Chapter 16

The Lymphatic System and Immunity
The Lymphatic System

- Lymph - fluid in the tissue spaces that carries protein molecules and other substances back to the blood

- Lymph organs:
  - Lymph nodes
  - Tonsils
  - Spleen
  - Thymus
Lymphatic Vessels

1. Lymphatic capillaries →
2. Lymph sinuses
3. in lymph node →
4. Lymphatic capillaries →
5. Thoracic duct

* Design permits only one-way movement of lymph
* Lymphatic capillaries - tiny sieves on blind-ended tubes in tissue spaces
* One cell layer of simple squamous epithelium
Lymph System & Flow

https://www.youtube.com/watch?v=EEP0PYEWcwU
Lymphatic Vessels

- **Right lymphatic duct**
  - Drains lymph from right upper extremity and right side of head, neck, and upper torso

- **Thoracic duct**
  - Largest lymphatic vessel
  - Has an enlarged pouch at base called cisterna chyli
  - Drains lymph from about ¾ of the body
The Lymphatic System

- Lymphedema - swelling (edema) of tissues caused by blockage of lymphatic vessels
- Lymphangitis - inflammation of lymphatic vessels, may progress to septicemia (blood infection)
Lymph nodes (lymph glands)

* Located in clusters along lymphatic vessels
* Become enlarged and tender when bacteria are present
* Functions:
  1. Defense
  2. WBC formation
  3. Filter lymph
Lymphatic System Dysfunctions

- Lymphoma - malignant tumor of lymph nodes
- Two types: Hodgkin disease (lymphocytes) and non-Hodgkin lymphoma
- Sx: painless enlargement of lymph nodes
Lymph Flow Risks

- Cancer cells can metastasize easily move through lymphatic vessels to other parts of the body
Functions of the Thymus gland:

- Helps T lymphocytes (T cells) to mature
- Secretes hormone (thymosin)

Involution/ change occurs over the years with fat replacing glandular tissue reducing immune system function.
Tonsils

- Composed of three masses of lymphoid tissue around the openings of the mouth and throat
  - Palatine tonsils ("the tonsils")
  - Pharyngeal tonsils (adenoids)
  - Lingual tonsils
- Subject to chronic infection
- Enlargement of palatine tonsils may impair breathing
Spleen

* Largest lymphoid organ in body
* Located in upper left quadrant of abdomen
* Often injured by trauma to abdomen
  * Bleeding could be fatal
* Functions:
  1. Phagocytosis of bacteria and old RBCs
  2. Acts as a blood reservoir
* Splenomegaly - enlargement of the spleen
Non-specific immunity

- Protects body from pathological bacteria, foreign tissue cells, and cancerous cells (1st line of defense)
- Made up of defensive cells and molecules
  1. Skin and mucous membrane
  2. Tears
  3. Phagocytosis – by WBC
  4. Inflammation
Specific Immunity

* AKA Adaptive immunity and **acquired immune system**
* Ability of body to recognize, respond to, and remember harmful substances or bacteria using antigens
* Inherited or inborn immunity - inherited immunity to certain diseases from time of birth

https://www.youtube.com/watch?v=njNdANeRK3A
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<th>Natural</th>
<th>Artificial</th>
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<td><strong>Active</strong></td>
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<td>Contract disease and produce memory cells</td>
<td>Receive a vaccination and produce memory cells</td>
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<td><strong>Passive</strong></td>
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<td>Receive maternal antibodies through placenta or breast milk</td>
<td>Receive antiserum with antibodies from donor</td>
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**Passive Artificial**

- Receive antiserum with antibodies from donor
- Short term
Antibodies

- Protein compounds with specific combining sites
- Antibodies attach to specific antigens/pathogens (foreign proteins), forming antigen-antibody complex - called **humoral** or **antibody-mediated** immunity
Complement proteins

- Group of proteins normally present in blood in inactive state
- Complement cascade
  1. Complement system proteins bind to the bacterium
  2. Opens the pores in its membrane
  3. Fluid and salt move it causing swelling and bursting the cell.
Phagocytes: cells that protect the body by ingesting harmful foreign particles, bacteria, and dead or dying cells.

They are essential for fighting infections and for subsequent immunity.

Types:
1. Neutrophils
2. Monocytes
**Lymphocytes**: Small lymphocytes consist of T cells and B cells.

- T cells circulate in the blood after maturing in thymus and attack invaders
- After they mature in bone marrow, inactive B cells migrate chiefly to lymph nodes. They create antibodies to warn WBCs and T cells of pathogen’s presence
Hypersensitivity of the Immune System

* Inappropriate or excessive immune response
* Allergy - hypersensitivity to harmless environmental antigens (allergens)
  * Immediate allergic responses usually involve humoral immunity
  * Delayed allergic responses usually involve cell-mediated immunity
Hypersensitivity of the Immune System

* Autoimmunity - inappropriate, excessive response to self-antigens
* Causes autoimmune diseases
* Systemic lupus erythematosus (SLE) - chronic inflammatory disease caused by numerous antibodies attacking a variety of tissues
Isoimmunity

Excessive reaction to antigens from another human
May occur between mother and fetus during pregnancy
May occur in tissue transplants (causing rejection syndrome)
Congenital immune deficiency or immunodeficiency (rare)

- Results from improper lymphocyte development before birth
- Severe combined immune deficiency (SCID)—caused by disruption of stem cell development
Develops after birth:
Acquired immunodeficiency syndrome (AIDS)—caused by HIV infection of T cells
HIV is spread by direct contact of body fluids
A "cocktail" of several antiviral drugs can reduce the effects of the HIV infection