

Unit Objectives:

- Describe the structure and function of the cardiovascular system
- Describe the structure and function of the lymphatic system and immunity
- Describe the structure and function of the respiratory system

Relevant Topics in Textbook:

Chapter 12 Blood

Chapter 13 Cardiovascular System

Chapter 14 Lymphatic System and Immunity

Chapter 16 Respiratory System

Lecture Exam Review Questions: Lectures 19 and 20

Defenses & Disease

1. What is the name of the virus that causes the seasonal flu?

Influenza virus

2. Why do we repeatedly get the flu? (i.e. why do we need to get a flu shot annually?)

Antigenic drift - the virus can change from year to year so the immune system is less effective at detecting the new version.

- a. We often describe Influenza A as H1N1 or H3N2, what do the H's and N's represent?

The H & N are makers on the virus

- H = Hemagglutinin; a surface glycoprotein found on the influenza viruses (18 versions)
- N = Neuraminidase ; a protein enzyme found on the influenza viruses (11 versions)

3. Describe the mechanism of disease/illness prevention using a vaccine. (i.e. what cells are vaccines attempting to stimulate??)

They stimulate an immune response and build defenses in case you are exposed to a virus - B cells and T cells in the body will remember that virus in case you are exposed to the pathogen later.

4. How are traditional vaccines produced? Describe the basic process.

- The vaccine virus is obtained from the CDC then is provided the vaccine manufacture, the manufacture will inject the virus into fertilized hen eggs which are rapidly dividing and growing, the virus gets incorporated into the cells and start replicating the virus particles (similar to how they would in our bodies) the replicated viruses are collected from the egg fluid and the virus is inactivated by heat, chemicals, or radiation treatment, this then renders the virus incapable of harm or division, then the hemagglutinin is purified and quantified for vaccine

5. What is the difference between an epidemic and a pandemic?

- Epidemic = An outbreak of a disease that affects many in a population and beings to spread rapidly. (Local spread)
- Pandemic = A larger epidemic- covers several countries or spreads from one continent to another

6. Explain how HIV infection disrupts the immune system leading to AIDS.

- A virus that targets the helper T cells which can wipe out our immune system and possibly lead to AIDS,
 - a. What is the normal role of our T Helper cells?
 - These are immune cells and coordinators of our adaptive immune response

7. Describe the potential cause and consequence of autoimmune disease.

- Your immune system attacks itself - can cause organ dysfunction and chronic disease.

a. Is our immune system supposed to target “self” cells?

- No

8. What are HLA's?

- HLA = Human leukocyte antigens - molecules that hold antigens on the surface of all uncleared cells of the body that the immune system can detect. (Different people have different HLA markers)
 - a. Explain tissue matching for organ transplantation and what the mechanism of rejection by our immune system would be.
 - Organ transplantation matching – The blood types have to match , the HLA markers have to match, and we have to check the plasma of the receptive T to make sure they don't have pre existing antibodies that will attack any donor cells.
 - Mechanism of rejection – The cytotoxic T cells will attack the cells that do not have the right markers, B cells may make antibodies that will be directed against the new cells

9. What is an allergy?

- Allegy = An inappropriate immune response to antigens that pose no threat or harm of the body EX: Cats, dogs, pollen

Many people experience seasonal allergies that cause runny noses, sneezing, itching etc. but others can have severe allergic reactions.

a. How can allergic reactions become life threatening?

- When the chemicals released during the immune response dilate our vessels or close off our airways. Histamine will dilate the vessels which will drop our blood pressure.

Ventilation and Control of Breathing

1. What structures are associated with the following parts of the respiratory system?

- Upper respiratory system – Nose, Pharynx, Larynx, Trachea
- Lower respiratory system – Bronchi, bronchioles, lungs
- Respiratory muscles – Diaphragm, intercostal muscles

a. What is the site of gas exchange?

- The respiratory zone - consists of bronchioles, alveolar ducts and alveoli

2. Describe the function of the various types of alveolar cells.

Type 1: Squamous epithelium & site of gas exchange

Type 2: secrete areolar fluid and contains surfactant - helps reduce surface tension

Alveoli macrophages: keep surfaces sterile (Zamboni)

3. What is Minute Ventilation?

- The volume of air into (or out of) the lungs per minute
- Minute ventilation = Respiratory rate X tidal volume

4. Ventilation is continually adjusted to maintain constant arterial O₂, CO₂ and pH...

a. Where are the sensors for these parameters?

Central chemoreceptors

b. Where is the respiratory control center?

- Medulla oblongata

c. What is the most important parameter (O₂, CO₂ or pH) impacting respiratory rate/depth (under normal conditions)?

- Arterial CO₂

5. Explain the process of inspiration and expiration. List the FULL sequence of events for each, including the volume and pressure changes, as well as the muscles involved.

- Inspiration process: (Breathing in)

Volume changes lead to pressure changes which lead to flow of gases to equalize pressure
When pressure inside the lungs does not exceed the atmospheric pressure, air moves into the lungs

Air moves into the lungs after alveolar pressure falls below atmospheric pressure - this requires our respiratory muscles. The medulla sends signals to the muscles and they contract which increases the size of the thorax. This will decrease intrapleural pressure and leads to expansion of the lungs which will drop the pressure

- Expiration process: (Breathing out) Volume change, pressure change, air moves into or out of the lungs
 - When the pressure inside the lungs exceeds atmospheric pressure, air moves out of the lungs

We stop sending the signal and the diaphragm will recoil (relax) and the rib cage will come back which will increase the pressure

6. What can a pulmonary function test (spirometry) tell about a person's respiratory system?

- They measure different volumes of how much air you can breathe in or breathe out. You can find your total lung capacity and many different measurements can be found with a pulmonary test.

7. What is COPD?

- COPD = Chronic obstructive pulmonary disorder an umbrella that many different disorders can fall under EX: Emphysema
 - a. How do conditions such as emphysema and chronic bronchitis impair ventilation of the lung and therefore gas exchange?
 - Destruction of alveoli and pulmonary capillaries create loss of surface area and lung capacity and reduces the amount of oxygen our body can have
 - b. What is asthma? How can asthma be treated?
 - Decrease in the diameter of the bronchi, inflammation of the bronchi, mucus production, attacks increase airway spasms and narrowing leading to shortness of breath and wheezing
 - Asthma =
 - Treatment: We can use an M3 blocker to prevent constriction or use NEPI to open the airways and prevent them from closing.

8. What role does surfactant play in the lungs?

- Water molecules in the lungs try to stick together and the surfactant keeps surface tension together so the water molecules are dispersed, and keeps the alveoli from collapsing
 - a. Why do babies born prematurely often suffer from respiratory distress syndrome (RDS)?
 - An infant born prior to 30 weeks does not have fully developed lungs which causes surfactant not to be produced and leads to difficulty breathing.