

## Component I: Core

### Module B: Terminology, Anatomy and Physiology

#### Topic 12: Immune System

##### Statement of Purpose

To prepare the learner with basic knowledge of the immune system.

##### Student Learning Outcomes

Upon completion of this topic, the learner will be able to:

1. Spell and define key terms.
2. Describe the body's defense against disease.
3. Explain the purpose of the lymphatic system as it relates to immunity.
4. Describe the major structures and functions of the immune system.
5. Describe the immune response.
6. Explain the acquisition of immunity.
7. Differentiate between a balanced immune system, an over active immune system and an underactive immune system.

##### Terminology

- |                            |                          |
|----------------------------|--------------------------|
| 1. Adenoids                | 27. Infection            |
| 2. Allergens               | 28. Interferons          |
| 3. Antibody                | 29. Lymph nodes          |
| 4. Antibody mediated       | 30. Lymphocyte           |
| 5. Antigen                 | 31. Lysis                |
| 6. Antigenic cells         | 32. Lysozymes            |
| 7. Bacteria                | 33. Macrophage           |
| 8. B-Lymphocyte            | 34. Mechanical barriers  |
| 9. Bone marrow             | 35. Microorganism        |
| 10. Cell markers           | 36. Monocyte             |
| 11. Cell mediated          | 37. Neonate              |
| 12. Chemical barriers      | 38. Nonspecific defenses |
| 13. Coated cells           | 39. "Not self"           |
| 14. Complement system      | 40. Parasitic infections |
| 15. Edema                  | 41. Pathogen             |
| 16. Environmental antigens | 42. Phagocyte            |
| 17. Enzymatic reactions    | 43. Phagocytosis         |
| 18. Filtration             | 44. Platelets            |
| 19. Immune response        | 45. Precursor cells      |
| 20. Immunity               | 46. Red blood cell       |
| 21. Immunoglobulin         | 47. "Self"               |
| 22. Immunoglobulin A (IgA) | 48. Spleen               |
| 23. Immunoglobulin D (IgD) | 49. Stem cell            |
| 24. Immunoglobulin E (IgE) | 50. Thymus               |
| 25. Immunoglobulin G (IgG) | 51. Tonsils              |
| 26. Immunoglobulin M (IgM) | 52. T-Lymphocyte         |

- 53. Vaccine
- 54. Virus

- 55. White blood cell

## References

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4. Blesi, M., Wise, B.A., & Kelley-Arney, C, (2012) *Medical Assisting Administrative and Clinical Competencies* (7<sup>th</sup> Ed.) Clifton Park, NY: Delmar, Cengage Learning
5. Lindh, W., Pooler, M., Tamparo, C. & Dahl, B., (2013). *Comprehensive Medical Assisting Administrative and Clinical Competencies* (5<sup>th</sup> Ed.). Clifton Park, NY: Delmar, Cengage Learning.
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8. Proctor, D. B., & Young-Adams, A. P. (2011). *Kinn's The Medical Assistant: An Applied Learning Approach* (11<sup>th</sup> Ed.). Philadelphia, PA: Saunders Elsevier
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## Websites

1. [www.innerbody.com](http://www.innerbody.com)
2. [www.cdc.gov](http://www.cdc.gov)
3. [www.vivo.colostate.edu/hbooks/pathphys/digestion/](http://www.vivo.colostate.edu/hbooks/pathphys/digestion/)
4. [www.merckmanuals.com/professional/pulmonary\\_disorders.html](http://www.merckmanuals.com/professional/pulmonary_disorders.html)
5. [www.lung.org/associations/states/california/](http://www.lung.org/associations/states/california/)
6. [www.stedmanonline.com/index.aspx](http://www.stedmanonline.com/index.aspx)
7. [http://kidshealth.org/parent/general/body\\_basics/kidneys\\_urinary.html](http://kidshealth.org/parent/general/body_basics/kidneys_urinary.html)

Content Outline/Theory Objectives	Suggested Learning Activities
<p><b>Objective 1</b>  <b>Spell and define key terms.</b></p> <ul style="list-style-type: none"> <li>A. Review the terms listed in the terminology section.</li> <li>B. Spell the listed terms accurately.</li> <li>C. Pronounce the terms correctly.</li> <li>D. Use the terms in their proper contexts.</li> </ul>	<ul style="list-style-type: none"> <li>A. Games: word searches, crossword puzzles, Family Feud, Jeopardy, bingo, spelling bee, hangman and concentration.</li> <li>B. Administer vocabulary pre-test and post-test.</li> <li>C. Discuss learning gaps and plan for applying vocabulary.</li> </ul>
<p><b>Objective 2</b>  <b>Describe the body's defense against disease.</b></p> <ul style="list-style-type: none"> <li>A. Infection is the presence of a pathogen in or on the body.</li> <li>B. Pathogen is a disease-causing agent such as a bacterium, virus, toxin, fungus, or protozoan.</li> <li>C. Non-specific defenses are the body's mechanisms to protect itself against pathogens             <ul style="list-style-type: none"> <li>1. Phagocytosis                 <ul style="list-style-type: none"> <li>a. The ingestion and digestion of bacteria and particles by phagocytes.</li> <li>b. Engulfs microorganisms (antigens) or other cells and foreign particles by phagocytes.</li> <li>c. Neutrophils</li> <li>d. Monocytes</li> </ul> </li> <li>2. Fever and inflammation.</li> <li>3. Mechanical barriers                 <ul style="list-style-type: none"> <li>a. Mucus membrane covering linings of tubes.</li> <li>b. Skin covering the body; provides barriers against pathogens.</li> <li>c. Reflexes such as coughing.</li> <li>d. Natural killer cells.</li> <li>e. Interferons.</li> <li>f. Complement.</li> </ul> </li> <li>4. Chemical barriers                 <ul style="list-style-type: none"> <li>a. Chemicals and enzymes in the body provide barriers that destroy pathogens.</li> <li>b. Acids in the stomach.</li> </ul> </li> <li>5. Lysozymes in tears</li> <li>6. Fever, elevated body temperature stimulates the production of the immune system lymphocytes.</li> <li>7. Inflammatory process, the primary objective of inflammation is to localize and eradicate the irritant and repair the surrounding tissue                 <ul style="list-style-type: none"> <li>a. Tissue injury causes release of the mediators of inflammation.</li> <li>b. Vasodilation brings more blood to the area</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>A. Lecture/Discussion</li> <li>B. Assigned Readings</li> <li>C. Use anatomical diagrams/ posters/videos/computer assisted learning/ workbook activities.</li> <li>D. Divide students into groups of four and have them choose a topic from the list below.</li> <li>E. Create posters and present to class             <ul style="list-style-type: none"> <li>a. Describe the inflammatory process.</li> <li>b. Immunization, myths and facts</li> <li>c. Barriers and how they protect the human from pathogens</li> <li>d. Description of specific defenses and how their mechanisms are activated.</li> <li>e. Immunity and how artificial, natural, and passive immunity occurs.</li> <li>f. Other (teacher approved)</li> </ul> </li> <li>F. Ask students to review the immunity pages in the Centers of Disease Control (C.D.C.)</li> </ul>

<p>causing redness and warmth.</p> <ul style="list-style-type: none"> <li>c. Increase in permeability leads to release of fluid which leads to swelling and pain.</li> <li>d. Migration of neutrophils to the area, chemotaxis.</li> <li>e. Blood bring proteins to replace injured tissues and clotting factors to stop any bleeding.</li> </ul> <p>D. Specific defenses</p> <ul style="list-style-type: none"> <li>1. Immunities acquired from a specific pathogen that prevents any reoccurrence (i.e. chicken pox).</li> <li>2. Antigens are foreign substances in the body found on the surface of the pathogen.</li> <li>3. Immune system is programmed to respond to antigens.</li> </ul>	<p>website. <a href="http://www.cdc.gov">www.cdc.gov</a></p> <p>G. Ask them to be prepared to discuss a particular section addressing immunity.</p>
<p><b>Objective 3</b>  <b>Explain the purpose of the lymphatic system as it relates to immunity.</b></p> <p>A. Lymph glands are organs of the immune system</p> <ul style="list-style-type: none"> <li>1. Lymphocytes develop, grow and perform immune functions. Two main cell types for immune responses <ul style="list-style-type: none"> <li>a. B-cells for antibody mediated responses.</li> <li>b. T-cells for cell mediated responses.</li> </ul> </li> <li>2. The immune cells use cell markers on membrane surfaces <ul style="list-style-type: none"> <li>a. Recognize themselves and all other molecules defined as “self”.</li> <li>b. Recognize cells and molecules as “alien” or coded as “not self”.</li> <li>c. Recognize specific antigens including those of infectious agents and allergens.</li> </ul> </li> </ul> <p>B. Immunoglobulins, produced by B-cells, are large molecules known as antibodies</p> <ul style="list-style-type: none"> <li>1. IgG antibodies <ul style="list-style-type: none"> <li>a. Are found in all body fluids.</li> <li>b. They are the smallest but most common antibody of all the antibodies in the body.</li> <li>c. IgG antibodies are very important in fighting bacterial and viral infections.</li> <li>d. IgG antibodies are the only type of antibody that can cross the placenta in a pregnant woman to help protect the fetus.</li> </ul> </li> <li>2. IgM antibodies <ul style="list-style-type: none"> <li>a. Are the largest antibody.</li> <li>b. They are found in blood and lymph fluid and are the first type of antibody made in response to an infection.</li> <li>c. They also cause other immune system cells to destroy foreign substances.</li> </ul> </li> <li>3. IgA antibodies <ul style="list-style-type: none"> <li>a. Protect body surfaces that are exposed to outside foreign substances.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>A. Lecture/Discussion</li> <li>B. Assigned Readings</li> <li>C. Use anatomical diagrams/posters/videos/computer assisted learning/workbook activities.</li> </ul>

<ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>b. This type of antibody is also found in saliva, tears, and blood.</li> </ul> </li> <li>4. IgE antibodies           <ul style="list-style-type: none"> <li>a. Are found in the lungs, skin and mucous membranes.</li> <li>b. They cause the body to react against foreign substances such as pollen, fungus spores, and animal dander.</li> <li>c. They may occur in allergic reactions to milk, some medicines and some poisons.</li> <li>d. IgE antibody levels are often high in people with allergies and parasitic infections.</li> </ul> </li> <li>5. IgD antibodies           <ul style="list-style-type: none"> <li>a. Are found in small amounts in the tissues that line the belly or chest.</li> <li>b. How they work is not clear.</li> </ul> </li> <li>C. Complement system consists of proteins that aid in the lysis of cells           <ul style="list-style-type: none"> <li>1. Activated complement proteins form complexes of proteins that create holes in the bacterial cell wall.</li> <li>2. Water and salts diffuse through the bacterial cell wall.</li> <li>3. The bacterium swells and bursts.</li> <li>4. Complement attracts phagocytes.</li> <li>5. Complement stimulates inflammation.</li> </ul> </li> </ul>	
<p><b>Objective 4</b>  <b>Describe the major structures and functions of the immune system.</b></p> <ul style="list-style-type: none"> <li>A. Tonsils and adenoids           <ul style="list-style-type: none"> <li>1. The tonsils are collections of lymphatic tissue located on each side of the throat or pharynx.</li> <li>2. There are three sets of tonsils, the palatine, pharyngeal (adenoids) and lingual tonsils.</li> <li>3. All contain a large number of leukocytes and act as filters to protect the body.</li> <li>4. Tonsils are not required for life and can safely be removed if they become a continuous site of infection.</li> </ul> </li> <li>B. Lymph nodes           <ul style="list-style-type: none"> <li>1. Composed of lymphatic tissue located along the route of the lymphatic vessels; they have several functions:               <ul style="list-style-type: none"> <li>a. Serve as filters guarding against the spread of infection.</li> <li>b. Produce lymphocytes and monocytes.</li> <li>c. Produce antibodies to fight disease.</li> </ul> </li> <li>2. Lymph and lymph vessels.               <ul style="list-style-type: none"> <li>a. Tissue fluid enters the lymph vessels.</li> <li>b. Lymph vessels return lymph fluid to the blood by way of four lymphatic vessels.</li> <li>c. Lymph capillaries, lymphatics, thoracic duct and the right lymphatic duct.</li> <li>d. The purpose of lymph is to return protein, fats,</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>A. Lecture/Discussion</li> <li>B. Assigned Readings</li> <li>C. Use anatomical diagrams/posters/videos/computer assisted learning/workbook activities.</li> </ul>

hormones and other substances back to the blood.

C. Thymus

1. Located in the upper portion of the mediastinum.
2. Most active in the first few months after birth to establish the infant's immune system.
3. Essential for the proper development of the immune system.
4. Secretes the hormone thymosin, which changes lymphocytes to T lymphocytes (simply called T cells).
5. Is sensitive to sex hormones and at puberty gradually atrophies.

D. Bone marrow

1. Bone marrow is tissue that fills the cores of larger bones.
2. A major source of stem cells, which can be harvested for certain medical treatments.
3. Produces all three types of blood cells, as well as lymphocytes, which support the immune system.
4. Transplants are frequently performed in patients whose own marrow has become diseased.

E. Spleen

1. Blood formation
  - a. In neonates, produces all red blood cells.
  - b. In adults produces lymphocytes and monocytes only.
2. If bone marrow is damaged, spleen can produce various blood cells.
3. Blood storage for immediate use.
4. Blood filtration and removal of cells coated with immunoglobulins and complement proteins.

<p><b>Objective 5</b>  <b>Describe the immune response</b></p> <ul style="list-style-type: none"> <li>A. Two main types of immunity             <ul style="list-style-type: none"> <li>1. Humoral immunity involves the production of antibody molecules in response to an antigen and is mediated by B-lymphocytes.</li> <li>2. Cell-mediated immunity involves the production of cytotoxic T-lymphocytes, activated macrophages, activated natural killer cells (NK cells) and cytokines in response to an antigen and is mediated by T-lymphocytes.</li> </ul> </li> <li>B. Types of T lymphocyte             <ul style="list-style-type: none"> <li>1. Cytotoxic T cells (CD8).</li> <li>2. Helper T cells (CD4).</li> <li>3. Suppressor T cells.</li> <li>4. Memory T cells.</li> </ul> </li> <li>C. Immune response             <ul style="list-style-type: none"> <li>1. The antigen presents to the monocyte (macrophage) and the monocyte digest the antigen.</li> <li>2. The sensitized macrophage sensitizes the Helper T cell.</li> <li>3. The T helper cells help the Cytotoxic T cells proliferate.</li> <li>4. Sensitized B lymphocytes differentiate into antibody producing plasma cells.</li> <li>5. Antibodies activate complement destroying the antigen.</li> <li>6. The memory T and B cells have memory of the encounter.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>A. Lecture/Discussion</li> <li>B. Assigned Readings</li> <li>C. Use anatomical diagrams/posters/videos/computer assisted learning/workbook activities.</li> </ul>
<p><b>Objective 6</b>  <b>Explain the acquisition of immunity</b></p> <ul style="list-style-type: none"> <li>A. Acquired immunity is the body's response to a specific pathogen.</li> <li>B. Passive acquired immunity results when a person receives protective substances produced by another human (mother to baby).</li> <li>C. Injection of antibodies             <ul style="list-style-type: none"> <li>1. Active acquired immunity develops following direct exposure to the pathogenic agent.</li> </ul> </li> <li>D. Immunizations or vaccinations are special types of active acquired immunity             <ul style="list-style-type: none"> <li>1. Vaccine consists of a low dose of dead or deactivated bacteria or viruses. As a protein foreign to the body, these antigens trigger antibody production against them.</li> <li>2. Toxoids consist of a chemically altered toxin (the poisonous material produced by a pathogenic organism). Having been treated chemically, the toxin will not cause disease. It will, however, stimulate the immune response.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>A. Lecture/Discussion</li> <li>B. Assigned Readings</li> <li>C. Use anatomical diagrams/posters/videos/computer assisted learning/workbook activities.</li> </ul>

**Objective 7**

**Differentiate between a balanced immune system, an overactive immune system and an underactive immune system.**

- A. Balanced immune system has optimal effectiveness.
- B. Overactive immune system
  - 1. Internal threat or autoimmune, the body does not recognize self-antigens.
    - a. Problems include diabetes type 2, rheumatoid arthritis, multiple sclerosis, systemic lupus and erythematosus.
  - 2. External threats include allergies and anaphylaxis.
- C. Underactive immune system
  - 1. Immunodeficiency including HIV, AIDS, Tuberculosis, and Cancer.

- A. Lecture/Discussion
- B. Assigned Readings
- C. Use anatomical diagrams/posters/videos/computer assisted learning/workbook activities.