Chapter 17 Reading guide

1. Define pathogen, epidemic, pandemic, virulence, direct contact, indirect contact, autoinoculate.
2. Describe several risk factors for disease which you can not control.
3. Describe several risk factors for disease which you can control.
4. Using figure 17.1, describe generally how the body defends itself against pathogens.
5. Using figure 17.1, list the categories of microorganisms that could be pathogenic.
6. Describe many modes of transmission for disease.
7. Now describe in more detail the 6 categories of microorganisms that could cause disease. For each:
    a. Describe its form (size, etc)
    b. Explain how if affects us/ makes us sick.
    c. List and describe examples of pathogens
    d. List and describe examples of diseases they can cause.

8. What are some examples of disease/conditions that can be caused by Staphylococcus bacteria? By Streptococcus bacteria?
9. What is meningitis? What are symptoms? How is it spread? What causes it? Between bacterial and viral, which is typically more severe (untreated)? Which is generally more treatable?
10. What is pneumonia? What are symptoms? How is it spread? What causes it? Between bacterial and viral, which is typically more severe (untreated)? Which is generally more treatable?
11. What is tuberculosis? Why is it making a comeback? What causes it? Are any TB strains completely resistant to treatment? Explain. (be sure to use required links for this, too)
12. List the other bacterial diseases mentioned by the text.
13. How are colds spread? Colds are endemic; what does that mean? What are the best ways to prevent/minimize colds? When is a person most contagious?
14. Why should you never give children aspirin, but especially when they have a cold or flu?
15. What are symptoms of flu? Why can flu be potentially dangerous? Is vaccination effective against all forms? Explain.
16. Using figure 17.2, compare and contrast cold/flu.
17. What is hepatitis? What are symptoms? Discuss the hep types, how each is transmitted, and the potential severity of each. How can you reduce your chance of contracting each type?
18. Discuss mumps, measles and chickenpox in general.
19. List the viral diseases for which there are vaccines (that the book mentions, there are certainly more!)
20. What is the relationship between chicken pox and shingles?
21. Explain why your skin and body linings are such important components of disease protection.

22. Define immunity, antigen, antibody, immunoglobulin, lymphocyte (B and T), macrophage, memory T and B lymphocytes. Now explain how all of these terms are related in terms of how your immune system fights infection.
23. Why will you launch a more effective attack on a pathogen the second time you are exposed to it (and all subsequent exposures) than the first time you were exposed to it? -by the way, the immune response with subsequent exposures is so effective that you may be exposed multiple times and never even realize it!- How do vaccines relate to this phenomenon?
24. Why can fever be advantageous? How about pain?
25. Explain how vaccines work.
26. Using table 17.2, explain several ways to avoid illness from pathogens.
27. For each of the Emergent and Resurgent diseases, and for each of the Sexually Transmitted Infections listed by the text, answer the following to the level of detail provided by the text/my notes:
    a. What causes it (what CATEGORY only, you don't need to name the specific type unless I ask that in another question in the reading guides. For example, Avian Flu is caused by viruses, but you do not need to name the specific viral type that causes it. Just state that it is caused by virus)
    b. Symptoms, prognosis if untreated (what will happen to the victim), and possible complications.
    c. Is it preventable; beyond good hygiene, HOW can it be prevented (vaccine, condom use, etc)?
    d. Is it treatable; if so, how? How effective is treatment?
    e. How is it transmitted?

28. What is the name of the virus that causes AIDS?
29. Discuss some differences between males and females in terms of risks of STIs (especially HIV), prognosis and symptoms.
30. Discuss in detail how HIV is transmitted and how to avoid exposure. Be sure to also use "Skills for behavior change," page 543.

-From required links and/or my notes-

31. Does the Why Files present any evidence that "germs" can become resistant to common household cleaners? Explain.
32. WhyFiles says that the AMA "fulminated" in alarmist terms about antibiotic resistance. Who are the AMA? What did they say? Why is it a big deal that they used alarmist terminology?
33. Explain how bacteria become resistant to antibiotics; be sure to mention "mutation" and gene-sharing.
34. Explain how/why each of the following contribute to the development of superbugs: not taking all of your antibiotics when you have a bacterial infection (stopping early because you feel better), using "antibacterial" products, prophylactic use of antibiotics, applying antibiotics to livestock as part of their normal feed.
35. Discuss several specific steps that can curb the rate of antibiotic resistance development, including things that YOU can do. Be sure to use your text, the WhyFiles, Mayo and my notes for this.*

36. What does Mayo Clinic have to say about "The Scope of Your Responsibility?"
37. What are antibiotics? What category/s of pathogens do they treat? Which category do they NOT treat?
38. What did Amy Chapin and her colleagues find when they investigated whether resistant bacteria might be emerging from swine CAFOs (the conventional way livestock are raised these days, wallowing in their own poop and urine, housed nose-to-butt and fed tons of antibiotics because the conditions are so unsanitary)?
39. From the Cells Alive activity, rank the following in terms of their relative sizes (you don't need to list ACTUAL sizes): Ebola virus, *Staphylococcus* bacteria, your red blood cells, a mite, your hair diameter, your lymphocytes, 1 piece of pollen, the head of a pin.

*One thing to add: choose ONLY organic animal products: meats (chicken, beef, pork, etc), eggs and dairy. One of the restrictions applied to organic animal products is that they may not be given indiscriminate antibiotics, and they must have some access to open air and pasture. The best choice is to get to know some local farmers and find some that allow 100% pasturing (with nightly cooping for safety with chickens) in addition to the regular organic standards (go back to chapter 8 notes for specific recommendations).

Supplemental Lectures

I. More general information about the categories of microbes

a. Some background-There are 6 major categories of potentially-pathogenic microbes, as you know. Within each category, there are many different strains-or types. This is similar to the fact that there are many categories of vertebrate animals: mammals, birds, fish, etc. Within each of those categories, there are more types; for example, mammals include monkeys, dogs, cats, rabbits, etc.

So, for example, one category of microbe is bacteria. Within bacteria, there are many types, like Escherichia (the "E" of E. coli), blue-green algae, Staphylococcus (ie, "Staph"), etc.

Anyway, within most categories of microbe, only SOME of the types are pathogens. For example, within the category bacteria, the vast majority of bacteria are GOOD: some decompose dead material and help make fertile soil, some produce oxygen (O2), some help make foods like yogurt and cheese (like the *Acidophilus* you hear about a lot), and some live in and on us and help to protect us from harmful types.

A very small percentage of bacterial types are pathogenic, for example. This is also true of worms, protozoa, and fungi.

However, all viruses are pathogenic… not all infect humans, but all infect some sort of living thing: some viruses infect insects, some infect plants, some even infect bacteria!

Prions are totally different: there are "normal" prions- proteins found in neurons that serve some (as yet unknown) function. Only "abnormal" prions- normal prions that have changed shape- are infectious. If you ingest the abnormal ones, for example in meat from a cow with mad cow, they can be absorbed into your blood, travel to your brain and cause your normal functioning prions to change shape and become pathogenic. We know very little about prions.

b. **Pathogen names vs. disease names-** Anyway, all of the types of pathogens within the microbe categories have specific names. For example, the bacterial type that causes botulism is called *Clostridium botulinum.* One virus that can cause pneumonia is called Respiratory Syncytial Virus.

   Some diseases are caused only by one microbe category and type; for example, TB is always caused by the bacterial type *Mycobacterium tuberculosis.* But, some diseases describe SYMPTOMS rather than a specific type of infection. These diseases can be caused by many different types of pathogens. For example, pneumonia describes a set of infection-induced symptoms; they are marked by fluid and inflammation in the lungs.

   Many different types of pathogens can find their way into your lungs and cause pneumonia, including many types of bacteria and many types of viruses. So, pneumonia is not exclusively a bacterial disease, nor is it exclusively a viral disease. I am pointing this out because it is listed in the text under "Bacterial diseases."

   Meningitis is another one that describes a set of symptoms/conditions, which can be caused by several types of bacteria and several types of viruses.

   The remainder of the diseases listed in the text as examples for each microbe category are exclusively caused by that category of microbe (ex, TB is always bacterial, colds/flu are always viral, ringworm is always fungal, etc). For these, be sure to know the specific name of the pathogen type when provided by the book; you do NOT need to know the specific name for most of the Emergent/Resurgent and Sexually Transmitted diseases.

c. **A little more on pneumonia and meningitis-** Both can be either viral or bacterial. In both cases, bacterial is potentially much more severe with a greater risk of fatality. However, in both cases, only the bacterial form is treatable with antibiotics. This treatability will last as long as the bacterial

types that cause it do not evolve resistance to our antibiotics. Viral infections in general are largely untreatable; see below for more.

II. Prevention and Treatment of pathogenic diseases (be sure to understand the difference between prevention and treatment!)

a. Prevention includes:

i. Keep your immune system strong: eat well, exercise often, reduce stress, sleep enough, laugh often.

ii. Minimize exposure to pathogens: see text for LOTS of suggestions

iii. Vaccination- more info:
Most vaccines work against viral pathogens. Some provide lifelong immunity, some need periodic "boosters." Vaccinations teach your immune system how to recognize a specific viral type; basically, this virus can't launch a "surprise attack" once you've been vaccinated against it. Your immune system is always ready for it. Why? Vaccines launch a miniature immune response, and your immune system produces all those memory T and B lymphocytes that fight subsequent infections so effectively you probably won't even notice you were exposed.

Keep in mind that with vaccines, when you are exposed to the actual virus, your immune system still does all the work, NOT the vaccine. While there are concerns about vaccines (allergic responses, less strong immune response, to name a couple), we are NOT concerned about viruses gaining "resistance." That issue has to do with treatments, not preventions. So…

b. Treatment

i. ll First of all, it is extremely difficult to treat viruses. "Antivirals" can help to slow their rate of spreading and buy your immune system time to launch an effective attack.

*Antibiotics do NOTHING to treat viral infections, and vial infections are the most common of the normal respiratory sicknesses we get. Don't take antibiotics unless your doctor is absolutely CERTAIN your infection is bacterial!!!

ii. Bacteria are treated with antibiotics. These include penicillin, erythromycin, etc. Antibiotics are basically medicines that poison bacteria. These antibiotics are generally benign to us bu definitely disrupt our "normal flora," the friendly bacteria that help keep us healthy. Eating yogurt can help to restore them somewhat.

Few bacterial infections can be prevented medically (ie, with vaccinations). The common bacterial infections are generally more severe (untreated) than the common viral infections.

Many bacteria have developed resistance to multiple types of antibiotics. They are no longer treatable. This is because we overused and misused antibiotics for so long. See the text and required links for more on this, I will focus a lot on it!

iii. Worms, protozoa and fungi are treated with a variety of medicines, which are also generally pretty benign to us, though they can be more risky than antibiotics in some cases. These organisms can develop resistance, especially protozoans. The rate of their developing resistance is generally slower than that of bacteria, however, because they have longer generation times than bacteria, and they don't swap genes directly, like bacteria do.

iv. Prions- untreatable at this point.

To sum: All infectious diseases can be prevented to some extent with good and smart hygiene and lifestyle. There is still no guarantee, though; you can only REDUCE your risk of exposure. Some viruses can be prevented with vaccines. Many bacterial, fungal, protozoan and helminth (worms) infections can be treated; but overuse and misuse of treatments have created dangerous strains that cannot be treated. Viral infections cannot be treated with antibiotics, and any treatment against viruses is limited.