Microbiology 20 Study Guide – Exam #1

This is a list of general topics you should be prepared to answer questions on for each chapter. This guide is NOT what you should study but rather is a guide to help organize your studying of the material listed. Your actual studying should involve the textbook, Powerpoint slides, your notes and other supplemental material such as Mastering Microbiology. Keep in mind that you will not be tested on material in the book that was not covered in class, and should know all of the key terms at the end of the Powerpoint slides for each chapter. Most important, if you have trouble understanding anything, come to my office hour or see a tutor ASAP. Once you feel like you understand the material in a given chapter, be sure to test yourself using the chapter questions, Mastering Microbiology, the sample questions on this study guide, or coming up with your own. If you put in the time and effort and use all the resources available to you, I’m confident you all can perform very well on the exam.

Chapter 1 (Introduction/History of Microbiology)

- basic characteristics of organisms/entities that fall within the realm of microbiology
- various “highlights” in microbial discovery (and the associated discoverer)
- the contributions of Louis Pasteur, Robert Koch and others to the field of microbiology
- the important roles microbes play ecologically and in human affairs

sample questions:
1. What are the 2 major groups (domains) of prokaryotic organisms?
2. Indicate one beneficial role bacteria play in (or on) the human body.

Chapter 2 (Chemical Principles)

- how atoms form molecules and ions
- the nature of water as a solvent and pH
- recognize and know the chemical characteristics associated with the following functional groups
  - amino, carboxyl, hydroxyl, sulphhydryl, phosphate, methyl
- the general features and roles of each type of macromolecule:
  - lipids – steroids, fatty acids, triglycerides, phospholipids
  - carbohydrates – sugars, polysaccharides (starch, glycogen, cellulose)
  - amino acids & proteins
  - nucleotides & nucleic acids – DNA & RNA

sample questions:
1. How acidic is a solution at pH 4 (tomato juice) relative to a solution at pH 8 (sea water)?
2. What is the basic structure of a biological membrane?

Chapter 3 (Prokaryotic & Eukaryotic Cell Structure)

- the major characteristics, structures of prokaryotic & eukaryotic cells
- the function of each eukaryotic organelle or structure
- the various bacterial shapes & arrangements
- the various mechanisms of membrane transport
- diffusion and osmosis
- bacterial cell wall structure
  - difference between Gram-positive and Gram-negative cell walls
• the structure and function of prokaryotic flagella
  o flagellum structure: basal body, hook, filament
  o flagellar terminology: atrichous, monotrichous, peritrichous
  o motility in peritrichous bacteria, spirochetes (axial filaments)
• the production and function of endospores
• the function of other prokaryotic structures
  o ribosomes, inclusions, chromatophores, glycocalyx, fimbriae, pili
• the characteristics of prokaryotic DNA – chromosomes & plasmids

sample questions:
1. Describe or illustrate the basic structure of a bacterial flagellum.
2. Describe the structural differences between Gram-positive and Gram-negative cell walls and why each stains differently with the Gram stain.

Chapter 4A (Microscopy & Staining, Taxonomy & Nomenclature)
• the different types of light microscopy
  o bright field, dark field
  o phase contrast
  o fluorescence & confocal microscopy
• transmission and scanning electron microscopy
• newer forms of microscopy — scanning-tunneling & atomic force microscopy
• the concept of refraction and oil immersion microscopy
• various concepts pertaining to staining
• characteristics revealed by common staining methods:
  o simple, Gram, capsule, endospore, acid-fast, flagella stains
• the 4 steps of Gram staining and why cells stain Gram-negative or Gram-positive
• the taxonomic hierarchy
• scientific nomenclature of species

sample questions:
1. Why is oil necessary for oil immersion microscopy?
2. What is the purpose of a counter stain?

Chapter 11 (Survey of the Bacteria & Archaea)
• terminology describing energy and carbon sources, oxygen tolerance
• distinguish between the different types of photosynthetic bacteria
• the major groups and subgroups of prokaryotes
  o the general characteristics of each group or subgroup
  o examples of genera in each group or subgroup
• associate select microbial diseases with the genus/species of the corresponding pathogen

sample questions:
1. What disease is associated with Helicobacter pylori?
2. Indicate the 2 major phyla of Gram-positive bacteria.
3. Indicate 2 ways in which archaea differ from bacteria.
Chapter 12 (Eukaryotic Microbes: Algae, Protozoa, Fungi & Helminths)

- The Algae – general characteristics, examples, ecological roles
- The Protozoa:
  - examples and characteristics of each phylum
  - human pathogens and the diseases they cause
  - types of motility observed in protozoa
  - life cycle of Plasmodium
  - conjugation in ciliates
- The Fungi
  - general characteristics and structural features
  - asexual vs sexual reproduction
  - structural characteristics and asexual, sexual reproduction in each phylum
  - importance of budding yeasts for food production, biological research and production of recombinant proteins for the biotechnology industry
  - lichens and their ecological importance
- The Helminths – Flatworms (Platyhelminthes) and Roundworms (Nematodes)
  - Platyhelminthes – general characteristics, life cycles of flukes, tapeworms
  - Nematodes – general characteristics, life cycles of pinworms, hookworms

Sample questions:
1. Describe the basic structure of a typical mold.
2. Describe the life cycle of Plasmodium.
3. Describe the process of conjugation in Paramecium.

Potential topics for “higher point” questions:

- the life cycle of Plasmodium
- sexual reproduction in ciliates (conjugation) vs fungi
- the process of Gram staining and the differences between Gram + and Gram – cell walls
- the typical life cycles of pinworms, hookworms, tapeworms and flukes
- similarities, differences among the different types of microscopy

Extra credit article

“The Ultimate Social Network” by Jennifer Ackerman, Scientific American, June 2012, pp. 36-43.