. Diagram how two glucose monomers can be combined for form the disaccharide maltose. What is the name for this type of reaction? Then diagram your understanding how this disaccharide molecule can be split into two glucose units. What is the name for this type of reaction?

Name three different polysaccharides: describe how they differ in structure, and where they are most commonly found. Finally describe the biological functions of the polysaccharides.
Draw and describe the four different levels of protein structure. For each level of structure name the type or types of chemical bonding responsible for the structure.

What are the four nitrogen containing bases of DNA? Name the double ring bases and what name is given to these? Name the single ring bases and what name is given to these. What are the complementary base pairings of DNA?

Describe how the properties of phospholipids make these molecules well suited for plasma membranes.

<table>
<thead>
<tr>
<th>Class of Macromolecules</th>
<th>Chemical Elements</th>
<th>Monomers</th>
<th>Molecular Shape</th>
<th>Example of Polymer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>C,H,O</td>
<td>Fatty acids, glycerol</td>
<td>Triglycerides, rings</td>
<td>Triglycerides, rings</td>
</tr>
<tr>
<td></td>
<td>C,H,O,N,S</td>
<td>Helices, Globular</td>
<td></td>
<td>DNA</td>
</tr>
<tr>
<td>Nucleic Acids</td>
<td>Nucleotides</td>
<td></td>
<td></td>
<td>DNA</td>
</tr>
</tbody>
</table>
Chapter 3

Which units are used to measure the wavelength of light. What is the range of wavelengths of visible light? Which colors of visible light have the longest and shortest wavelengths? Describe the relationship between the wavelength of light and resolution.

Provide a definition of the terms resolution and refraction.

What is refraction of light? How does refraction affect image quality in a compound light microscope? Explain why it is necessary to use oil to see specimens magnified by the 100x objective using a compound light microscope?

What structure does light pass through after leaving the condenser in a compound light microscope?
The Gram stain is a differential stain. Describe the sequence of steps that need to be followed to perform a Gram stain. At which stage in the procedure are Gram positive and Gram negative organisms differentiated?

Be able to explain the difference in magnification and resolving power between compound light microscopes and electron microscopes.

Explain why an electron microscope can achieve greater resolution than a compound light microscope. State the limits of resolution for both types of microscopes.

What is the difference between a transmission electron microscope and a scanning electron microscope?

Chapter 4

Provide named examples (Genus and species) for each of the following types of bacteria: a bacillus, a streptococcus, a spirillum, a vibrio and a spirochete. Be familiar with the names of different cell shapes; bacillus, coccus, spirochete.
List and describe 5 differences that distinguish between Prokaryotic and Eukaryotic cells.

Compare the structures and general properties of the Gram positive and Gram negative cell walls. Draw cross sections through both types of cell wall. Provide named examples of each type of bacterium.

In terms of cellular arrangement, how do Streptococci differ from Staphylococci?

Compare and contrast the structure and function of fimbriae and pili in bacteria.
Compare and contrast a bacterial glycocalyx and a bacterial capsule in terms of their structure and function. Provide named examples of bacteria with slime layers and a capsule.

What type of molecule is peptidoglycan? Describe how the peptidoglycan layer of the bacterial cell wall is constructed.

Explain the difference between diffusion and osmosis.

Describe the structure and functions of the prokaryotic plasma membrane.

Describe the composition and structure of prokaryotic ribosomes. What is the function of ribosomes? Why is it medically significant that bacteria have structurally different ribosomes than eukaryotes like humans?
Describe the location and structure of bacterial plasmids. What is the function of the plasmids? Describe two differences between plasmids and bacterial chromosomes.

Name an endospore forming bacterium. Under which circumstances is it likely to form an endospore?

Describe the structure and the function of mitochondria in eukaryotic cells.

Contrast the location and the structural organization of the genetic information of eukaryotic and prokaryotic cells.

Draw and describe the structure and location of the smooth and rough endoplasmic reticulum in eukaryotic cells. Then compare the roles of the smooth and rough endoplasmic reticulum. Provide examples of molecules synthesized by each. What other organelle functions in the endomembrane system?
Describe the size and structure of eukaryotic ribosomes. What is the function of ribosomes. Describe the features that mitochondria share with prokaryote cells.

Describe the structure and the function of chloroplasts in eukaryotic cells. Describe the features that chloroplasts share with prokaryote cells.

<table>
<thead>
<tr>
<th>Organelle</th>
<th>Structure</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth Endoplasmic Reticulum</td>
<td>Centrally located, double membrane with large pores.</td>
<td>Protein synthesis</td>
</tr>
<tr>
<td>Mitochondrion</td>
<td>Organelle consisting of two membranes, the inner membrane folded and studded with enzymes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organelle consisting of two membranes, the inner membrane organized into stacks that contain light absorbing pigments</td>
<td>Site of Photosynthesis</td>
</tr>
<tr>
<td>Golgi Apparatus</td>
<td>Series of phospholipids membranes located towards edge of cell</td>
<td></td>
</tr>
<tr>
<td>Lysosomes</td>
<td>Membrane bound vesicles that contain degradative enzymes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Membrane bound vesicles that contain oxidative enzymes</td>
<td>Oxidize fats, alcohols, and toxins</td>
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</table>
Chapter 5 Microbial Metabolism

Using your own words provide definitions for the following terms; metabolism, anabolism, catabolism, reduction, and, oxidation.

Diagram and describe how enzymes affect the rate of biochemical reaction. How do enzymes affect the energy required for a reaction to occur? Describe 3 different physical and chemical factors that can influence enzyme activity.

Draw and describe how competitive and noncompetitive inhibitors inhibit enzyme function, and provide examples of each.

What is the chemical formula for glucose? Provide balanced chemical equations for the following catabolic reactions: glycolysis, the fermentation of glucose to lactic acid, the fermentation of glucose to ethanol, and the complete aerobic oxidation of glucose.
Where does glycolysis take place in (a) prokaryotic cells, and (b) eukaryotic cells? What is the substrate for glycolysis? How many molecules of ATP are produced in glycolysis, and which method of phosphorylation is used?

Where does the Electron Transport Chain take place in (a) prokaryotic cells, and (b) eukaryotic cells? Which molecules act as electron donor, and which molecule is the terminal electron acceptor in aerobic respiration? How many molecules of ATP are produced in the Electron Transport Chain?

Draw and describe how ATP is generated via chemiosmosis in the Electron Transport Chain in aerobic organisms. Where do the electrons that enter the ETC come from? Describe the role of protons in ATP synthesis.

What is the role of oxygen in aerobic respiration? Some organisms are able to use alternate inorganic molecules in the absence of oxygen (anaerobic). Provide an example of such a molecule and an organism that is capable of utilizing it.
Believe it or not the purpose of fermentation is not to make alcohol. During fermentation ATP energy is produced during the glycolysis. What is the purpose of the subsequent steps that lead to the production of ethanol?

What is the critical factor driving yeasts to use fermentation to metabolize sugar?

Explain the differences between: photoheterotrophs and photoautotrophs, and provide named (Genus and species) examples of each.

Explain the differences between chemoautotrophs and chemoheterotrophs, and provide named (Genus and species) examples of each.
Draw and label the structure of a chloroplast. Identify the locations of (a) ATP and (b) carbohydrate synthesis.

Complete the following flow chart on microbial metabolism

Start

Yes

Fixes Carbon?

Energy From Light?

No

Energy From inorganic oxidation?

Yes

No

Energy From Light?

Yes

Energy From organic oxidation?

No