Chapter 12: The Lymphatic System

I. The Lymphatic System

Objectives:
- Name the two major types of structures composing the lymphatic system, and explain how the lymphatic system is functionally related to the cardiovascular system and immune systems.
- Describe the composition of lymph, and explain its formation and transport.
- Describe the function(s) of lymph nodes, tonsils, the thymus, Peyer’s patches, and the spleen.

A. Two systems in one!
- Lymphatic vessels
- Lymphoid tissues and organs

B. Lymphatic vessels
- Importance
  - Loss of fluid to interstitial space at capillary beds
  - Role of lymphatic vessels
- Lymph capillaries
  - Function
  - Permeability
  - Problem with such high permeability
- Other lymphatics
a) Lymphatic collecting vessels

b) Lymphatic ducts

4. How lymph moves, since it has no pump

C. Lymph nodes

1. Function

2. Distribution

3. Macrophages and lymphocytes

4. Anatomy of a lymph node
   a) General structure

   b) Cortex vs. medulla

   c) Speed of lymph movement through lymph nodes

D. Other lymphoid organs

1. Spleen

2. Thymus gland

3. Tonsils

4. Peyer’s patches
II. Body Defenses

A. Nonspecific vs. specific defenses

1. Nonspecific defenses

2. Specific defenses

B. Nonspecific body defenses

<table>
<thead>
<tr>
<th>Objectives:</th>
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</thead>
<tbody>
<tr>
<td>• Describe the protective functions of the skin and mucous membranes.</td>
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<td>• Explain the importance of phagocytes and natural killer cells</td>
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<td>• Describe the inflammatory response.</td>
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<td>• Name several antimicrobial substances produced by the body that act in nonspecific body defense.</td>
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<td>• Explain how fever helps protect the body against invading bacteria.</td>
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</tbody>
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1. Surface membrane barriers

   a) Mechanical protection

   b) Chemical protection

   c) Cilia

2. Cells and chemicals

   a) Phagocytes

   b) Natural killer (NK) cells
c) Inflammatory response

(1) Cardinal signs

(2) Effects of histamine

(3) Benefits of the inflammatory response

(3) Role of neutrophils and macrophages

(4) Other events associated with inflammation

d) Antimicrobial chemicals

(1) Complement

(a) Complement fixation

(b) Effects of complement

(2) Interferons

(3) Fever
C. Specific body defenses: The immune system

Objectives:
- Define antigen and hapten, and name substances that act as complete antigens.
- Name the two arms of the immune response, and relate each to a specific lymphocyte type (B or T cell).
- Compare and contrast the development of B and T cells.
- State the roles of B cells, T cells, and plasma cells.
- Explain the importance of macrophages in immunity.
- List the five antibody classes, and describe their specific roles in immunity.
- Describe several ways in which antibodies act against antigens.
- Distinguish between active and passive immunity.
- Describe Immunodeficiencies, allergies, and autoimmune disease.

1. The immune response
   a) Definition
   b) Important aspects
   c) Humoral vs. cellular immunity

2. Antigens
   a) Definition
   b) Self vs. nonself antigens
   c) Haptens and allergies

3. Cells of the immune system: An overview
   a) Lymphocytes
      (1) T lymphocytes vs. B lymphocytes
(a) T lymphocytes

(b) B lymphocytes

(2) Determinants of which antigens our cells respond to

(3) After immunocompetence

b) Macrophages

(1) Antigen-presenters

(2) Killer macrophages

(3) Locations where macrophages are found

4. Humoral (antibody-mediated) immune response

a) Clonal selection and primary humoral response

b) Plasma cells vs. memory cells

c) Primary vs. secondary humoral response

d) Active and passive humoral immunity

(1) Active immunity
(2) Passive immunity

e) Antibodies

(1) Definition

(2) Basic antibody function (draw and label a picture, too)

(3) Antibody classes

(4) Antibody function

(a) Complement fixation

(b) Neutralization

(c) Agglutination

(d) Precipitation

5. Cellular (cell-mediated) immune response

a) How antigen-presentation works

b) Types of T cells

(1) Cytotoxic (killer) T cells
(2) Helper T cells and lymphokines

(3) Suppressor T cells

(4) Memory cells

6. Organ transplants and rejection
   a) Types of grafts
   b) Immunosuppressive therapy

7. Disorders of immunity
   a) Allergies
      (1) Immediate hypersensitivity
      (2) Delayed hypersensitivities
   b) Immunodeficiencies
      (1) Severe combined immunodeficiency disease (SCID)
      (2) Acquired immune deficiency syndrome (AIDS)
(3) Autoimmune diseases

(a) Definition

(b) Examples

(c) Causes

III. Developmental Aspects of the Lymphatic System and Body Defenses

A. Prenatal development

B. Early life

C. Role of the nervous system

IV. A Closer Look: AIDS: The Modern Day Plague

A. Symptoms

B. Cause

C. Effect of the disease on the immune system

D. Course of illness
E. Epidemiology

F. Transmission

G. Treatment