

# Protecting Health

## 15.1 [Nutrition, Exercise, and Health](#)

## 15.2 [The Excretory System](#)

## 15.3 [The Innate Immune System](#)

## 15.4 [The Acquired Immune System](#)



## Summary of Terms

- **Acquired immune system** A set of highly specific body defenses that respond to specific features of pathogens.
- **Antibody** A large, Y-shaped protein that binds to a pathogen's antigen, disabling the pathogen or marking it for destruction.
- **Antigen** A molecule or part of a molecule belonging to a pathogen that is recognized by cells of the acquired immune system.
- **B cells** Cells of the acquired immune system that react to pathogens in bodily fluids such as blood or lymph.
- **Innate immune system** A set of nonspecific body defenses that work against many different pathogens.
- **Kidneys** The paired organs of the excretory system that filter blood and produce urine.
- **Lymph** A clear fluid inside lymph vessels that contains large numbers of immune cells.
- **Memory cells** Immune cells made by the acquired immune system that remain in the body for a long time; these cells initiate a rapid, aggressive attack if the same pathogens are encountered again, providing some immunity during repeat exposures to the same pathogens.
- **Minerals** Inorganic substances required as components of various body tissues, such as calcium for bones and teeth and iron for hemoglobin.
- **Nephron** The functional unit of a kidney; it filters waste molecules from blood to produce urine.
- **Pathogens** Disease-causing agents such as bacteria, viruses, or other organisms.
- **T cells** Cells of the acquired immune system that attack pathogens inside the body's cells, such as those infected by viruses, as well as the body's own malfunctioning cells.



- **Vitamins** Organic molecules that are essential nonprotein components of certain enzymes; important components of our diet.

## Detailed Chapter Summary

From their diets, people ideally should obtain Calories to support their activities, a complete protein, and vitamins and minerals in small amounts. Exercise is a crucial part of any healthy lifestyle and provides an extremely wide variety of health benefits. Metabolic syndrome is an increasing health issue and is associated with carrying extra weight as well as insulin resistance.

The excretory system filters blood, removing wastes while leaving useful molecules behind. One important waste is urea, produced when amino acids are broken down to make ATP. The excretory system also controls the amount of water in the body, as well as levels of different ions and molecules in the blood. The kidneys are made up of functional units called nephrons. Each nephron is associated with a cluster of capillaries. Blood pressure pushes fluid from the capillaries into Bowman's capsule, a structure of the nephron. This fluid, called the filtrate, is initially very similar to blood plasma. From Bowman's capsule, the filtrate moves into the proximal tubule. In the proximal tubule, "good" molecules are transported from the filtrate back into the blood and waste molecules are transported from the blood to the filtrate. The filtrate then enters the loop of Henle, where water is reabsorbed. From the loop of Henle, the filtrate moves into the distal tubule, where more wastes are transported into the filtrate. Finally, the filtrate moves down the collecting duct. There, more water is reabsorbed if antidiuretic hormone is present. The filtrate is now urine. Urine flows from the collecting duct into the renal pelvis and then to the bladder, where it is stored for later release when convenient.

The immune system protects the body against a variety of pathogens. The lymphatic system includes a network of lymph vessels containing lymph, a clear fluid. The lymphatic system helps return fluids to the circulatory system. Lymph also carries many immune cells. A large number of immune cells are concentrated at lymph nodes in the body.

The innate immune system includes nonspecific body defenses that work against many different pathogens. Skin and mucous membranes provide barriers to the entry of pathogens. Mucous membranes are not as tough as skin, but they are covered with a layer of mucus that helps trap pathogens. Many mucous membranes are also flushed by fluids, such as tears, saliva, etc. Innate immune cells have receptors that recognize molecules found in many different kinds of pathogens. The innate immune system retains no memory of pathogens it has encountered in the past. In the inflammatory response, injury causes the release of molecules called histamines. The release of histamines results in increased blood flow and swelling, as well as the attraction of many innate immune cells to the site of injury.

The acquired immune system includes a set of highly specific body defenses. These are described as "acquired" because they become active only when features of specific pathogens are encountered. Each acquired immune cell has receptors that respond to a single antigen (a molecule or part of a molecule that belongs to a pathogen). All in all, there are over 10 million receptors in the acquired immune system, many more than are found in the innate immune system. The acquired immune system takes longer than the innate immune system to launch an effective response. However, the acquired immune system retains a memory for pathogens encountered in the past, and subsequent responses to the same pathogen are strong and rapid. This memory explains why you catch many diseases only once. It is also the basis for vaccines. B cells are made in the bone marrow and also mature there. B cells are a type of acquired immune cell that reacts to pathogens in body fluids. Activated B cells produce clones that release



large numbers of Y-shaped antibodies that bind to antigens on pathogens. The binding can interfere with the function of pathogens, mark them, or cause them to clump together. T cells are made in the bone marrow but mature in the thymus, and they are another type of acquired immune cell. T cells target pathogens inside body cells as well as the body's own malfunctioning cells. T cells mark infected or malfunctioning body cells for destruction and then kill them.

Vaccines rely on the memory cells produced by the acquired immune system to protect us from disease. A vaccine works by exposing someone to a pathogen's antigens, but without infecting them with the pathogen itself. Finally, some diseases of the immune system include autoimmune diseases and AIDS.

