

CHAPTER

13

► Immunology

The Lymphatic and Immune Systems

After studying this chapter, you will be able to:

- 13.1** Name the parts of the lymphatic and immune systems and discuss the function of each part
- 13.2** Define combining forms used in building words that relate to the lymphatic and immune system
- 13.3** Identify the meaning of related abbreviations
- 13.4** Name the common diagnoses, clinical procedures, and laboratory tests used in treating disorders of the lymphatic and immune systems
- 13.5** List and define the major pathological conditions of the lymphatic and immune systems
- 13.6** Explain the meaning of surgical terms related to the lymphatic and immune systems
- 13.7** List common pharmacological agents used in treating disorders of the lymphatic and immune systems

Structure and Function

The lymphatic and immune systems share some of the same structures and functions. Neither system is an easily defined system as the digestive or endocrine systems are. The immune system utilizes other systems to maintain its functions. Both the lymphatic and immune systems contain the lymph nodes, spleen, thymus gland, and some of the disease-fighting immune cells. The lymphatic system provides the location to gather and concentrate foreign substances present in the body so that lymphocytes circulating through the lymphatic organs and vessels are able to destroy and remove them from the body.

The lymphatic system has the following functions:

- It reduces tissue edema by removing fluid from capillary beds.
- It returns the proteins from the fluids to the blood.
- It traps and filters cellular debris including cancer cells, microbes, etc. with the help of cells called macrophages.
- It recycles body fluid to various parts of the body.
- It circulates lymphocytes to assist with the immune response.
- It moves fats from the GI tract to the blood.

The immune system has the following functions:

- The immune system protects the body against foreign body invasion.
- In normal function, the immune system coordinates activities in the blood, body tissues, and the lymphatic system to protect the body from invasion.



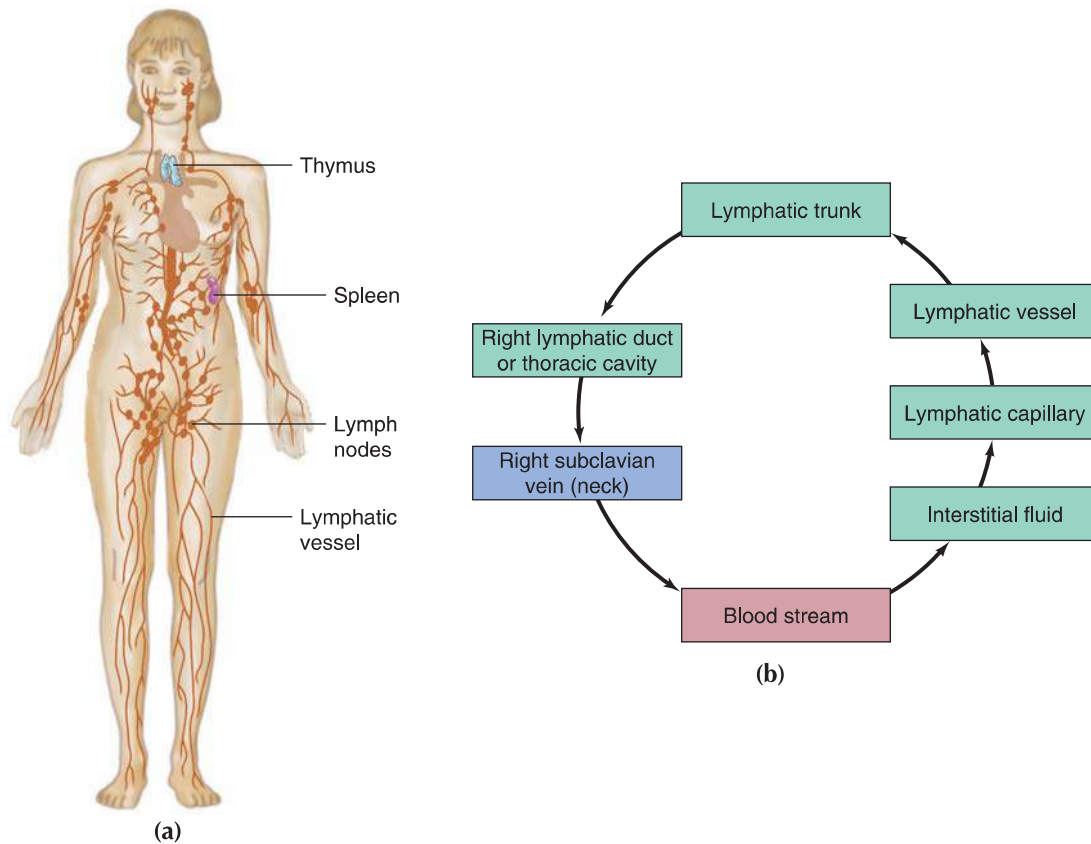


FIGURE 13-1 (a) The lymphatic and immune systems are the body's major defense against foreign substances; (b) flowchart of the path of lymph through the body.

- It fights off infections and protects against future infections by producing a variety of immune responses.
- It produces antibodies (immunoglobulins).

Figure 13-1a shows the lymphatic and immune systems. Figure 13-1b shows how lymph circulates throughout the body.

Lymphatic Organs and Structures

The lymphatic system is similar to both the cardiovascular and blood systems in that it involves a network of vessels that transports fluid around the body. The liquid part of the blood, plasma, has the ability to leave the blood capillaries and enter the cellular areas of the body. Once plasma leaves the vascular system, it is known as interstitial fluid. This interstitial fluid provides nutrients and performs other functions in the exchange of fluids to and from the cells. The lymphatic system serves as a drainage system to remove fluid from the cellular areas. It concentrates foreign substances to assist the immune system.

The lymphatic system consists of the following parts:

1. The *lymphatic pathways* are the vessels that transport **lymph** (the fluid of the lymphatic system) around the body. The smallest part of these pathways are the *microscopic capillaries* located in the capillary beds of the body. The capillary beds are thin-walled vessels that receive fluid and debris from the bloodstream. Once inside the beds, the fluid is known as lymph. The lymph travels throughout the lymphatic vessels in one direction only—back toward the heart. Lymphatic vessels

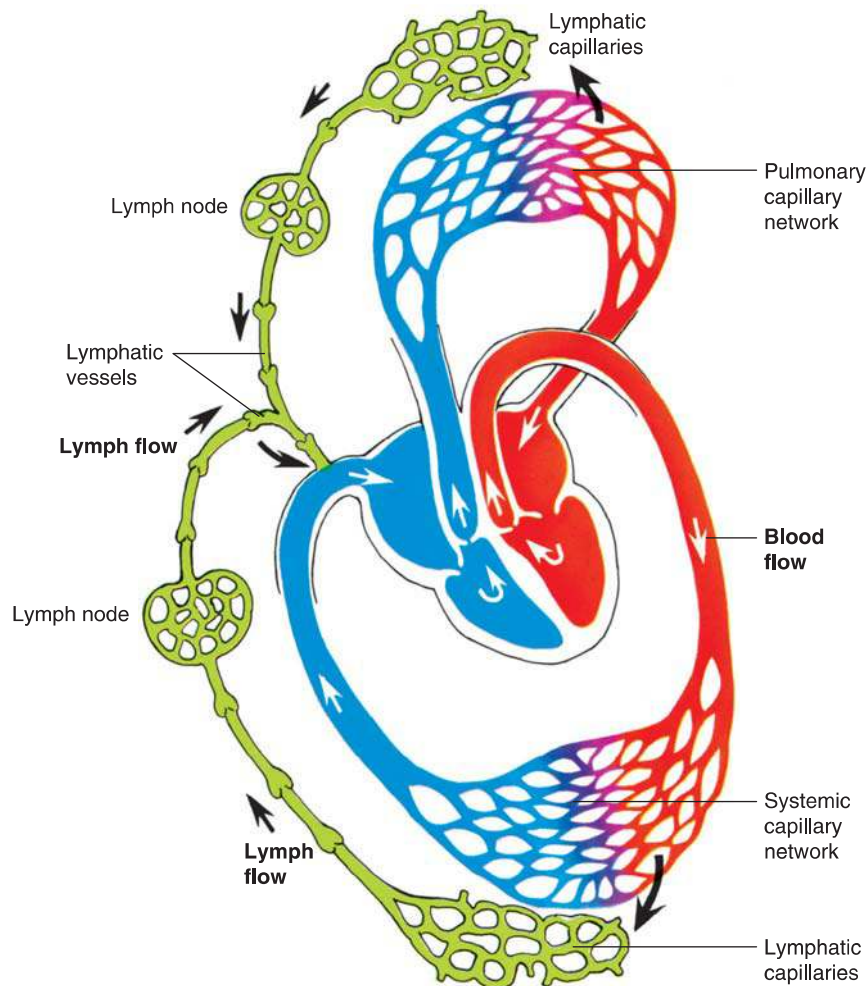


FIGURE 13-2 Lymphatic capillaries gather the lymph from the space between tissues.

contain valves that prevent backflow of lymph. As the vessels approach the heart, they carry more fluid and are larger in size. Figure 13-2 illustrates the flow of lymph through the body.

2. Located along the lymphatic vessels are the **lymph nodes** (Figure 13-3), small lumps of lymphatic tissue that serve as a collecting point to filter the lymph. The lymph passes through many lymph nodes for filtering so that it is ready for transferring back to the vascular system. By the time the fluid reaches the thoracic cavity, it has been filtered many times. The lymph nodes contain special cells (macrophages) that devour foreign substances. Lymph nodes become swollen with *lymphocytes* (lymph cells) and macrophages. Lymph nodes are located throughout the body except in the central nervous system. They are quite numerous near the joints of the body. The major groups of lymph nodes are located in the throat (the tonsils and adenoids are actually lymph tissue), neck, axilla (armpit), mediastinum, and groin.
3. The largest lymphatic organ, the **spleen**, is located in the upper left portion of the abdominal cavity, where unfortunately it can easily be injured and ruptured. In such cases, it must be repaired or removed (its functions are taken over by the lymph nodes, liver, and bone marrow). The function of the spleen is to filter foreign material from the blood, to store blood, to remove damaged or old red blood cells, and to activate lymphocytes that destroy some of the foreign substances filtered from the blood (Figure 13-4). The spleen is important not only

FIGURE 13-3 Lymph nodes contain cells (lymphocytes and macrophages) that ingest foreign substances.

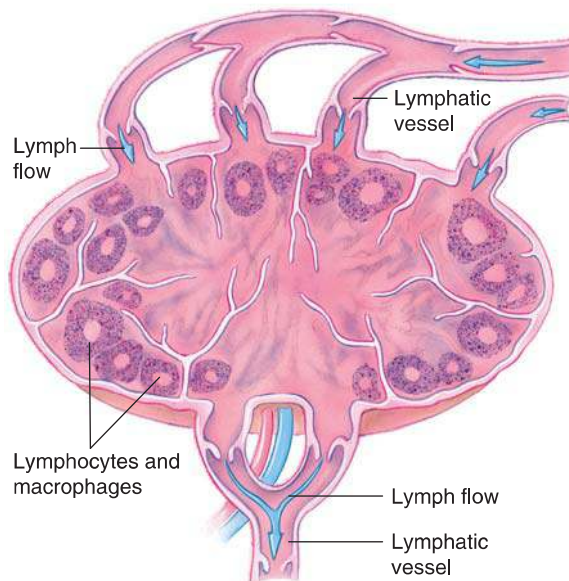
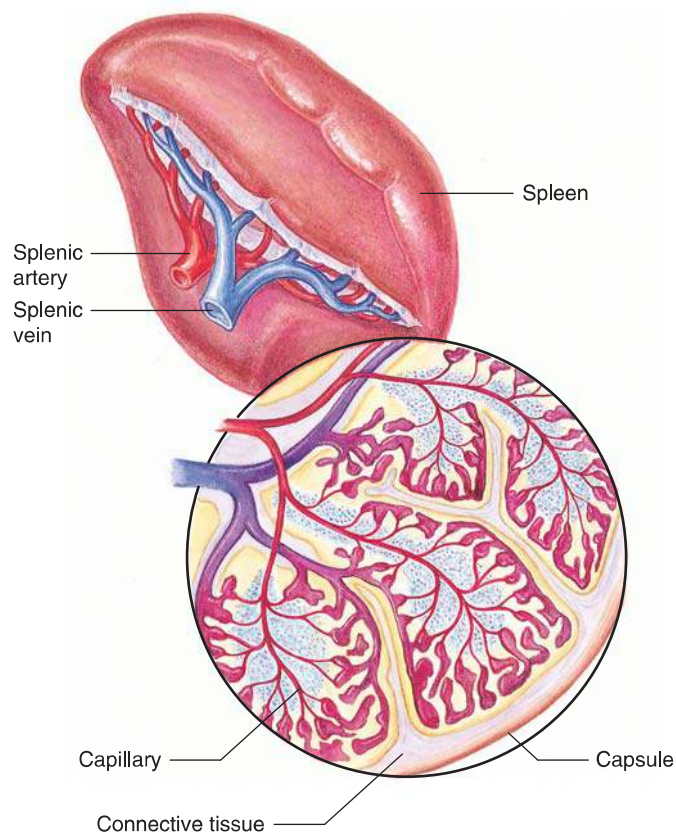


FIGURE 13-4 The spleen, like the lymph nodes, contains cells that destroy foreign substances.



to the lymphatic system but also to the circulatory system; its association with the circulatory system is similar to the association of the lymph node to the lymphatic system. The spleen is also a major site for immunoglobulin production by *B lymphocytes* that have differentiated into antibody-producing plasma cells.

4. The **thymus gland** is a two-lobed, soft gland located in the thoracic cavity (Figure 13-5). It is large during infancy and early childhood when immunity is most crucial, but gradually shrinks until it becomes connective tissue in adulthood (when the body has acquired other types of immunities). The thymus gland contains a high number of **T lymphocytes**

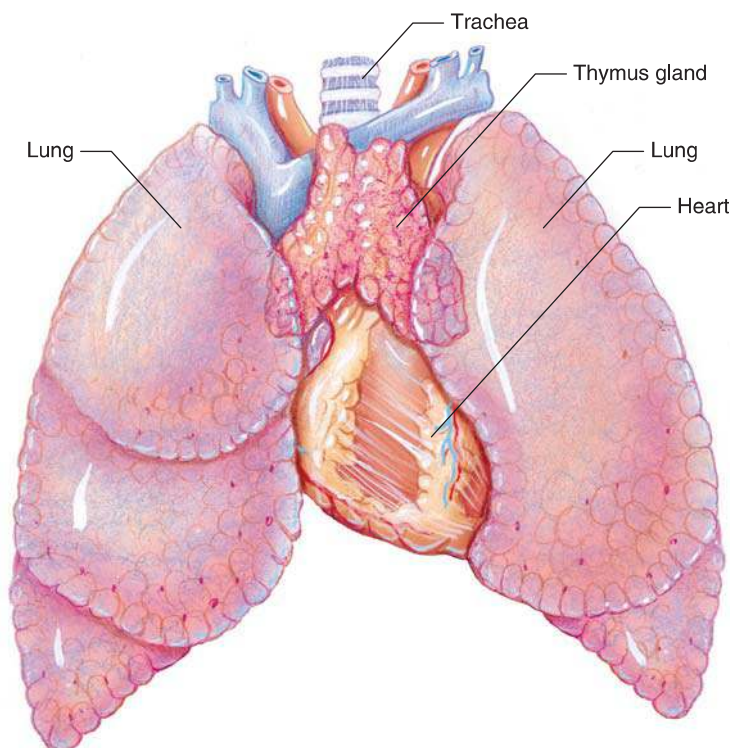


FIGURE 13-5 The thymus gland is located between the lungs.

(**T cells**) and a decreased number of **B lymphocytes (B cells)**. After being produced in the bone marrow, some of the lymphocytes (immature T cells) migrate through the thymus gland where they acquire the marker that identifies them as T lymphocytes. Other lymphocytes become B cells. T cells provide immunity after they leave the thymus. Their movement is aided by **thymosin**, a hormone secreted by the thymus.

The Immune System

The immune system relies on several other systems to accomplish its duties. The *reticuloendothelial system (RES)*, *hematopoietic system*, *mononuclear phagocytic system* (or *phagocytic system*), and *lymphoid system* are significant in the functions of the immune system. The hematopoietic system is responsible for the production of the blood cells in the bone marrow. The blood cells include the erythrocytes (red blood cells), leukocytes (white blood cells), and thrombocytes (platelets). The leukocytes include **lymphocytes**, monocytes, and granulocytes (*polymorphonucleated cells* or PMN). The RES and phagocytic systems provide the phagocytes of the tissues and the phagocytes of the blood that are called **macrophages** and **microphages**. Phagocytes remove foreign particles from the body by the process of **phagocytosis**, the internalization or “eating” of the particles and the digestion of the particles for presentation to the appropriate cells of the immune system. The immune response is divided into two kinds: the *cellular response* and the *humoral* or *immunoglobulin (antibody) response*.

Lymphocytes are one kind of leukocytes that are intimately involved in the immune system. Included in the classification of lymphocytes are the T lymphocytes (T cells) and the B lymphocytes (B cells). T cells are involved in both types of the immune response. In the cellular response the T cells accept information about the invading particle (antigen) and produce chemical substances called *lymphokines* to destroy the antigen. The B cells are responsible for the production of **antibodies** (also called immunoglobulins), i.e., the humoral response. The humoral response, or the antibody production,

requires the assistance of the T cells through their production of other chemical substances that act as signals to the B cells to begin antibody production.

The immune system shares several parts with the lymphatic system (lymph nodes, spleen, and thymus gland). These parts serve as defense mechanisms protecting the body. Parts of other systems, such as the skin, also play an important role in protecting the body from disease. The immune system of the body consists of all the processes that perform a series of defenses to protect from and respond to disease.

Mechanical and Chemical Defenses

The human body includes a number of mechanical, chemical, and other defenses against disease. When disease-causing agents, **pathogens**, try to enter the body, they are often stopped by the skin, the cilia in the nostrils, and by various mucous membranes—all of which are mechanical barriers to intrusion.

If some pathogens get past the mechanical defenses, they may be stopped by chemical barriers, such as gastric juices in the stomach. Pathogens in the bloodstream may be destroyed by phagocytosis, the ingesting of foreign substances by specialized cells like macrophages. In addition, humans are resistant to some diseases that affect other animals and vice versa. This natural resistance may occur because the pathogen finds the human's internal environment harmful to its survival.

On the other hand, some pathogens prefer the environment of the human body as opposed to that of other animals, so they affect humans but not animals. Some tick-borne diseases such as Lyme disease can have devastating consequences to humans but remain dormant in animals. Some bacteria are beneficial in humans because they help ward off disease. In the bloodstream, certain substances called **antigens** may provoke an immune response to certain diseases.

The Immune Process

Mechanical or chemical defenses work together to avert or attack disease. In addition, the body has specific defenses of the immune system called **immunity** that provide resistance to particular pathogens. There are three major types of immunity—natural immunity, acquired active immunity, and acquired passive immunity.

Natural Immunity

Natural immunity is the human body's natural resistance to certain diseases. This natural resistance varies for individuals, even to the extent that persons of certain racial backgrounds tend to have more or less resistance to certain diseases. Natural resistance depends on the individual's genetic characteristics and on some of the natural chemical defenses.

Acquired Active Immunity

The body develops **acquired active immunity** either by having a disease and producing natural antibodies to it or by being vaccinated against the disease. **Immunization** or **vaccination** is the injection of an **antigen**, a substance that provokes an immune response, from a different organism that causes active immunity via the production of antibodies. The substance is called a **vaccine**.

Acquired active immunity is further divided into two types. The first, **humoral immunity**, is immunity provided by **plasma cells**, which

produce antibodies called **immunoglobulins**. There are five major types of immunoglobulins:

- *Immunoglobulin G (IgG)* is effective against bacteria, viruses, and toxins.
- *Immunoglobulin A (IgA)* is common in exocrine gland secretions, such as breast milk, tears, nasal fluid, gastric juice, and so on. IgA transfers immunity from mother to infant through breast milk.
- *Immunoglobulin M (IgM)* develops in the blood plasma in response to certain antigens within the body or from foreign sources. It is the first antibody to be produced after infection.
- *Immunoglobulin D (IgD)* is important in B cell activation, which helps immunity by transforming itself into a plasma cell in the presence of a specific type of antigen.
- *Immunoglobulin E (IgE)* appears in glandular secretions and is associated with allergic reactions.

The second type of acquired active immunity, or **cell-mediated immunity**, is provided by the action of T cells. The T cells respond to antigens by multiplying rapidly and producing proteins called *lymphokines* (for example, **interferons** and **interleukins**) that have antiviral properties or properties that affect the actions of other cells in the body. T cells also produce substances to stimulate B cells to differentiate into plasma cells and to produce antibodies.

Three types of other specialized T cells are:

- **Helper cells** or CD4 cells that stimulate the immune response.
- **Cytotoxic cells** or CD8 cells that help in the destruction of infected cells.
- **Suppressor cells** or T cells (mainly CD8 and some CD4) that suppress B cells and other immune cells.

Acquired Passive Immunity

Acquired passive immunity is immunity provided in the form of antibodies or antitoxins that have been developed in another person or another species. Acquired passive immunity is necessary in cases of snakebite and tetanus or any problem where immediate immunity is needed. In such cases, a dose of **antitoxin** (antibody directed against specific toxins) is given to provide antibodies. Passive immunity may also be administered to lessen the chance of catching a disease or to lessen the severity of the course of the disease. **Gamma globulin** is a preparation of collected antibodies given to prevent or lessen certain diseases, such as hepatitis A, varicella, and rabies.

MORE ABOUT . . .

Immunization

Most children are immunized against childhood diseases routinely and those vaccines are thought to be safe and effective. There is a very small incidence of bad reactions to vaccines that have harmed some children. Recently, some groups have studied what is thought to be the higher incidence of autism since the introduction of routine vaccinations. So far, the evidence is that there is no connection between autism and childhood immunization through vaccine. Also, the risk of getting some of the diseases which the vaccines prevent is thought to have the potential for much greater harm to children.

VOCABULARY REVIEW

In the previous section, you learned terms relating to the lymphatic and immune systems. Before going on to the exercises, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Definition
acquired active immunity	Resistance to a disease acquired naturally or developed by previous exposure or vaccination.
acquired passive immunity	Inoculation against disease or poison, using antitoxins or antibodies from or in another person or another species.
antibody [ÄN-tē-bōd-ē] anti-, against + body	Specialized protein that fights disease; also called immunoglobulin.
antigen [ÄN-tī-jēn] anti(body) + -gen, producing	Any substance that can provoke an immune response.
antitoxin [än-tē-TÖK-sīn] anti-, against + toxin	Antibodies directed against a particular disease or poison.
B lymphocytes [LĪM-fō-sīts], B cells	A kind of lymphocyte that manufactures antibodies.
cell-mediated immunity	Resistance to disease mediated by T cells.
cytotoxic [sī-tō-TÖK-sīk] cell cyto-, cell + toxic	T cell that helps in destruction of infected cells throughout the body.
gamma globulin [GÄ-mă GLÖB-yū-līn]	Antibodies given to prevent or lessen certain diseases.
helper cell	T cell that stimulates the immune response.
humoral [HYŪ-mōr-äl] immunity	Resistance to disease provided by plasma cells and antibody production.
immunity [ī-MYŪ-nī-tē] Latin <i>immunitas</i> , freedom from service	Resistance to particular pathogens.
immunization [ĪM-yū-nī-ZÄ-shūn]	Vaccination.
immunoglobulin [ĪM-yū-nō-GLÖB-yū-līn] immuno-, immunity + globulin	Antibody.
interferon [īn-tēr-FĒR-ōn]	Protein produced by T cells and other cells; destroys disease-causing cells with its antiviral properties.
interleukin [īn-tēr-LŪ-kīn] inter-, among + leuk(ocyte)	Protein produced by T cells; helps regulate immune system.
lymph [līmf] Latin <i>lympa</i> , clear spring water	Fluid that contains white blood cells and other substances and flows in the lymphatic vessels.
lymph node	Specialized organ that filters harmful substances from the tissues and assists in the immune response.

Term	Definition
lymphocytes [LĪM-fō-sīts] lympho-, lymph + -cyte, cell	White blood cells made in the bone marrow that are critical to the body's defense against disease and infection.
macrophage [MÄK-rō-fāj] macro-, large + -phage, eating	Special cell that devours foreign substances.
microphage [MĪK-rō-fāj] micro-, small + -phage, eating	Small phagocytic cell that devours foreign substances.
natural immunity	Inherent resistance to disease found in a species, race, family group, or certain individuals.
pathogen [PÄTH-ō-jěn] patho-, disease + -gen, producing	Disease-causing agent.
phagocytosis [FÄG-ō-sī-TŌ-sīs] phagocyt(e) + -osis, condition	Ingestion of foreign substances by specialized cells.
plasma [PLÄZ-mă] cell	Specialized lymphocyte that produces immunoglobulins.
spleen [splēn] Greek <i>splen</i>	Organ of lymph system that filters and stores blood, removes old red blood cells, and activates lymphocytes.
suppressor [sū-PRĚS-ōr] cell	T cell that suppresses B cells and other immune cells.
T cells	Specialized white blood cells that receive markers in the thymus, are responsible for cellular immunity, and assist with humoral immunity.
thymosin [THĪ-mō-sĭn]	Hormone secreted by the thymus gland that aids in distribution of thymocytes and lymphocytes.
thymus [THĪ-mŭs] gland Greek <i>thymos</i> , sweetbread	Soft gland with two lobes that is involved in immune responses; located in mediastinum.
T lymphocytes	See T cells.
vaccination [VÄK-sĭ-NÄ-shŭn] Latin <i>vaccinus</i> , relating to a cow	Injection of an antigen from a different organism to cause active immunity.
vaccine [vāk-SĒN, VÄK-sĕn]	Antigen developed from a different organism that causes active immunity in the recipient.

CASE STUDY

Researching a Cure

Some hospitals are part of large university complexes. These hospitals often do many kinds of research and offer tertiary care, medical care at a center that has a unit specializing in certain diseases. They may provide data on drug trials. They may work on improving diagnostic testing. Some research is focused on diseases that are infectious and for which there is not yet a cure. The goal of many studies is to produce a vaccine.

Critical Thinking

1. Why would researchers want to produce a vaccine?
2. What form of immunity would a vaccination provide?

STRUCTURE AND FUNCTION EXERCISES

Find a Match

Match the correct definition in the right-hand column with the terms in the left-hand column.

- | | |
|--------------------------|----------------------------------------------------------|
| 3. ____ T cell | a. T cell that helps destroy foreign cells or substances |
| 4. ____ pathogen | b. T cell that regulates the amounts of antibody |
| 5. ____ immunoglobulin E | c. T cell that stimulates antibody production |
| 6. ____ IgD | d. antibody important in B-cell activation |
| 7. ____ helper cell | e. agent given to prevent or lessen disease |
| 8. ____ cytotoxic cell | f. lymphocyte associated with cellular immunity |
| 9. ____ suppressor cell | g. helps produce resistance to a disease or a poison |
| 10. ____ antitoxin | h. protein produced by B cells that fight foreign cells |
| 11. ____ antibody | i. disease-causing agent |
| 12. ____ gamma globulin | j. antibody associated with allergic reactions |

Check Your Knowledge

Fill in the blanks

13. People are born with some _____ immunity.
14. Vaccinations give _____ immunity.
15. Antitoxins give _____ immunity.
16. The special cells that ingest foreign substances are called _____.
17. Lymph contains _____ blood cells.
18. The thymus gland provides markers for cells that become _____.
19. Agents of T cells that destroy disease-causing cells are _____ and _____.
20. The fluid in the space between tissues is called _____.

Combining Forms and Abbreviations

The lists below include combining forms and abbreviations that relate specifically to the lymphatic and immune systems. Pronunciations are provided for the examples.

COMBINING FORM	MEANING	EXAMPLE
aden(o)	gland	<i>adenocarcinoma</i> [ĂD-ē-nō-kăř-sĭ-NŌ-mă], glandular cancer
immun(o)	immunity	<i>immunosuppressor</i> [ĬM-yū-nō-sŭ- PRĚS-ōr], agent that suppresses the immune response
lymph(o)	lymph	<i>lymphocyte</i> [LĬM-fō-sĭt], white blood cell associated with the immune response

COMBINING FORM	MEANING	EXAMPLE
lymphaden(o)	lymph nodes	<i>lymphadenopathy</i> [lĭm-făd-ĕ-NŎP-ă-thē], disease affecting the lymph nodes
lymphangi(o)	lymphatic vessels	<i>lymphangitis</i> [lĭm-făn-JĪ-tĭs], inflammation of the lymphatic vessels
splen(o)	spleen	<i>splenectomy</i> [splē-NĚK-tō-mē], removal of the spleen
thym(o)	thymus	<i>thymectomy</i> [thĭ-MĚK-tō-mē], removal of the thymus
tox(o), toxi, toxico	poison	<i>toxicosis</i> [tŏk-sĭ-KŎ-sĭs], systemic poisoning

ABBREVIATION	MEANING	ABBREVIATION	MEANING
AIDS	acquired immunodeficiency syndrome	CML	chronic myelogenous leukemia
ALL	acute lymphocytic leukemia	CMV	cytomegalovirus
AML	acute myelogenous leukemia	EBV	Epstein-Barr virus
AZT	Azidothymidine	EIA, ELISA	Enzyme-linked immunosorbent assay
CLL	chronic lymphocytic leukemia	HIV	human immunodeficiency virus
HSV	herpes simplex virus	IgM	immunoglobulin M
IgA	immunoglobulin A	PCP	Pneumocystis carinii pneumonia
IgD	immunoglobulin D	SLE	systemic lupus erythematosus
IgE	immunoglobulin E	ZDV	Zidovudine
IgG	immunoglobulin G		

CASE STUDY

Checking for Immunity

Jill, a three-year-old girl, was playing barefoot in her backyard when she stepped on a rusty nail. The nail punctured her skin and made her vulnerable to tetanus, a muscle disease (see Chapter 5). Jill is up to date on all her vaccinations. The most common early childhood vaccination is DPT (diphtheria, pertussis, and tetanus). The vaccinations last for a number of years.

Critical Thinking

- Is it likely that Jill will contract tetanus? Why or why not?
- What type of immunity to tetanus does Jill have?

COMBINING FORMS AND ABBREVIATIONS EXERCISES

Build Your Medical Vocabulary

Fill in the missing word part.

23. Removal of lymph nodes: _____ectomy

24. Hemorrhage from a spleen: _____rrhagia
25. Tumor of the thymus: _____oma
26. Lacking in some immune function: _____deficient
27. Cell of a gland: _____cyte
28. Skin disease caused by a poison: _____derma
29. Dilation of the lymphatic vessels: _____ectasis
30. Resembling lymph: _____oid

Find a Match

Match the term on the left with the correct definition on the right.

- | | |
|-----------------------------|--------------------------------------------|
| 31. ____ toxicologist | a. anemia resulting from a poison |
| 32. ____ splenomegaly | b. malignancy in the lymphatic vessels |
| 33. ____ lymphangiosarcoma | c. cystic mass containing lymph |
| 34. ____ splenomyelomalacia | d. inflammation of a lymph node |
| 35. ____ lymphocele | e. spleen enlargement |
| 36. ____ lymphadenitis | f. expert in the science of poisons |
| 37. ____ toxanemia | g. softening of the spleen and bone marrow |

Diagnostic, Procedural, and Laboratory Terms

Abnormalities of lymph organs can be checked in a CAT scan. Several blood tests that indicate the number and condition of white blood cells are used in diagnosing lymph and immune systems diseases. HIV infection is diagnosed mainly with two blood serum tests, **enzyme-linked immunosorbent assay (EIA, ELISA)** and **Western blot**. ELISA tests blood for the antibody to the HIV virus (as well as antibodies to other specific viruses, such as hepatitis B), and the Western blot is a confirming test for the presence of HIV antibodies. A diagnosis of AIDS is made on the basis of the presence of opportunistic infections and T cell counts in specified ranges.

Allergy tests are performed by an allergist. Tests usually consist of some form of exposure to a small amount of the suspected allergen to see if a reaction occurs. Now there are even home allergy tests available that can detect allergies by testing a small amount of blood.

VOCABULARY REVIEW

In the previous section, you learned terms relating to diagnosis, clinical procedures, and laboratory tests. Before going on to the exercises, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Definition
enzyme-linked immunosorbent assay (EIA, ELISA [ĕ-LĪ-ză, ĕ-LĪ-să])	Test used to screen blood for the presence of antibodies to different viruses or bacteria.
Western blot	Test primarily used to check for antibodies to HIV in serum.

DIAGNOSTIC, PROCEDURAL, AND LABORATORY TERMS EXERCISES

Check Your Knowledge

Circle T for true or F for false.

38. The ELISA tests for HIV. T F
39. A Western blot determines if Hepatitis B is present. T F
40. An analysis of white blood cells can help in diagnosing lymph and immune system diseases. T F

CASE STUDY

Handling the Emergency

Kyle, a seven-year-old boy, came to the emergency room at the hospital in respiratory distress. His mother says that he often has respiratory allergies. He was taken to the imaging area for chest x-rays. His lungs show some restricted areas. He is also given a thorough medical exam to make sure that nothing other than an allergic reaction is causing the breathing difficulties. If the examination is normal, Kyle will be sent to an allergist to

determine the cause of his allergic reaction. The resident performing the exam marks the patient's record as shown below.

Critical Thinking

41. Why did Kyle need a thorough physical exam?
42. Did the physical exam show any abnormalities other than respiratory allergies?

GENERAL: He is a well-developed, well-nourished male in moderate respiratory distress.

HEENT: Tympanic membranes unremarkable. Eyes, nose, mouth, and throat normal.

NECK: No masses. Supple.

LUNGS: Breath sounds clear bilaterally with somewhat decreased air exchange and diffuse expiratory wheeze. Work of breathing is mildly to moderately increased.

CARDIAC: No murmur or gallop. Pulses 2+ and symmetrical.

ABDOMEN: Soft and nontender without organomegaly or mass.

GU: Normal male.

EXTREMITIES: Unremarkable.

NEUROLOGIC: Alert and appropriate. Cranial nerves intact. Reflexes 2+ and symmetrical.

Pathological Terms

Diseases of the lymph and immune systems include diseases that attack lymph tissue itself; diseases that are spread through the lymphatic pathways; and diseases that flourish because of a suppression of the immune response. Disorders of the lymph and immune systems can be caused by an overly vigorous response to an immune system invader. This is the case with some diseases of other body systems, such as multiple sclerosis, in which the immune system attacks some of the nervous system's protective covering, myelin. It is also the case with **allergy**, an immune overresponse to a stimulus.

The most widespread virus that attacks the immune system is the **human immunodeficiency virus (HIV)**, a virus spread by sexual contact, exchange of bodily fluids, or intravenous exposure. A person may be *HIV positive*, meaning that the person carries the HIV virus but has not yet come down with HIV infections (diseases that tend to occur in HIV-positive people) or been given a diagnosis of AIDS. Many people are HIV positive without knowing it; only a test can make that diagnosis when there are no symptoms. Figure 13-6 shows an HIV virus.

The CDC has a group called the Divisions of HIV/AIDS prevention (www.cdc.gov/hiv/dhap.htm) that provides up-to-date information on prevention, research, and testing.

AIDS

AIDS or **acquired immunodeficiency syndrome** is the most widespread **immunosuppressive disease**, a disease that suppresses the ability of the immune system to defend against infection. AIDS is a complex of symptoms and caused by the HIV virus. The HIV virus is a type of **retrovirus**, a ribonucleic acid (RNA) that causes reversal of normal cell copying. The retro- (reverse) is the opposite of the ordinary method of DNA copying itself onto RNA.

AIDS patients are subject to a number of **opportunistic infections**, infections that a healthy immune system can easily fight off but take hold because of the lowered immune response. Many of these infections are present in other body systems. Table 13-1 lists some opportunistic infections commonly present in AIDS patients and the parts of the body affected.

FIGURE 13-6 A microscopic picture of an HIV virus.

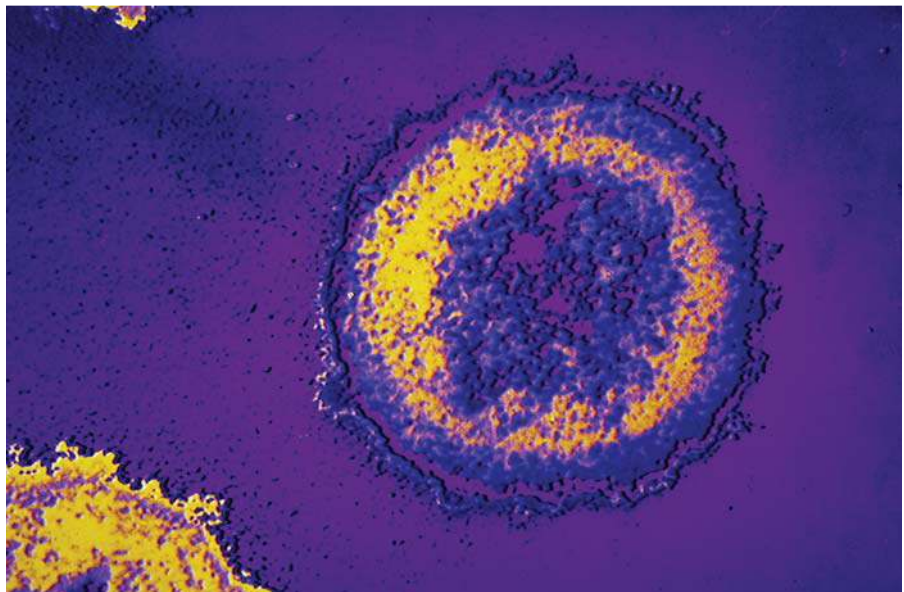


TABLE 13-1 Some Opportunistic Malignancies and Infections That Often Accompany AIDS

Opportunistic Infection	Type of Malignancy or Infection	Areas Affected
candidiasis	caused by fungus— <i>Candida albicans</i>	digestive tract, respiratory tract, skin, and some reproductive organs (particularly the vagina)
cytomegalovirus	Herpesviridae	can infect various cells or organs (like the eyes); causes swelling
Kaposi's sarcoma	malignancy arising from capillary linings	skin and lymph nodes
<i>Mycobacterium avium-intracellulare</i> (MAI)	caused by bacterium found in soil and water	systemic infection with fever, diarrhea, lung and blood disease, and wasting
<i>Pneumocystis carinii</i> pneumonia (PCP)	caused by parasite— <i>Pneumocystis carinii</i>	lungs—a particularly dangerous type of pneumonia

AIDS affects the entire body, with diseases such as herpes, candidiasis, and Kaposi's sarcoma appearing on the skin, and *Pneumocystis carinii* pneumonia (PCP) appearing in the lungs.

Other Immune System Disorders

Opportunistic infections also attack the immune systems of people with immunosuppressive disorders other than AIDS. Any recipient of an organ transplant must take immunosuppressive drugs to avoid organ rejection.

MORE ABOUT . . .

Contracting AIDS

When the AIDS epidemic began in the United States, many people feared that the HIV virus could be spread by casual contact. In fact, time has shown that there are very few specific ways it can be transmitted. These are the ways that AIDS is transmitted and how it is not transmitted.

How HIV Is Transmitted

Sexual contact, particularly vaginal, anal, and oral intercourse

Contaminated needles (intravenous drug use, accidental needle stick in medical setting)

During birth from an infected mother

Receiving infected blood or other tissue (rare; precautions usually prevent this)

How HIV Is NOT Transmitted

Casual contact (social kissing, hugging, handshakes)

Objects—toilet seats, deodorant sticks, doorknobs

Mosquitoes

Sneezing and coughing

Sharing food

Swimming in the same water as an infected person

These drugs leave the patient open to opportunistic infections. There are a number of other immunosuppressive disorders. Some are congenital and may be inherited. Others are a result of disease; for example, a severe case of diabetes can weaken the immune system.

Lymphoma, cancer of the lymph nodes, is a relatively common cancer with high cure rates. Some AIDS patients are especially susceptible to lymphomas because of their lowered immune systems. There are many different types of lymphomas. Two of the most common are **Hodgkin's lymphoma (Hodgkin's disease)**, a type of lymph cancer of uncertain origin that generally appears in early adulthood, and **non-Hodgkin's lymphoma**, a cancer of the lymph nodes with some cells resembling healthy cells and spreading in a diffuse pattern. It usually appears in mid-life. Depending on how far the disease has spread (**metastasis**), both types can be arrested with chemotherapy and radiation. Surgery (bone marrow transplantation) is also useful in Hodgkin's lymphoma.

Malignant tumors appear in many places in the lymph system. A **thymoma** is a tumor of the thymus gland. Hodgkin's lymphoma is a malignancy of the lymph nodes and spleen. Enlarged lymph nodes, enlarged spleen (**splenomegaly**), and overactive spleen (**hypersplenism**) characterize this disease. Non-Hodgkin's lymphoma is a disease with malignant cells that resemble large lymphocytes (**lymphocytic lymphoma**) or large macrophages called *histiocytes* (hence the name **histiocytic lymphoma**).

Nonmalignant lesions on the lymph nodes, lungs, spleen, skin, and liver can indicate the presences of **sarcoidosis**, an inflammatory condition that can affect lung function. Swollen lymph nodes (**lymphadenopathy**) can also indicate the presence of **infectious mononucleosis**, an acute infectious disease caused by the Epstein-Barr virus. Infectious mononucleosis is often called the "kissing disease," because it is usually transmitted through mouth-to-mouth contact during kissing, sharing drinks, and sharing eating utensils. Rest is generally the only cure.

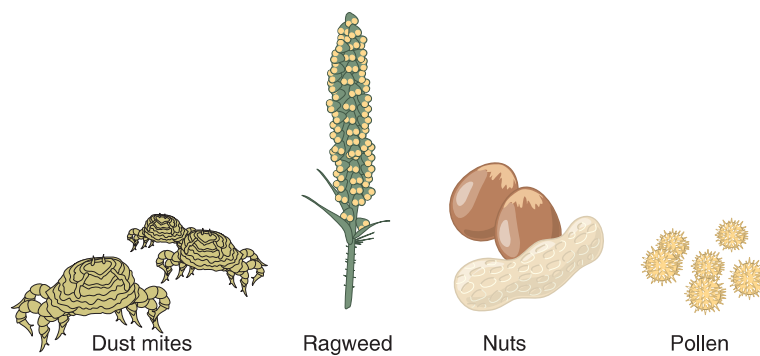
The Allergic Response

Allergies are a problem of the immune system that affect millions of people. They are due to the production of IgE antibodies against an **allergen**, an allergy-causing substance (Figure 13-7). Antibodies and some antigens cause a histamine to be released into the tissues. This histamine release is the cause of the symptoms of allergies.

Allergies vary for different people depending on time of year, amount of exposure to different allergens, and other immunological problems.

The Lymphoma Research Foundation (www.lymphoma.org) is dedicated to assisting people with lymphoma and related diseases and ultimately to eradicating the disease.

FIGURE 13-7 Some common allergens that provoke a response in many people.



Hypersensitivity increases as exposure increases, sometimes resulting in **anaphylaxis** (or *anaphylactic reaction* or *shock*), a reaction so severe that it can be life-threatening by decreasing blood pressure, affecting breathing, and causing loss of consciousness. Some people are extremely allergic to peanuts. A person with a severe peanut allergy who ingests even a tiny amount of peanuts (as in a cookie) will immediately go into an anaphylactic reaction. Some people are allergic in the same way to other foods and to bee stings. Most severely allergic people carry a dose of epinephrine to slow the reaction.

The Food Allergy and Anaphylaxis Network (www.foodallergy.org) provides up-to-date information about foods that have been recalled due to undeclared potentially allergic products such as peanuts and milk hidden in them.

Autoimmune Disorders

The immune system can also turn against its own healthy tissue. **Autoimmune diseases**, such as rheumatoid arthritis, lupus, and scleroderma, result from the proliferation of T cells that react as though they were fighting a virus, but are actually destroying healthy cells. **Autoimmune responses** often result from the body's need to fight an actual infection, during which the immune system becomes overactive.

The American Autoimmune and Related Diseases Association (www.aarda.org) keeps track of autoimmune diseases and provides helpful patient information.

VOCABULARY REVIEW

In the previous section, you learned terms relating to pathology. Before going on to the exercises, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Definition
acquired immunodeficiency [ĪM-yū-nō-dē-FĪSH-ĕn-sē] syndrome	AIDS.
AIDS [ādz]	Most widespread immunosuppressive disease; caused by the HIV virus.
allergen [ĀL-ĕr-jēn] allerg(y) + -gen, producing	Substance to which exposure causes an allergic response.
allergy [ĀL-ĕr-jē]	Production of IgE antibodies against an allergen.
anaphylaxis [ĀN-ă-fī-LĀK-sīs]	Life-threatening allergic reaction.
autoimmune [ăw-tō-ī-MYŪN] disease auto-, self + immune	Any of a number of diseases, such as rheumatoid arthritis, lupus, and scleroderma, caused by an autoimmune response.
autoimmune response	Overactivity in the immune system against the body, causing destruction of one's own healthy cells.
histiocytic [HĪS-tē-ō-SĪT-ĭk] lymphoma	Lymphoma with malignant cells that resemble histiocytes.
Hodgkin's lymphoma, Hodgkin's disease After Thomas Hodgkin (1798–1866), British physician	Type of lymph cancer of uncertain origin that generally appears in early adulthood.

Term	Definition
human immunodeficiency virus (HIV) [ĤM-yū-nō-dē-FĬSH-ĕn-sē]	Virus that causes AIDS; spread by sexual contact, exchange of body fluids, and shared use of needles.
hypersensitivity [HĬ-pĕr-sĕn-sĭ-TĬV-ĭ-tē] hyper-, excessive + sensitivity	Abnormal reaction to an allergen.
hypersplenism [hĭ-pĕr-SPLĒN-ĭzm]	Overactive spleen.
immunosuppressive [ĤM-yū-nō-sŭ-PRĚS-ĭv] disease	Disease that flourishes because of lowered immune response.
infectious mononucleosis [MŌN-ō-nŭ-klē-Ō-sĭs] mono-, one + nucle(us) + -osis, condition	Acute infectious disease caused by the Epstein-Barr virus.
lymphadenopathy [lĭm-făd-ĕ-NŌP-ă-thē]	Swollen lymph nodes.
lymphocytic [lĭm-fō-SĬT-ĭk] lymphoma	Lymphoma with malignant cells that resemble large lymphocytes.
lymphoma [lĭm-FŌ-mă] lymph-, lymph + -oma, tumor	Cancer of the lymph nodes.
metastasis [mě-TĂS-tă-sĭs] Greek, a removing	Spread of a cancer from a localized area.
non-Hodgkin's lymphoma	Cancer of the lymph nodes with some cells resembling healthy cells and spreading in a diffuse pattern.
opportunistic [ŏp-pŏr-tŭ-NĬS-tĭk] infection	Infection that takes hold because of lowered immune response.
retrovirus [rĕ-trō-VĬ-rŭs]	Type of virus that spreads by using the body's DNA to help it replicate its RNA.
sarcoidosis [sărkŏy-DŌ-sĭs] sarcoid, former word for sarcoma + -osis	Inflammatory condition with lesions on the lymph nodes and other organs.
splenomegaly [splĕn-ō-MĚG-ă-lē] spleno-, spleen + -megaly, enlargement	Enlarged spleen.
thymoma [thĭ-MŌ-mă] thym(us) + -oma, tumor	Tumor of the thymus gland.

CASE STUDY

Helping to Manage a Disease

University Hospital has an extensive oncology department involved in research. Jane Bryant is a 32-year-old woman with AIDS. Recently, Kaposi's sarcoma has appeared on her arms and back. She was referred to the oncology department for chemotherapy. In addition, her doctors prescribed a new medication that increases T cell count and the effectiveness of the immune response.

Critical Thinking

43. What might be the advantage for a chronically ill person to be treated in a research hospital?
44. Jane has AIDS, an immunosuppressive disease. Why is she being referred to the oncology department?

PATHOLOGICAL TERMS EXERCISES

Spell It Correctly

Put a C after each word that is spelled correctly; if a word is incorrectly spelled, write it correctly.

45. retorvirus_____

46. immunosuppressive_____

47. imunodeficiency_____

48. sarcodosis_____

49. lumphoma_____

50. mononucleosis_____

51. anphylaxis_____

52. histocytic_____

53. metastasis_____

54. thimoma_____

Check Your Knowledge

For each of the following statements, write either lymph or immune in the blank to complete the sentence.

55. Allergies involve a(n) _____ response.

56. Splenomegaly is a symptom of _____ system disease.

57. Multiple sclerosis is a disease in which the _____ system attacks some of the body's cells.

58. Sarcoidosis is an inflammatory condition of the _____ system.

59. AIDS is a disease of the _____ system.

Surgical Terms

Cancers of the lymph system may require a **lymph node dissection**, removal of cancerous lymph nodes for microscopic examination. A **lymphadenectomy** is the removal of a lymph node, and a **lymphadenotomy** is an incision into a lymph node. A **splenectomy** is removal of the spleen, which is usually required if it is ruptured. Other organs of the body, such as the liver, will take over the functions of the spleen if it is removed. A **thymectomy** is removal of the thymus gland, which is very important to the maturation process but not as serious once a patient reaches adulthood.

MORE ABOUT . . .

Lymph Node Surgery

A person with a malignant neoplasm in the breast must have further tests to determine if the cancer has metastasized. In the past, biopsies included removal of many lymph nodes until one without cancer was found. Now, a procedure called sentinel node biopsy is commonly used. A contrast medium is injected into the area around the tumor. The first node it reaches is the sentinel node. It is checked for malignancy. If that node is clean, then no further biopsy is done on the other lymph nodes, and the patient is spared painful surgical side effects.

VOCABULARY REVIEW

In the previous section, you learned terms relating to surgery. Before going on to the exercises, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms.

Sometimes information about where the word came from is included after the term. The etymologies (word histories) are for your information only. You do not need to memorize them.

Term	Definition
lymphadenectomy [lĭm-făd-ĕ-NĚK-tō-mē] lymphaden-, lymph node + -ectomy, removal	Removal of a lymph node.
lymphadenotomy [lĭm-făd-ĕ-NŎ-tō-mē] lymphadeno-, lymph node + -tomy, a cutting	Incision into a lymph node.
lymph node dissection	Removal of a cancerous node for microscopic examination.
splenectomy [splē-NĚK-tō-mē] splen-, spleen + -ectomy	Removal of the spleen.
thymectomy [thī-MĚK-tō-mē] thym(us) + -ectomy	Removal of the thymus gland.

CASE STUDY

Getting an Examination

John Latella, a patient with AIDS, came to the hospital's clinic for his monthly T cell test and to review the medications he is taking. He seems to be feeling more energetic, so John believes his T cell test will show improvement. During the examination, however, the doctor notices an enlargement in John's lymph nodes. He sends John to the outpatient surgical unit for a biopsy.

Critical Thinking

60. If the node is malignant, what kind of surgery will most likely be performed?
61. A malignancy may have to be treated with radiation and/or chemotherapy, both of which destroy some healthy cells at the same time that they destroy malignant cells. Why would such treatment be especially risky for an AIDS patient?

SURGICAL TERMS EXERCISES

Build Your Medical Vocabulary

Write and define the lymph and immune system combining forms in the following words.

- | | |
|--------------------|------------------|
| 62. splenectomy | 64. thymectomy |
| 63. lymphadenotomy | 65. lymphangioma |

Pharmacological Terms

Diseases of the lymph and immune systems are often treated with relatively high doses of chemotherapy and/or radiation. Advances in AIDS research have made it possible to manage this disease (i.e., to prolong patient's life) once thought fatal. A "cocktail" of anti-HIV drugs, a potential HIV/AIDS vaccine, and other newer drug compounds are bringing hope for long-term vitality to people with AIDS. Other drug compounds have been developed to fight opportunistic infections. Table 13-2 lists some of the important immune system medications.

TABLE 13-2 Medications Used to Treat Disorders of the Lymphatic and Immune Systems

Drug Class	Purpose	Generic	Trade Name
antiviral used in AIDS	to block virus growth	zidovudine lopinavir and ritonavir didanosine stavudine, lamivudine, and nevirapine	Retrovir, AZT Kaletra Videx Triomune
antimicroorganism agent used in AIDS	to prevent PCP	pentamidine	Pentam 300
antihistamines		loratidine diphenhydramine fexofenadine	Claritin Benadryl Allegra

Genetic research is focusing on all the major chronic diseases. While diseases of the lymphatic and immune systems do not currently have specific genetic therapies, many researchers believe that advances in genetic therapies will bring relief for many of these diseases.

CASE STUDY

Getting Good News

John Latella's biopsy reveals that the node is not malignant. The swelling is thought to be an infection. Further blood tests show that it is. John already takes a number of prophylactic medications aimed at preventing infection. For this infection, he is put on a course of antibiotics.

Critical Thinking

66. Why does John find it difficult to fight infections?
67. What results are the antibiotics supposed to provide?

PHARMACOLOGICAL TERMS EXERCISES

Check Your Knowledge

Fill in the blanks.

68. AIDS patients often have to take many medications, including some to avoid _____ infections.
69. Lymphomas are generally treatable with _____ and _____.
70. One AIDS drug that blocks virus growth is _____.
71. One body substance manufactured and given in high doses in immune disorders is _____.

CHALLENGE SECTION

The clinic at University Hospital is treating a young woman with AIDS. She is monitored monthly at the clinic. Her latest blood test is shown on the next page.

Critical Thinking

72. Is this lab test a test for AIDS?
73. Which lab test results are indicative of opportunistic infection?

Laboratory Report University Hospital 3 Center Drive Westford, NH 11114 900-546-8000			
Patient: Amy Carr Date Collected: 04/30/XXXX Date Received: 04/30/XXXX	Patient ID: 099-00-1200 Time Collected: 16:05 Date Reported: 5/06/XXXX	Date of Birth: 12/04/81 Total Volume: 2000	
Test	Result	Flag	Reference
<i>Complete Blood Count</i>			
WBC	13.2	*	3.9-11.1
RBC	4.11		3.80-5.20
HCT	39.7		34.0-47.0
MCV	96.5		80.0-98.0
MCH	32.9		27.1-34.0
MCHC	34.0		32.0-36.0
MPV	8.6		7.5-11.5
NEUTROPHILS %	45.6		38.0-80.0
NEUTROPHILS ABS.	1.82		1.70-8.50
LYMPHOCYTES %	36.1		15.0-49.0
LYMPHOCYTES ABS.	1.44		1.00-3.50
EOSINOPHILS %	4.5		0.0-8.0
EOSINOPHILS ABS.	0.18		0.03-0.55
BASOPHILS %	0.7		0.0-2.0
BASOPHILS ABS.	0.03		0.000-0.185
PLATELET COUNT	229		150-400
<i>Automated Chemistries</i>			
GLUCOSE	80		65-109
UREA NITROGEN	17		6-30
CREATININE (SERUM)	0.6		0.5-1.3
UREA NITROGEN/CREATININE	28		10-29
SODIUM	140		135-145
POTASSIUM	4.4		3.5-5.3
CHLORIDE	106		96-109
CO ₂	28		20-31
ANION GAP	6		3-19
CALCIUM	9.8		8.6-10.4
PHOSPHORUS	3.6		2.2-4.6
AST (SGOT)	28		0-30
ALT (SGPT)	19		0-34
BILIRUBIN, TOTAL	0.5		0.2-1.2
PROTEIN, TOTAL	7.8		6.2-8.2
ALBUMIN	4.3		3.5-5.0
GLOBULIN	3.5		2.1-3.8
URIC ACID	2.4		2.0-7.5
CHOLESTEROL	172		120-199
TRIGLYCERIDES	68		40-199
IRON	85		30-150
HDL CHOLESTEROL	54		35-59
CHOLESTEROL/HDL RATIO	3.2		3.2-5.7
LDL, CALCULATED	80		70-129
T3, UPTAKE	32		24-37
T4, TOTAL	6.9		4.5-12.8

USING THE INTERNET

Go to the CDC's National Prevention Information Network (<http://www.cdcnpin.org>) and choose an article from one of their featured publications. Write a paragraph summarizing the content of the article.

CHAPTER REVIEW

The material that follows is to help you review this chapter.

Check Your Knowledge

Circle T for true and F for false

74. An antigen is a specialized protein that fights disease. T F
75. A T cell that helps in destruction of infected cells throughout the body is known as a cytotoxic cell. T F
76. Pathogens are prevented from entering the body by the skin, the cilia in the nostrils, and by various mucus membranes. T F
77. A person develops natural immunity by either having a disease or by being vaccinated against the disease. T F
78. Rheumatoid arthritis, lupus, and scleroderma are considered to be autoimmune diseases. T F

Find the Match

Write the letter of the definition for each term in the space provided.

- | | |
|---------------------------------|----------------------------------------------------|
| 79. ____ immunoglobulin G (IgG) | a. appears in glandular secretions |
| 80. ____ immunoglobulin A (IgA) | b. first antibody to be produced after infection |
| 81. ____ immunoglobulin M (IgM) | c. assists in B cell activity |
| 82. ____ immunoglobulin D (IgD) | d. effective against bacteria, viruses, and toxins |
| 83. ____ immunoglobulin E (IgE) | e. common in exocrine gland secretions |

Find the Match

Write the letter of the definition for each term in the space provided.

- | | |
|---------------------------|-------------------------------------------------------------|
| 84. ____ antigen | a. CD4 cells that stimulate the immune response |
| 85. ____ antibody | b. T cells that suppress B cells and other immune cells |
| 86. ____ helper cells | c. any substance that can provoke an immune response |
| 87. ____ cytotoxic cells | d. specialized protein that fights disease |
| 88. ____ suppressor cells | e. CD8 cells that help in the destruction of infected cells |

Build Your Medical Vocabulary

Divide each of the following terms into words parts and then define the term.

89. lymphangiogram: _____
90. thymopathy: _____
91. lymphadenopathy: _____
92. splenomalacia: _____
93. splenorrhagia: _____

DEFINITIONS

Define and pronounce each of the following terms. The terms in the curly blue brackets refer to the Spanish glossary available online at www.mhhe.com/medterm3e.

WORD

94. acquired active immunity
95. acquired passive immunity
96. acquired immunodeficiency [ĬM-yū-nō-dē-FĬSH-ĕn-sē] syndrome
97. aden(o)
98. AIDS
99. allergen [ĂL-ĕr-jĕn] {**alergeno**}
100. allergy [ĂL-ĕr-jē] {**alergia**}
101. anaphylaxis [ĂN-ă-fĭ-LĂK-sĭs] {**anafilaxia o anafilaxis**}
102. antibody [ĂN-tē-bōd-ē] {**anticuerpo**}
103. antigen [ĂN-tĭ-jĕn] {**antígeno**}
104. antitoxin [ăn-tē-TÖK-sĭn] {**antitoxina**}
105. autoimmune [ăw-tō-ĭ-MYŪN] disease
106. autoimmune response
107. B lymphocytes [LĬM-fō-sĭts], B cells
108. cell-mediated immunity
109. cytotoxic [sĭ-tō-TÖK-sĭk] cell
110. enzyme-linked immunosorbent assay (EIA, ELISA)
111. gamma globulin [GĂ-mă GLÖB-yū-lĭn]
112. helper cell
113. histiocytic [HĬS-tē-ō-SĬT-ĭk] lymphoma
114. Hodgkin's lymphoma, Hodgkin's disease
115. human immunodeficiency [ĬM-yū-nō-dē-FĬSH-ĕn-sē] virus (HIV)
116. humoral [HYŪ-mōr-ăl] immunity
117. hypersensitivity [HĬ-pĕr-sĕn-sĭ-TĬV-ĭ-tē] {**hipersensibilidad**}
118. hypersplenism [hĭ-pĕr-SPLĒN-izm]
119. immun(o)
120. immunity [ĭ-MYŪ-nĭ-tē] {**inmunidad**}
121. immunization [ĬM-yū-nĭ-ZĂ-shŭn]
122. immunoglobulin [ĬM-yū-nō-GLÖB-yū-lĭn] {**inmunoglobina**}
123. immunosuppressive [ĬM-yū-nō-sŭ-PRĒS-ĭv] disease
124. infectious mononucleosis [MÖN-ō-nŭ-klē-Ō-sĭs]
125. interferon [ĭn-tĕr-FĒR-ōn]
126. interleukin [ĭn-tĕr-LŪ-kĭn] {**interleucina**}
127. lymph [lĭmf] {**linfa**}
128. lymph(o)
129. lymphaden(o)
130. lymphadenectomy [lĭm-făd-ĕ-NĚK-tō-mē] {**linfadenectomía**}
131. lymphadenopathy [lĭm-făd-ĕ-NŌP-ă-thē] {**linfadenopatía**}
132. lymphadenotomy [lĭm-făd-ĕ-NŌ-tō-mē]
133. lymphangi(o)
134. lymph node
135. lymph node dissection
136. lymphocytes [LĬM-fō-sĭts] {**linfocitos**}
137. lymphocytic [lĭm-fō-SĬT-ĭk] lymphoma
138. lymphoma [lĭm-FŌ-mă] {**linfoma**}
139. macrophage [MĂK-rō-făj] {**macrófago**}
140. metastasis [mĕ-TĂS-tă-sĭs] {**metastasis**}
141. microphage [MĬK-rō-făj] {**micrófago**}
142. natural immunity
143. non-Hodgkin's lymphoma
144. opportunistic [ōp-pōr-tŭ-NĬS-tĭk] infection
145. pathogen [PĂTH-ō-jĕn] {**patógeno**}
146. phagocytosis [FĂG-ō-sĭ-TŌ-sĭs] {**fagocitosis**}
147. plasma [PLĂZ-mă] cell
148. retrovirus [rĕ-trō-VĬ-rŭs] {**retrovirus**}
149. sarcoidosis [săr-kōy-DŌ-sĭs] {**sarcoidosis**}
150. spleen [splĕn] {**bazo**}
151. splen(o)
152. splenectomy [splĕ-NĚK-tō-mē] {**esplenectomía**}
153. splenomegaly [splĕn-ō-MĒG-ă-lē]

WORD

- | | | |
|-------------------------------------------------|------------------------------------------|----------------------------------------------------|
| 154. suppressor [sŭ-PRĚS-
ōr] cell | 158. thymoma [thī-MŌ-mă]
{timoma} | 162. tox(o), toxi, toxico |
| 155. T cells | 159. thymosin [THĪ-mō-sĭn]
{timosina} | 163. vaccination [VĀK-sĭ-NĀ-
shŭn] {vacunación} |
| 156. thym(o) | 160. thymus [THĪ-mŭs] gland | 164. vaccine [vāk-SĔN, VĀK-sĕn]
{vacuna} |
| 157. thymectomy [thī-MĚK-tō-mē]
{timectomía} | 161. T lymphocytes | 165. Western blot |

Abbreviations

Write the full meaning of each abbreviation

ABBREVIATION

- | | | |
|-----------|-----------------|----------|
| 166. AIDS | 173. EBV | 180. IgG |
| 167. ALL | 174. EIA, ELISA | 181. IgM |
| 168. AML | 175. HIV | 182. PCP |
| 169. AZT | 176. HSV | 183. SLE |
| 170. CLL | 177. IgA | 184. ZDV |
| 171. CML | 178. IgD | |
| 172. CMV | 179. IgE | |

Name _____ Date _____

Chapter 13: Word- Building (20 questions—1 pts. each)

Using the following combining forms, complete the word that best fits the definition of each word relating to the lymphatic and immune systems listed below. Combining forms may be used more than once.

aden(o) splen(o)
immun(o) thym(o)
lymph(o) tox(o)
lymphaden(o) toxi
lymphangi(o) toxico

1. Cell formed in lymph: _____ cyte
2. Agent that suppresses an immune response: _____ suppressant
3. Imaging of lymph nodes: _____ ography
4. Discharge of lymph into urine: _____ uria
5. Glandular tumor: _____ oma
6. Hernia in the spleen: _____ cele
7. Circulation of lymph: _____ kinesis
8. Cell that develops in the thymus: _____ cyte
9. Inflammation of lymph nodes: _____ itis
10. Therapy that stimulates the immune system: _____ therapy
11. Tumor in thymal tissue: _____ oma
12. Obstruction of lymph flow: _____ stasis
13. Morbid fear of poisoning: _____ phobia
14. Glandular cell: _____ cyte
15. Susceptible to poisons: _____ phil
16. Formation of lymphatic tissue: _____ poiesis
17. Poisonous: _____ ferous
18. Muscle tumor with glandular parts: _____ myoma
19. Anemia resulting from a poison: _____ anemia
20. Enlarged spleen: _____ megaly