Reading Road Map, MH Chapters 21 (21.1 and 21.2) & Ch 22 Sections 1, 2,3,4 and 7.

As always, you can manipulate this document as it is in WORD.

*** Take notes for your vaccine paper! See the directions on Moodle!

Brace yourself, this is a bit long. Don't work so hard that you get sick. 😊

Ch. 21: Lymphatic System

*21.1a Anatomy of Lymphatic and Immune systems. Please check out Figure 21.2, noting the vessels on the left and structures on the right.

Lymph is a second highway system through the body. If you (asking for a friend?) pick a pimple, you might find a clear fluid exiting the pore. This is lymph. Its watery nature supports both the Cardiovascular (Ch 20) and the Immune systems (Ch 22). See Fig 21.9 p. 846. Please read paragraph 1 on p. 834. What is the role of lymphatic vessels in support of the cardiovascular system? It returns excess fluid to venous blood to maintain fluid balance.

1. About 3L per day is absorbed into the capillaries from interstitial fluid. This is a mere 15% of the fluid that enters that surrounding tissue. What is lymph and how does it differ from blood?

   Lymph is primarily composed of water, dissolved ions, and traces of proteins. Unlike blood, it does not contain an formed elements (cells). It is used to drain extracellular wastes and remove them from systemic circulation.

2. How does the fluid get back in (this should be a review)

It enters lymphatic capillaries from the extracellular space, which then merge into lymphatic vessels

3. The lymphatic vessels do not move with the power of the heart, so how does lymph move lymph throughout the vessels? (21.1b).

   Lymph moves in conjunction with the muscular system which forces it through the lymphatic vessels. Which eventually give way to the various lymphatic trunks that drain into the heart.

   Having thought about how this process happens, no wonder a massage is so effective.

   Lymph drains into large ducts, then into venous circulation.

4. From T 21.1, please compare how B cells and T cells differ. What happens in the bone marrow? What happens in the thyroid? See also Fig. 21.9 and note how the structures assist the immune system.

   B cells: Mature in the red bone marrow
   T cells: Mature in the thymus
   Both assist in defending the body from infections and the development of cancers(s).

Recall that you will be writing a short paper on the immune system and vaccinations. Ch 22 notes will be helpful as you explain HOW we develop and use our natural immunity versus acquired immunity, and how pathogen type (bacteria? virus?) plays a role.

Ch. 22: Immune System:

Please note that "virulence" does not always and only pertain to viruses.

Please see 22.1 There are 5 different categories of pathogens. What is the *main difference* between bacteria and viruses and *WHY* do you think viruses cannot (typically) be killed by an antibiotic? (Such as penicillin, a general antibiotic that breaks cell walls and prevents reproduction). (Actually, we are closely related to bacteria)

Bacteria do NOT and viruses DO need a host to reproduce. Which category includes *nosocomial infections E. Coli,* MRSA and *Pseudomonas aeruginosa*?

Viruses: DNA/RNA strands that are contained within a protein capsid.

Bacteria: Small, prokaryotic, single celled organisms, that require a host to grow/thrive.

Fungi: Small Eukaryotic organisms that have a cell wall that is external to their plasma membrane.

Protozoans: Unicellular Eukaryotic organisms that lack a cell wall.

Multicellular parasites: Nonmicroscopic organisms that reside within a host.

Nosocomial infections are bacterial infections in origin.

The reason that viruses are antibiotic resistant is due to the fact that they are not technically alive, depending on whom you ask, and function more like destructive biological particulate. They are also significantly smaller than bacteria as well.

22.2c Innate versus Adaptive Immunity: You will be explaining this in your paper, in terms of getting a disease and/or getting a vaccine.

1.Please compare (Similarities) and contrast (differences) these two types of immunity. Include the main type of initiating cell if appropriate, and what process/cells/organs are triggered.

Innate (Not specific, like phages)

- Part of the body (skin, mucosal membranes).
- Immune cells.
- Physiological properties such as inflammation, and such.
- These are traits that do not require prior exposure to pathogenic agents.

Adaptive (Specific)

- **Immunity that comes from the exposure of lymphocytes to foreign substances.**
- **Can be triggered by a foreign substance entering the body.**
- **Is the mechanism through which vaccines convey immunity.**

2.One of the things that is so great about our immune system is making sure we don't get sick in the first place. This is called our "first line of defense". What are the specific organs/cells/tissues/behaviors we use to fight off respiratory disease and what do the do? (function)

Nasal secretions- Contain lysozymes, defenses, and IgA: Contain and destroy microbial substances in the nasal cavity

Vibrissae (hairs in nose): Trap microbes within the nasal cavity

Cilia (sweep mucous): Sweep mucous into regions where it can be expelled or swallowed

Cough/sneeze: Mechanical elimination of foreign substances.

3. Proinflammatory cells include basophils (from Ch 18: circulate in blood) and mast cells (from Ch 18: reside in connective tissue, mucosal linings) release **histamine** and **heparin.** What is the role of these chemicals in the inflammatory response?

The role of histamine is to increase capillary permeability on the arterial side, whilst heparin increases inflammation. Both chemicals ultimately serve as an anticoagulant within the body.

4. What are the 4 steps of inflammation, summarized?

Recognition of the damaged tissue, recruitment of the inflammatory cells, removal of foreign bodies, repair of the damaged tissue.

5. See “Concept Connection” 22.3c.

You run a WBC test on your patient, a six year old boy, Eli on October 6. You look at his eosinophil count, his monocyte count, neutrophils and lymphocytes. His neutrophil count is high. Symptoms include a lengthy fever (mom reports symptoms starting on September 20) and his flu-like symptoms actually got worse around September 26. His cough produces green mucous. RSV and Strep throat are common at his school. Please list what an elevated number for each test should reveal AND what the function of each cell type is.

Cell type	**Elevated test?**	**Function?**
eosinophil	parasitic	Release cytotoxic chemicals to breakdown the parasite. Greater than 500 per microliter is considered high.
lymphocyte	Viral or chronic bacterial	Produce specific antibodies that target the foreign agent. Greater than 3.1 per microliter is considered high.
monocyte	Inflammatory disorder/TB	Release inflammatory compounds into a region. Greater than 1000 per microliter is considered high.
neutrophil	Acute bacterial	Engulf the bacterial agent and break it down. Greater than 6000 per microliter is considered high.

Which is more likely? Is it the bacteria or is it the viral disease?

See 22.3f. Your neighbor, Laura explains that she is feeling lousy, fatigued and hot. Her temp is 100 degrees. She has rosy cheeks and asks you why on earth she has been shivering, yet warm.

Please answer her Q, and explain the hormones involved (and what they do) in the non-specific events of a fever, which of course is a _____ (virus? Bacteria?)

At the core, a fever is the result of the release of Pyrogens into her bloodstream as a response to a bacterial infection. This causes the hypothalamus to release Prostaglandin E2 which causes the body's core temperature to rise past 37*C

See 22.4 Adaptive Immunity (Think, for your paper…what is the role of immunizations in acquiring this?)

1. What is the difference between cell-mediated and antibody-mediated immunity, and where do these cells mature? (bone or thymus?)

   Cell mediated immunity is the body's T-lymphocytes differentiate into helper and cytotoxic forms. Antibody mediated immunity is when B-cells develop into plasma cells that synthesize and release antibodies.

2. A. Using 22.4a and Fig 22.9 as well as what you know about cell-cell signaling and blood typing due to proteins on cell surfaces, explain what a foreign antigen is:

   A foreign antigen is a cell surface protein that is not native to the body of the individual. These are used by the body to identify foreign cells to the body, that while they often are, are not always pathogenic (mismatched donor blood for example)

   *The Y-shaped protein is an immunoglobulin (See 22.8a)

   B. A "receptor complex" on the surface of T and B Lymphocytes. What is the difference between these two types of cells in terms of how they recognize an antigen.

   T-Lymphocytes require an antigen presenting cell, whereas B-Lymphocytes do not.

3. Explain "hypersensitivities", such as that with poison ivy, as a result of haptens.

This occurs when a molecule is too small to cause a major response on its own, but when combined with the chemical elements of the body, creates a larger effect on the overall organism.

4. T-lymphocytes must recognize foreign antigens attached to an MHC molecule in order to become a T-helper or cytotoxic T lymphocyte. MHCs act like a docking station for a spaceship, which is the T-lymphocyte. What is an MHC, and what is the difference between all nucleated cells and those in an antigen presenting complex?

   An MHC is a Major Histocompatibility Complex, which are divided into class I and class II.

   MHC class I are glycoproteins that are embedded in/extend beyond the plasma membranes of all nucleated cells, serve to display endogenous proteins, and are constantly on display.

   MHC class II serve to bind to fragments of phagocytized pathogens in order to recognize pathogenic agents.

Section 22.7:

Remember our work on blood types? Recall that an antigen GENerates a response (could be clotting, or attack etc.-see T 22.5.) and an ANTIbody is a cell (immunoglobulin) that is released by B-lymphocytes and grabs the antigen for further destruction.

1. What do activated Helper T-lymphocytes DO for the immune response?

The activate cytotoxic T-lymphocytes, as well as enhancing the formation and activity of the cells that provide innate immunity.

2. What do activated Cytotoxic T lymphocytes do?

They destroy unhealthy or infected cells that display an antigens. The response is initiated upon contact with the unhealthy or foreign cell's MHC class I molecules.

3. What is the role of the B-Lymphocytes?

   It is to form antibodies and provide antibody mediated immunity.

Using Sections 22.3,22.4 and esp. 22.9, continue to work on your paper. See the directions on Moodle! Please note: herd Immunity is an old Ecology term. It means

that by being in a herd (not six feet away) we build our immune systems by exposure. This makes the entire herd stronger. Back in the day, moms used to get kids together who were exposed to Chicken Pox, for example, with the knowledge that by exposing kids, their immune systems form memory cells in preparation for later and greater exposures.

This was most likely not my best work for this class. Lightening struck twice as I was working on this on the 28th, taking my family's dog and devastating my parents. As such, I've been working to complete this under a less than ideal situation.