Micr-22 Exam 2 Study Guide Revised Fall 2018

Test Preparation Suggestions

- □ If you need more background to address the items below, look over all of the "Check Your Understanding" and Study Questions for the relevant chapters.
- □ Be able to describe the meaning of major terms, with explanations appropriate for someone who has not taken this class.
- □ Before our exam, be able to describe and explain the following structures and ideas, respectively.
- □ Be able to place these topics in the broader context of microbiology. (For example: Why do we care about pili?)
- □ Expect a few questions from our discussions in class. It is not possible to predict what issues may arise, but they are certainly worth reviewing.
- □ Expect a few "challenge questions" which reach across multiple topics, and require your independent critical thinking. Some examples can be found at the end of textbook chapters. One strategy to prepare for these is to identify themes in the course.
- □ Stick with it! I'm counting on you to come to me with your questions.

Terms used in these guides:
Identify: Write the name.
Describe: Write a sentence.
Recognize: Given a list, be able to identify.
Distinguish: Given a list, be able to describe differences.
Explain: Write a description of why particular things happen.

Be able to…

Microbial Metabolism (Ch. 5)

1. Define catabolic and anabolic reactions.
2. Describe the purpose of enzymes.
3. Describe and draw diagrams of competitive, allosteric, and feedback inhibition of enzymes.
4. Describe three main ways to generate ATP (substrate-level phosphorylation, oxidative phosphorylation, photophosphorylation).
5. Reproduce the overview figure of respiration and fermentation (fig. 5.11).
6. Identify where most ATP is produced in respiration.
7. Draw a labeled diagram of electron transport and chemiosmotic generation of ATP (as in fig. 5.16).
8. Use terms from table 5.5 to distinguish among aerobic respiration, anaerobic respiration, and fermentation, in terms of their chemical requirements.
9. Describe the pentose-phosphate pathway and the Entner-Doudoroff pathway. How are they different from glycolysis? Why does anyone care about these pathways?
10. Recognize some of the many end-products that can arise from fermentation (fig. 5.18: lactic acid, ethanol, CO_2, propionic acid, acetic acid, H_2, acetone, isopropyl alcohol, butanediol, formic acid, acetoin).
11. Identify where different organic food molecules enter catabolic pathways (ex: fig. 5.21; proteins, lipids, carbohydrates).
12. Identify the major common features shared by photosynthesis and cellular respiration.

Microbial Growth (Ch. 6)

13. Discuss how variations in temperature, pH, and osmotic pressure affect microbial growth, referring to specific mechanisms such as enzyme denaturation.
14. Explain why specific chemical elements are required for microbial growth (*i.e.* carbon, nitrogen, sulfur, phosphorus, and trace elements).
15. Explain why oxygen is required by some organisms, and is poisonous to others. [Be able to describe the origin of toxic forms of oxygen (specifically superoxide anion and hydrogen peroxide) and the function of enzymes that detoxify them (specifically catalase and peroxidase)].
16. Identify which type of bacteria is likely to grow in a certain oxygen environment. (For example, in a high oxygen environment, you could find obligate aerobes, facultative anaerobes, and aerotolerant anaerobes.)
17. Explain why biofilms are: (1) considered communities, (2) challenging to study, and (3) sometimes problematic in healthcare settings.
18. Describe what it means for a growth medium to be complex, vs. chemically-defined.
19. Compare and contrast selective and differential media.
20. Explain how enrichment cultures work.
21. Describe binary fission.
22. Solve math equations involving basic logarithms. For example, solve for x: $\log_{10} x = 7$.
23. Interpret graphs with axes in log scales.
24. Diagram and label phases of growth with a graph (similar to fig. 6.15). Be able to distinguish these from "stages of disease."

Control of Microbial Growth (Ch. 7)

25. Describe some of the history of asepsis (Semmelweis, Pasteur, Lister).
26. Distinguish among sterilization, disinfection, antisepsis, degerming, sanitization, germicide, bacteriostasis, and asepsis.
27. Discuss why the microbial death curve has its particular shape.

28. Discuss how the # of microbes, environmental contaminants, time, and microbial characteristics influence treatment effectiveness.
29. Describe various methods of physical control: moist heat, pasteurization, dry heat, filtration, low temperatures, high pressure, dessication, osmotic pressure, and radiation.
30. Distinguish between HTST pasteurization and UHT treatment, with general positives and negatives of each.
31. Categorize the mode of action of control agents as causing damage to the plasma membrane, to proteins, or to nucleic acids, or some other mode of action.
32. Describe how the disk-diffusion method works to evaluate disinfectants.
33. Describe the modes of action of bisphenols (ex: Triclosan), halogens (specifically iodine and chlorine), alcohols, heavy metals (specifically silver and copper), soap, quats, sodium nitrite, and formaldehyde. (It is sufficient to categorize them as causing damage primarily to proteins, to lipids and the plasma membrane, or other mechanisms of action.)
34. Recognize factors that lead to the difficulties of treating various infections (fig. 7.11).

Microbial Genetics (Ch. 8)

35. Describe these primary differences between prokaryotes and eukaryotes:
    - bidirectional replication of DNA (in some bacteria).
    - location of DNA replication: nucleus vs. cytoplasm.
    - in prokaryotes: no introns or exons.
    - simultaneous transcription and translation (why is this possible?)
36. Explain why regulation of gene expression can be valuable to a cell.
37. Describe what "repression" and "induction" mean, in reference to genes.
38. Draw a diagram of a general operon.
39. Describe the functions of each part of an operon.
40. Label and explain what is happening in figures depicting these operons:
    - negative inducible (ex: fig. 8.12, *lac* operon)
    - negative repressible (ex: fig. 8.13, tryptophan enzymes)
    - combinations of positive and negative (ex: fig. 8.15, *lac* operon)
41. Distinguish among these mutation types: base substitution, missense, nonsense, and frameshift.
42. Describe the mutagenic actions of X-rays, gamma rays, and UV light.
43. Describe how mutagens influence the frequency of mutation, and compare this frequency to natural mutation rates (see p.228).
44. Produce a diagram to explain how the Ames reverse gene mutation test works.
45. Distinguish between vertical and horizontal gene transfer.
46. Explain what happened in Griffith's experiment on two strains of *Streptococcus pneumoniae*.
47. Explain the differences among transformation, conjugation, and transduction, being sure to use these terms: "naked" DNA, sex pili, plasmid, phage.
48. Describe the implications of the R factor plasmid for bacterial resistance to antibiotics and mercury (see fig. 8.30).
49. Describe the actions of transposons and their role in evolution.

Viruses, Viroids, and Prions (Ch. 13)

50. Describe general characteristics of viruses (figs. 13.2, 13.3, 13.4).
51. Describe how viruses are different from bacteria (table 13.1).
52. Describe general variations in viral structure and morphology.
53. Describe how taxonomy of viruses is determined.
54. Discuss the costs and benefits of various virus cultivation methods: living animals, embryonated eggs, cell cultures.
55. Describe viral multiplication
    - lytic and lysogenic cycles
    - effects of lysogeny: resist reinfection, new abilities (phage conversion), specialized transduction
56. Identify differences in multiplication between phages + animal viruses (table 13.3, figure 13.15).
57. Connect the action of viruses to the development of cancers.
58. Define latent viral infections, prions.

Antimicrobial Drugs (Ch. 20)

59. Describe some of the history of chemotherapy (Ehrlich, Fleming).
60. Explain why drugs have narrow vs. broad spectrum of antimicrobial activity.
61. Contrast bactericidal and bacteriostatic.
62. Describe modes of action of antimicrobial drugs / possible targets
    ex: Cell wall inhibitors; Big example: Penicillins + how they're vulnerable
    ex: Inhibitors of protein synthesis: four different targets (includes tunnel through 50S)
    ex: Antifungal drugs: how they work
63. Describe tests to guide chemotherapy: Kirby-Bauer, E test, broth dilution.
64. Discuss how antimicrobial drug resistance develops: mechanisms, types of misuse, how to prevent.
65. Recognize visual effects of combinations of drugs on a growth plate (synergism, antagonism).
66. Describe possible future tools: antimicrobial peptides, antisense agents (not in book), phage therapy.