CHAPTER 7

Skin Structure, Growth, and Nutrition

Chapter Outline

Learning Objectives

After completing this chapter, you will be able to:

- ☑ **LO1** Describe the structure and composition of the skin.
- ☑ **LO2** List the functions of the skin.
- ☑ **LO3** List the classes of nutrients essential for good health.
- ☑ **LO4** List the food groups and dietary guidelines recommended by the U.S. Department of Agriculture (USDA).
- ☑ **LO5** List and describe the vitamins that can help the skin.

Key Terms

Page number indicates where in the chapter the term is used.

acne (acne vulgaris)
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arrector pili muscles
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callus
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collagen
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comedo (blackhead)
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dermal papillae
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dermatologist
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dermatology
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dermis (derma, corium, cutis, true skin)
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elastin
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epidermal–dermal junction
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epidermis
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esthetician
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eumelanin
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keratin
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melanin
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melanocytes
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motor nerve fibers
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papillary layer
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papule (pimple)
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pheomelanin
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Propionibacterium acnes (P. acnes)
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pustule
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reticular layer
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sebaceous glands (oil glands)
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sebum
pg. 163

secretory coil
pg. 162

secretory nerve fibers
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sensory nerve fibers
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stratum corneum (horny layer)
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stratum germinativum (basal cell layer)
pg. 158

stratum granulosum (granular layer)
pg. 157

stratum lucidum
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stratum spinosum
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subcutaneous tissue (adipose tissue, subcutis tissue)
pg. 159

sudoriferous glands (sweat glands)
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tactile corpuscles
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vitamin A
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vitamin C
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vitamin D
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vitamin E
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Clear, glowing skin is one of today's most important hallmarks of beauty. No matter how advanced the latest skin care technology may be, you still have to learn how to care for your client's skin and know what you should do to keep it healthy. That means you must study the structure of the skin, how skin grows, and why it is important to maintain a healthy diet.

Why Study Skin Structure, Growth, and Nutrition?

Cosmetologists should study and have a thorough understanding of skin structure, growth, and nutrition because:

- Knowing the skin's underlying structure and basic needs is crucial in order to provide excellent skin care for clients.
- You will need to recognize adverse conditions, including skin diseases, inflamed skin, and infectious skin disorders so that you can refer clients to medical professionals for treatment when necessary.
- Twenty-first century skin care has entered the realm of high technology so you must learn about and understand the latest developments in ingredients and state-of-the-art delivery systems in order to help protect, nourish, and preserve the health and beauty of your clients' skin.

Anatomy of the Skin

The medical branch of science that deals with the study of skin—its nature, structure, functions, diseases, and treatment—is called **dermatology** (dur-muh-TAHL-uh-jee). A **dermatologist** (dur-muh-TAHL-uh-jist) is a physician who specializes in diseases and disorders of the skin, hair, and nails. Dermatologists attend four years of college, four years of medical school, and about four years of specialty training in dermatology. Because some skin symptoms may be a sign of internal disease, many dermatologists have additional training in internal medicine.

Cosmetologists may be allowed to clean skin, preserve the health of skin, and beautify the skin, depending on the laws and regulations of their state. In some states, a cosmetologist must become an esthetician in order to perform services on the skin. An **esthetician** specializes in the cleansing, beautification, and preservation of the health of skin on the entire body, including the face and neck.

Cosmetologists are not allowed to diagnose, prescribe, or provide any type of treatment for abnormal conditions, illnesses, or diseases. Cosmetologists refer clients with medical issues to dermatologists more than to any other type of physician.

The skin is the largest organ of the body. If the skin of an average adult were stretched out, it would cover over 3,000 square inches and weigh about 6 to 9 pounds. Our skin protects the network of muscles, bones, nerves, blood vessels, and everything else inside our bodies. It is the only natural barrier between our bodies and the environment.

Healthy skin should be free of any visible signs of disease, infection, or injury. It is slightly moist, soft, and flexible. Ideally, healthy skin has a smooth, fine-grained texture (feel and appearance). The surface of healthy skin is slightly acidic, and its immune responses react quickly to organisms that touch or try to enter it. Appendages of the skin include hair, nails, and sudoriferous (sweat) and sebaceous (oil) glands.

Continued, repeated pressure on any part of the skin, especially the hands and feet, can cause it to thicken and develop into a **callus** (KAL-us), which is an important and needed protective layer that prevents damage to the underlying skin.

The skin of the scalp is constructed similarly to the skin elsewhere on the human body, but the scalp has larger and deeper hair follicles to accommodate the longer hair of the head.

The skin is composed of two main divisions: the epidermis and the dermis (**Figure 7–1**).

The **epidermis** (ep-uh-DUR-mis) is the outermost and thinnest layer of the skin. It contains no blood vessels, but has many small nerve endings. The epidermis is made up of five layers.

- The **stratum corneum** (STRAT-um KOR-nee-um), also known as **horny layer** (HOR-nee LAY-ur), is the outer layer of the epidermis. The stratum corneum is the layer we see when we look at the skin and is the layer cared for by salon products and services. Its scale-like cells are continually being shed and replaced by cells coming to the surface from underneath. These cells are made up of **keratin** (KAIR-uh-tin), a fibrous protein that is also the principal component of hair and nails. The cells combine with lipids (fats) produced by the skin to help make the stratum corneum a protective, water-resistant layer.
- The **stratum lucidum** (STRAT-um LOO-sih-dum) is the clear, transparent layer under the stratum corneum; it consists of small cells through which light can pass.
- The **stratum granulosum** (STRAT-um gran-yoo-LOH-sum), also known as **granular layer** (GRAN-yuh-lur LAY-ur), is the layer of the epidermis that is composed of cells that look like granules and are filled with keratin. The cells die as they are pushed to the surface to replace dead cells that are shed from the stratum corneum.

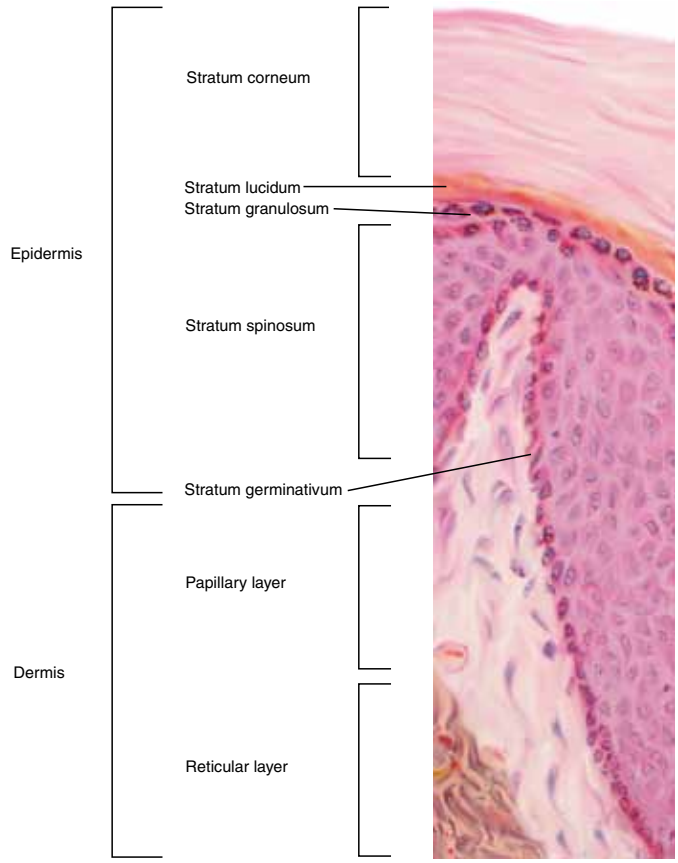
did you know?

A callus is nature's way of protecting the skin from damage and infection. Complete removal of a callus is a medical procedure that should not be performed in the salon.

did you know?

The skin located under our eyes and around the eyelids is the thinnest skin of the body. The skin on the palms of our hands and soles of our feet is the thickest skin.

▶ **Figure 7–1**
Layers of the skin.



did you know?

The epidermis is only 0.04 millimeter (mm) to 1.5 mm thick. One millimeter is .039 of an inch.

- The **stratum spinosum** (STRAT-um spy-NOH-sum), is the spiny layer just above the stratum germinativum. The spiny layer is where the process of skin cell shedding begins.
- The **stratum germinativum** (STRAT-um jer-mih-nah-TIV-um), also known as **basal cell layer** (CEL LAY-ur), is the deepest layer of the epidermis. This is the live layer of the epidermis that produces new epidermal skin cells and is responsible for the growth of the epidermis. It is composed of several layers of differently shaped cells. The stratum germinativum also contains special cells called **melanocytes** (muh-LAN-uh-syts), which produce the dark skin pigment called melanin. Melanin protects the sensitive cells in the dermis (which is located below the epidermis) from the destructive effects of excessive ultraviolet (UV) light from the sun or from ultraviolet lamps. Melanin is discussed in greater detail later in this chapter.

The **dermis** (DUR-mis), also known as **derma** (DUR-muh), **corium** (KOH-ree-um), **cutis** (KYOO-tis), or **true skin**, is the underlying or inner layer of the skin. The dermis extends to form the subcutaneous tissue. The highly sensitive dermis layer of connective tissue is about 25 times thicker than the epidermis. Within its structure, there are numerous blood vessels, lymph vessels, nerves, sudoriferous (sweat) glands, sebaceous (oil) glands, and hair follicles, as well as arrector pili muscles. **Arrector pili muscles** (ah-REK-tohr PY-leh MUS-uls) are the small, involuntary muscles in the base of the hair that cause goose flesh—or *goose bumps*, as many people call them—and papillae. The

dermis is comprised of two layers: the papillary (superficial layer) and the reticular (deeper layer).

- The **papillary layer** (PAP-uh-lair-ee LAY-ur) is the outer layer of the dermis, directly beneath the epidermis. Here you will find the **dermal papillae** (DUR-mul puh-PIL-eye) (singular: dermal papilla; DUR-mul puh-PIL-uh), which are small, cone-shaped elevations at the base of the hair follicles. Some papillae contain looped capillaries, and others contain small epidermal structures called **tactile corpuscles** (TAK-tile KOR-pusuls), with nerve endings that are sensitive to touch and pressure. This layer also contains melanocytes, the pigment-producing cells. The top of the papillary layer where it joins the epidermis is called the **epidermal–dermal junction** (ep-ih-DUR-mul-DUR-mul JUNK-shun).
- The **reticular layer** (ruh-TIK-yuh-lur LAY-ur) is the deeper layer of the dermis that supplies the skin with all of its oxygen and nutrients. It contains the following structures within its network:
  - Fat cells
  - Blood vessels
  - Lymph vessels
  - Sebaceous (oil) glands
  - Sudoriferous (sweat) glands
  - Hair follicles
  - Arrector pili muscles
  - Nerve endings

did you know?

Goose bumps often appear on your skin when you are cold or scared. You most likely will see them on the areas of your skin that have little hair.

Subcutaneous tissue (sub-kyoo-TAY-nee-us TISH-oo), also known as **adipose tissue** (AD-uh-pohs TISH-oo) or **subcutis tissue** (sub-KYOO-tis TISH-oo), is the fatty tissue found below the dermis. It gives smoothness and contour to the body, contains fats for use as energy, and also acts as a protective cushion for the skin. Subcutaneous tissue varies in thickness according to the age, gender, and general health of the individual (**Figure 7–2**).

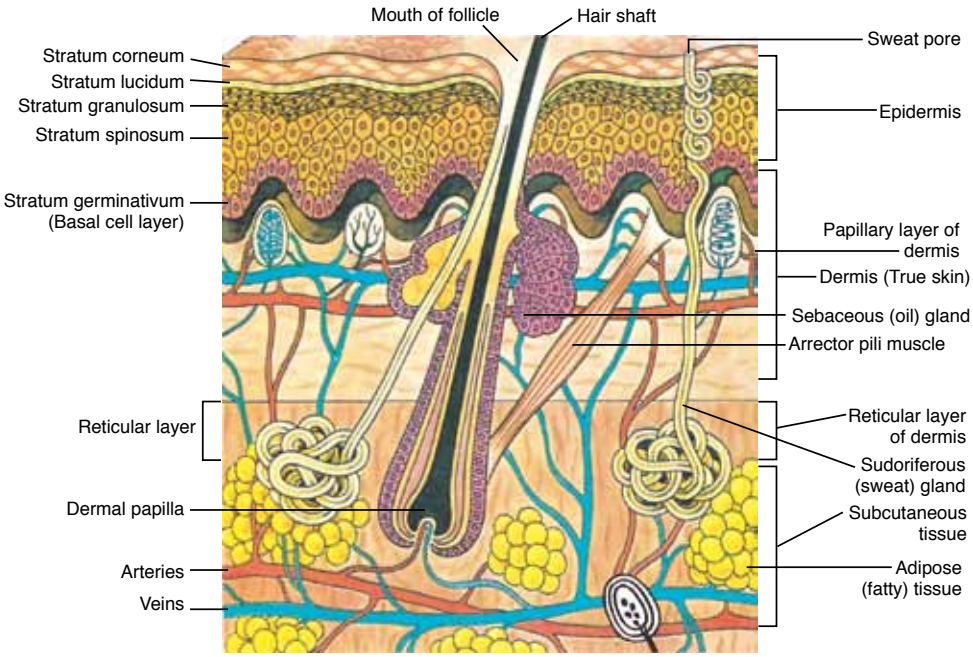


Figure 7–2
Structures of the skin.

How the Skin is Nourished

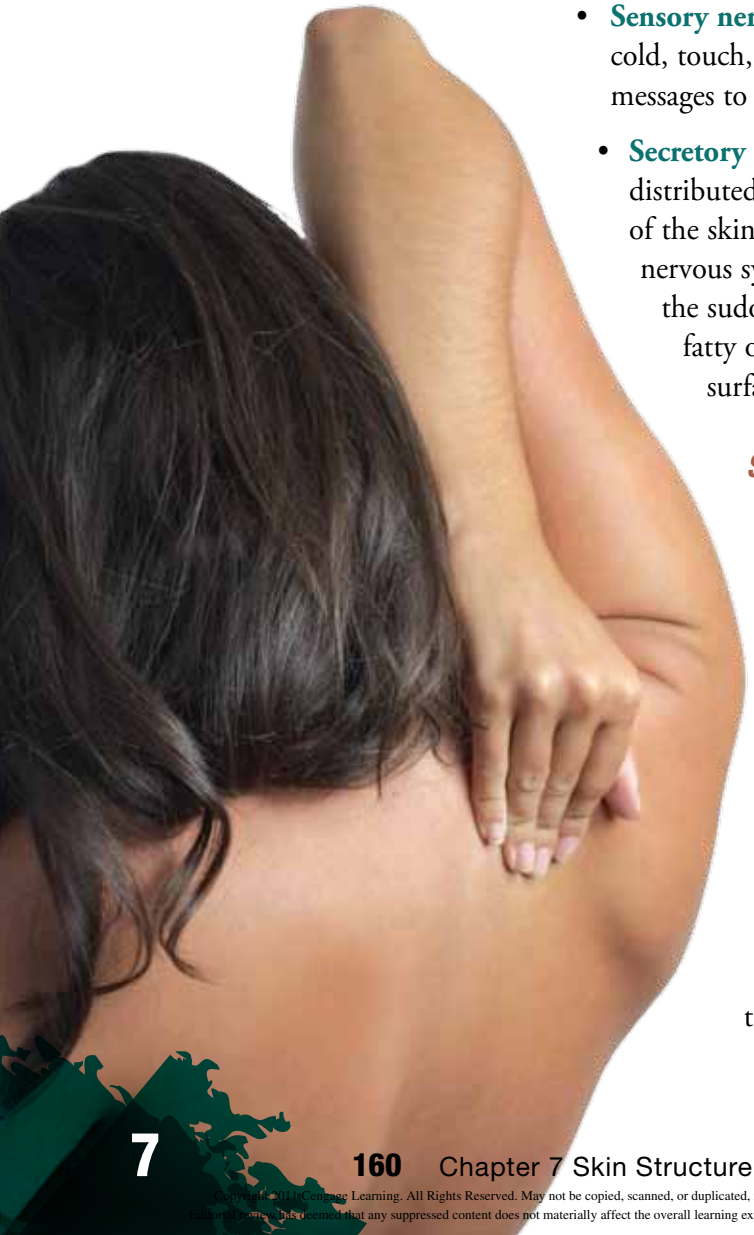
Blood supplies nutrients and oxygen to the skin. Nutrients are molecules from food, such as protein, carbohydrates, and fats. These nutrients are necessary for cell life, repair, and growth. The skin cannot be nourished properly from the outside in with cosmetic products; it must have nourishment from foods that we eat.

Lymph, the clear fluids of the body that bathe the skin cells, remove toxins and cellular waste, and have immune functions that help protect the skin and body against disease. Networks of arteries and lymph vessels in the subcutaneous tissue send their smaller branches to hair papillae, hair follicles, and skin glands.

Nerves of the Skin

The skin contains the surface endings of the following nerve fibers:

- **Motor nerve fibers** (MOH-tur NURV FY-burs) are distributed to the arrector pili muscles attached to the hair follicles. Motor nerves carry impulses from the brain to the muscles.
- **Sensory nerve fibers** (SEN-soh-ree NURV FY-burs) react to heat, cold, touch, pressure, and pain. These sensory receptors send messages to the brain.
- **Secretory nerve fibers** (seh-KREE-toh-ree NURV FY-burs) are distributed to the sudoriferous (sweat) and sebaceous (oil) glands of the skin. Secretory nerves, which are part of the autonomic nervous system, regulate the excretion of perspiration from the sudoriferous glands and control the flow of sebum (a fatty or oily secretion of the sebaceous glands) to the surface of the skin.



Sense of Touch

The papillary layer of the dermis houses the nerve endings that provide the body with the sense of touch, pain, heat, cold, and pressure. Nerve endings are most abundant in the fingertips. Complex sensations, such as vibrations, seem to depend on the sensitivity of a combination of these nerve endings.

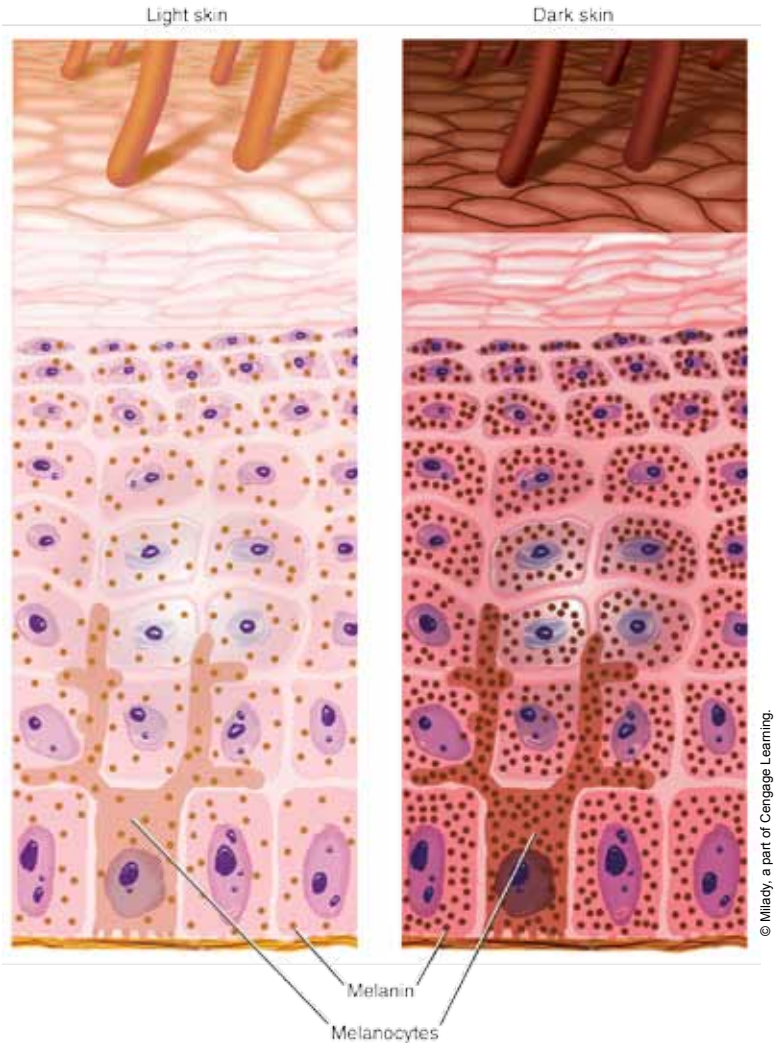
Skin Color

The color of the skin—whether fair, medium, or dark—depends primarily on **melanin** (MEL-ah-nin), the tiny grains of pigment (coloring matter) that are produced by melanocytes and then deposited into cells in the stratum germinativum layer of the epidermis and the papillary layers of the dermis. The color of the skin is

a hereditary trait and varies among races and nationalities. Genes determine the amount and type of pigment produced in an individual.

The body produces two types of melanin: **pheomelanin** (fee-oh-MEL-uh-nin), which is red to yellow in color, and **eumelanin** (yoo-MEL-uh-nin), which is dark brown to black. People with light-colored skin mostly produce pheomelanin, while those with dark-colored skin mostly produce eumelanin. The size of melanin granules varies from one individual to another.

Melanin helps protect sensitive cells from the sun's UV light, but it does not provide enough protection to prevent skin damage. Daily use of a sunscreen with a sun protection factor (SPF) of 15 or higher can help the melanin protect the skin from burning, skin cancer, and premature aging (**Figure 7–3**).



▼ **Figure 7–3**
Melanocytes in the epidermis produce melanin.

Strength and Flexibility of the Skin

The skin gets its strength, form, and flexibility from two specific structures found within the dermis: collagen and elastin. These two structures are composed of flexible protein fibers, and they make up 70 percent of the dermis.

Collagen (KAHL-uh-jen) is a fibrous protein that gives the skin form and strength. This fiber makes up a large percentage of the dermis and provides structural support by holding together all the structures found in this layer. When collagen fibers are healthy, they allow the skin to stretch and contract as needed. If collagen fibers become weakened due to age, lack of moisture, environmental damage such as UV light, or frequent changes in weight, the skin will begin to lose its tone and suppleness. Wrinkles and sagging are often the result of collagen fibers losing their strength.

Elastin (ee-LAS-tin) is a protein base similar to collagen that forms elastic tissue. Elastin is interwoven with the collagen fibers. Elastin fiber gives the skin its flexibility and elasticity. It helps the skin regain its shape, even after being repeatedly stretched or expanded. Elastin can be weakened by the same factors that weaken collagen.

Both types of fibers are important to the overall health and appearance of the skin. As we age, gravity causes these fibers to weaken. In the end, a loss of elasticity results in sagging skin.

A majority of scientists now believe that most signs of skin aging are caused by sun exposure over a lifetime. Using high-SPF sunscreen,

did you know?

The word *collagen* comes from the Greek words *kolla,* meaning glue, and *gennan*, meaning to produce.

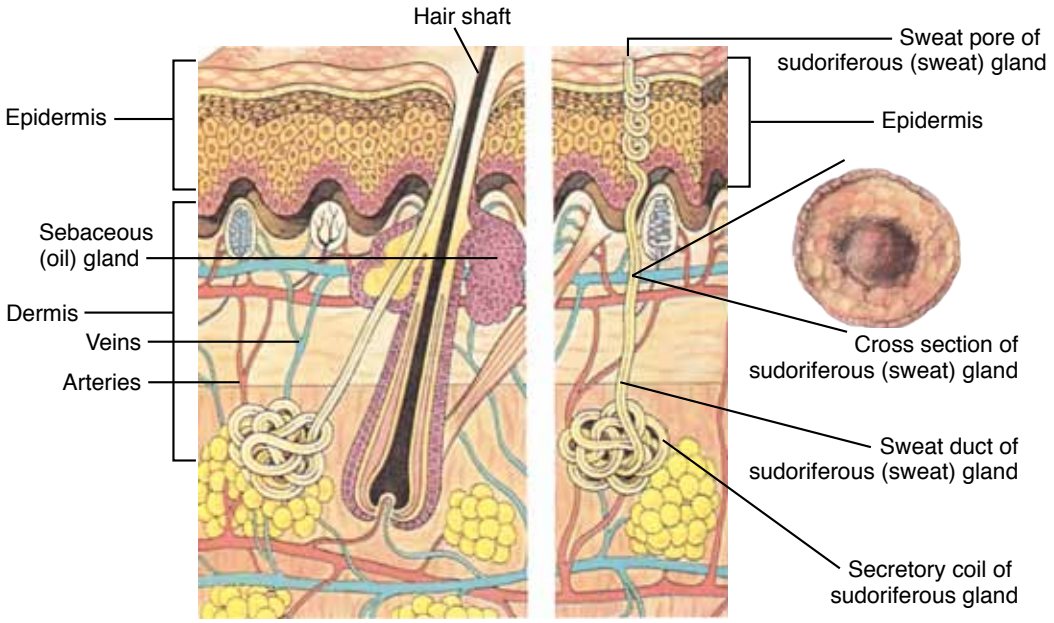


Figure 7–4
Sudoriferous gland and sebaceous gland.

maintaining a moisturizing skin-care regimen, and keeping skin free of disease will slow the weakening of collagen and elastin fibers and help skin look young longer.

Glands of the Skin

The skin contains two types of duct glands that extract materials from the blood to form new substances. These are sudoriferous glands and sebaceous glands. (See **Figure 7–4.**)

did you know?

Our bodies stop producing elastin around the age of 12 or 13. So what happens when the body stops producing elastin? The skin begins to age.

Sudoriferous (Sweat) Glands

Sudoriferous glands (sood-uh-RIF-uhrus GLANZ), also known as **sweat glands**, excrete perspiration and detoxify the body by excreting excess salt and unwanted chemicals. They consist of a **secretory coil** (seh-KREET-toh-ree KOYL), the coiled base of the sudoriferous gland, and a tube-like sweat duct that ends at the surface of the skin to form the sweat pore. Practically all parts of the body are supplied with sudoriferous glands, which are more numerous on the palms of the hands, the soles of the feet, the forehead, and the underarm (armpit).

The sudoriferous glands regulate body temperature and help eliminate waste products from the body. The evaporation of sweat cools the skin's surface. The activity of sudoriferous glands is greatly increased by heat, exercise, emotions, and certain drugs.

The excretion of sweat is controlled by the nervous system. Normally, 1 to 2 pints of salt-containing liquids are eliminated daily through sweat pores in the skin.

Sebaceous (Oil) Glands

Sebaceous glands (sih-BAY-shus GLANZ), also known as **oil glands**, are connected to the hair follicles. They consist of little sacs with ducts that open into the follicles. These glands secrete **sebum** (SEE-bum), a fatty or oily substance that lubricates the skin and preserves the softness of the hair. With the exception of the palms of the hands and the soles of the feet, these glands are found in all parts of the body, particularly in the face and scalp, where they are larger.

Ordinarily, sebum flows through the oil ducts leading to the mouths of the hair follicles. However, when the sebum hardens and the duct becomes clogged, a pore impaction called a **comedo** (KAHM-uh-doe) (plural: comedones; KAHM-uh-dohnz), also known as **blackhead**, a hair follicle filled with keratin and sebum, is formed. This can lead to acne, a papule, or a pustule.

Acne (AK-nee), also known as **acne vulgaris** (AK-nee vull-GAIR-us), is a skin disorder characterized by chronic inflammation of the sebaceous glands from retained secretions and bacteria known as **Propionibacterium acnes** (pro-PEE-ah-nee-back-tear-ee-um AK-nes), abbreviated P. acnes, the technical term for acne bacteria. A **papule** (PAP-yool), also known as **pimple**, is a small elevation on the skin that contains no fluid but may develop pus. A **pustule** (PUS-chool) is a raised, inflamed papule with a white or yellow center containing pus in the top of the lesion referred to as the head of the pimple. ☑ **LO1**

did you know?

Touch is one of the first senses to develop in the human body.

Functions of the Skin

The six principal functions of the skin are protection, sensation, heat regulation, excretion, secretion, and absorption.

- **Protection** The skin protects the body from injury and bacterial invasion. The outermost layer of the epidermis is rendered water-resistant by a thin layer of sebum and fatty lipids. The fatty lipids exist between the cells and are produced through the cell renewal process. This outermost layer is resistant to wide variations in temperature, minor injuries, chemically active substances, and many forms of bacteria.
- **Sensation** By stimulating different sensory nerve endings, the skin responds to heat, cold, touch, pressure, and pain. When the nerve endings are stimulated, a message is sent to the brain. You respond by saying "Ouch" if you feel pain, by scratching if you have an itch, or by pulling

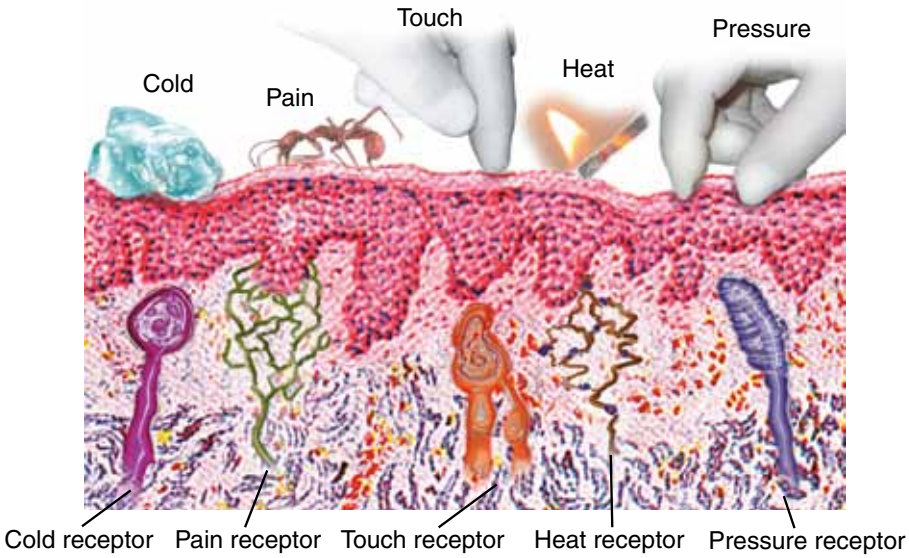


Figure 7–5
Sensory nerve endings in the skin.

away if you touch something hot. Some sensory nerve endings are located near hair follicles (**Figure 7–5**).

- **Heat regulation** The skin protects the body from the environment. A healthy body maintains a constant internal temperature of about 98.6 degrees Fahrenheit (37 degrees Celsius). As changes occur in the outside temperature, the blood and sudoriferous glands of the skin make necessary adjustments to allow the body to be cooled by the evaporation of sweat.
- **Excretion** Perspiration from the sudoriferous glands is excreted through the skin. Water lost through perspiration takes salt and other chemicals with it.
- **Secretion** Sebum is secreted by the sebaceous glands. This oil lubricates the skin, keeping it soft and pliable. Oil also keeps hair soft. Emotional stress and hormone imbalances can increase the flow of sebum.
- **Absorption** Some ingredients can be absorbed by the outer layers of the skin, but very few ingredients can penetrate the epidermis. Small amounts of fatty materials, such as those used in many advanced skin care formulations, may be absorbed between the cells and through the hair follicles and sebaceous gland openings. However, cosmetic products are not formulated to penetrate the epidermis. ☑ **LO2**

Nutrition and Maintaining Skin Health

For your own benefit, as well as for the benefit of your clients, you should have a basic understanding of how to maintain healthy skin by making the right nutritional choices. You have heard people say, "You are what you eat." Mainly, that is very true. To keep the body healthy,

people must ensure that what they eat helps regulate hydration (keeping a healthy level of water in the body), oil production, and overall function of the cells. Skin disorders, fatigue, stress, depression, and some diseases can be caused by an unhealthful diet or improper hydration.

FYI

If you want more information about nutrition, you can go to the USDA's Web site at http://www.usda.gov or the U.S. Department of Health and Human Services' Web site at http://www.hhs.gov and enter a search for the word *nutrition*.

Essential Nutrients

There are six classes of nutrients that the body needs:

- Carbohydrates
- Fats
- Proteins
- Vitamins
- Minerals
- Water

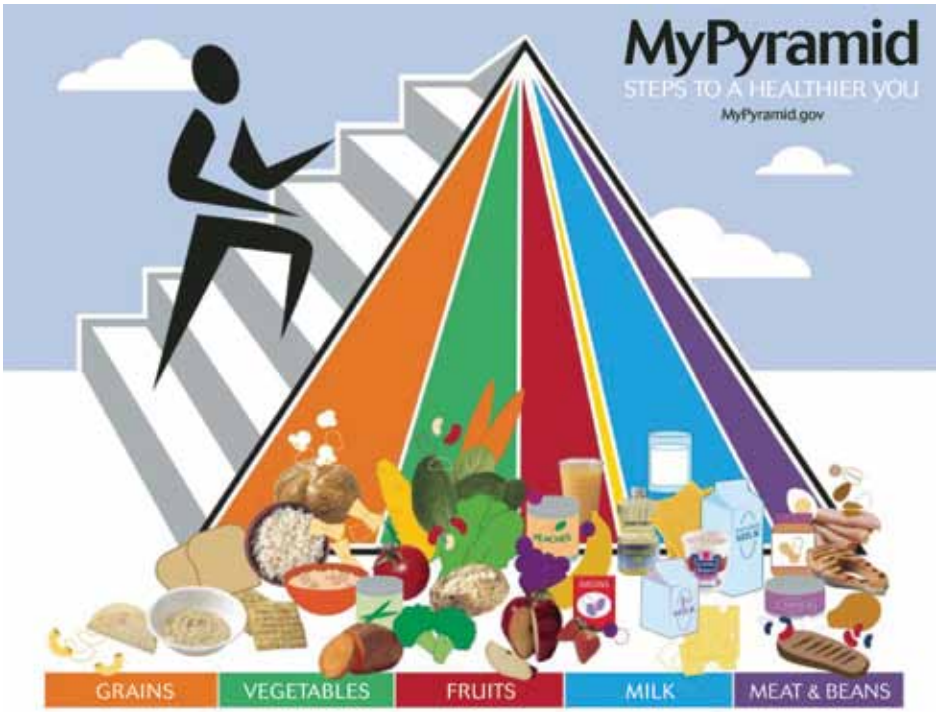
These essential nutrients are obtained through eating and drinking. The body cannot make nutrients in sufficient amounts to sustain itself properly. ✓ **LO3**

The United States Department of Agriculture (USDA) developed a food pyramid to help people determine the amounts of food they need to eat from the five basic food groups. Those food groups are:

- Grains
- Vegetables
- Fruits
- Milk
- Meat, poultry, fish, and beans

Eating the recommended amounts of foods from the five basic groups is the best way to support and maintain the health of the skin. See the recommended daily food amounts in **Figure 7–6**.

In addition to following the recommendations included in the daily food pyramid, the USDA and the United States Department of Health and Human Services have established the dietary guidelines below to assist people with a balanced diet.



Courtesy of U.S. Dept. of Agriculture.

Figure 7–6
Daily food pyramid recommended by the USDA.

- Eat a variety of foods.
- Select a diet that is high in fresh fruits, vegetables, and grain products and low in fats, saturated fat, and cholesterol.
- Eat moderate amounts of salt and sugar, including the sodium and modified sugars that are in prepared food products.
- Drink an appropriate amount of water. (See the formula in the FYI sidebar to determine the appropriate amount of water based on your body weight.)
- Keep consumption of alcoholic beverages to a minimum.
- Balance your diet with the right amount of physical activity.
- Maintain or improve your weight. ✓ **LO4**

FYI

Do you want to know how much water you should drink every day? Here is an easy formula that will tell you the number of ounces of water you should be drinking each day:

Divide your body weight by two. The result is the number of ounces of water that you should drink every day. Example: 160 pounds ÷ 2 = 80 ounces of water.

Keep in mind that the average water bottle that most people carry with them holds just a bit over 16 ounces (1 pint). Therefore, a person who weighs 160 pounds should drink at least 5 bottles of water. (80 ounces ÷ 16 ounces = 5 bottles.)

People who are very active should drink even more water.

One of the best ways to follow a healthy diet is to read food labels. Food labels can help you select healthy foods. Food labels also contain nutrition facts about serving size, number of servings per container, calorie information, and the quantities of nutrients per serving. If you have any questions or concerns about the ingredients or nutritional value of a food product, contact the manufacturer by telephone or through a Web site to obtain supplemental information.

Vitamins and Dietary Supplements

Vitamins play an important role in the skin's health, often aiding in healing and softening the skin and in fighting diseases. Vitamins such as A, C, D, and E have been shown to have positive effects on the skin's health when taken by mouth. If a person's daily food consumption is lacking in nutrients, vitamin and mineral supplements purchased through a health food store, vitamin store, or pharmacy can help provide some of the nutrients needed. Be sure to read the recommended daily allowance (RDA) for each vitamin and mineral supplement. These recommendations are listed on the supplement labels. Again, if you have any questions or concerns about the supplements, especially if the level of any nutrient is over 100 percent of the RDA, contact the manufacturer either by telephone or through a Web site. Remember that vitamins are nutritional supplements, not cosmetic ingredients. In fact, the law prohibits manufactures from claiming that any skin care product or cosmetic has nutritional value.

The following vitamins can help the skin in significant ways:

- **Vitamin A** supports the overall health of the skin and aids in the health, function, and repair of skin cells. It has been shown to improve the skin's elasticity and thickness.
- **Vitamin C** is an important substance needed for the proper repair of the skin and tissues. This vitamin aids in and accelerates

the skin's healing processes. Vitamin C also is vitally important in fighting the aging process and promotes the production of collagen in the skin's dermal tissues, keeping the skin healthy and firm.

- **Vitamin D** enables the body to properly absorb and use calcium, the element needed for proper bone development and maintenance. Vitamin D also promotes rapid healing of the skin.
- **Vitamin E** helps protect the skin from the harmful effects of the sun's UV light. Some people claim that vitamin E helps to heal damage to the skin's tissues when taken by mouth.

Because the nutrients the body needs for proper functioning and survival must come primarily from what we eat and drink, you should not depend on supplements to make up for poor nutrition. If your daily food consumption is lacking in nutrients, you should strive to improve your diet rather than relying on vitamins and mineral supplements to provide nourishment.

Clients may occasionally ask you about nutrition and their skin. **Table 7–1**, RDA Chart for Vitamins and Minerals: Natural Sources, Functions, and Deficiency Symptoms on the pages that follow, is a good reference for selecting foods that promote a healthy body and healthy skin. If clients ask you detailed questions about nutrition, you should tell them to seek the advice of a physician or a nutritionist. ✓ LO5

Water and the Skin

There is one item that no person can live without: water. To function properly, the body relies heavily on the benefits of water. This is especially true when it comes to the skin. Water composes 50 percent to 70 percent of body weight. The amount of water needed by an individual varies, depending on body weight and the level of daily physical activity (**Figure 7–7**).

Drinking pure water is essential to the health of the skin and body because it sustains the health of the cells, assists with the elimination of toxins and waste, helps regulate the body's temperature, and aids in proper digestion. All these functions, when performing properly, help keep the skin healthy, vital, and attractive.

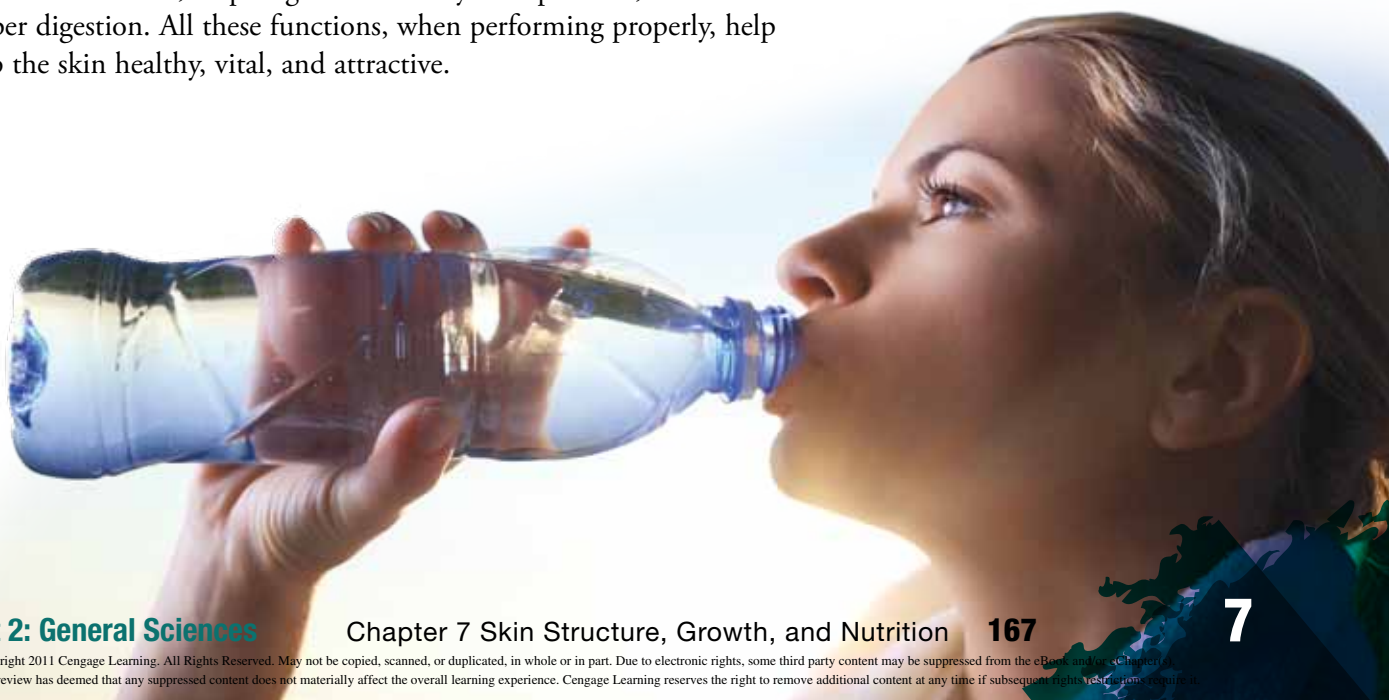
did you know?

Research suggests that many problems may be caused by insufficient water intake. Here are a few:

- Even mild dehydration will slow metabolism by as much as 3 percent.
- Cracked skin on the feet and lips are often warning signs of dehydration.
- Lack of water is the principal cause of daytime fatigue.
- A 2 percent drop in body water can trigger fuzzy short-term memory, trouble with basic computations, and may cause difficulty focusing on a computer screen or printed page.

Pass the water, please!

▼ **Figure 7–7**
Water is essential for healthy skin.



RDA CHART FOR VITAMINS AND MINERALS: NATURAL SOURCES, FUNCTIONS, AND DEFICIENCY SYMPTOMS

VITAMIN/ MINERAL RDA	NATURAL SOURCES	FUNCTIONS	DEFICIENCY SYMPTOMS
A 5,000 IU	Yellow and green fruits and vegetables, carrots, dairy products, fish liver oil, yellow fruits	Growth and repair of body tissues, bone formation, vision	Night blindness, dry scaly skin, loss of smell and appetite, fatigue, bone deterioration
B-1 Thiamine 1.5 mg	Grains, nuts, wheat germ, fish, poultry, legumes, meat	Metabolism, appetite maintenance, nerve function, healthy mental state, muscle tone	Nerve disorders, cramps, fatigue, loss of appetite, loss of memory, heart irregularity
B-2 Riboflavin 1.7 mg	Whole grains, green leafy vegetables, liver, fish, eggs	Metabolism; healthy hair, skin, and nails; cell respiration; formation of antibodies and red blood cells	Cracks and lesions in corners of mouth, digestive disturbances
B-6 Pyridoxine 2 mg	Whole grains, green leafy vegetables, yeast, bananas, organ meats	Metabolism; formation of antibodies; sodium and potassium balance	Dermatitis, blood disorders, nervousness, weakness, skin cracks, loss of memory
B-7 Biotin 300 mcg	Legumes, eggs, grains, yeast	Metabolism, formation of fatty acids	Dry, dull skin, depression, muscle pain, fatigue, loss of appetite
B-12 Cobalamine 6 mcg	Eggs, milk/milk products, fish, organ meats	Metabolism, healthy nervous system, blood cell formation	Nervousness, neuritis, fatigue
Choline (no RDA)	Lecithin, fish, wheat germ, egg yolk, soybeans	Nerve metabolism and transmission; regulation of liver, kidneys, gall bladder	Hypertension, stomach ulcers, liver and kidney conditions
Folic acid Folacin 400 mcg	Green leafy vegetables, organ meats, yeast, milk products	Red blood cell formation and growth and cell division (RNA and DNA)	Gastrointestinal disorders, poor growth, loss of memory, anemia
Inositol (no RDA)	Whole grains, citrus fruits, yeast, molasses, milk	Hair growth, metabolism, lecithin formation	Elevated cholesterol, hair loss, skin disorders, constipation, eye abnormalities
B complex Niacin 20 mg	Meat, poultry, fish, milk products, peanuts	Metabolism; healthy skin, tongue, and digestive system; blood circulation; synthesis of sex hormones	Fatigue, indigestion, irritability, loss of appetite, skin conditions

Table 7–1 RDA Chart for Vitamins and Minerals: Natural Sources, Functions, and Deficiency Symptoms.

(Continues)

VITAMIN/ MINERAL RDA	NATURAL SOURCES	FUNCTIONS	DEFICIENCY SYMPTOMS
B complex PABA (no RDA)	Yeast, wheat germ, molasses	Metabolism, red blood cell formation, intestines, color of hair, sunscreen	Digestive disorders, fatigue, depression, constipation
B-15 Pantothenic acid 10 mg	Whole grains, pumpkin seeds, sesame seeds	Metabolism, stimulation of nerve and glandular systems, cell respiration	Heart disease, glandular disorders, nerve disorders, poor circulation
C Ascorbic acid 60 mg	Citrus fruits, vegetables, tomatoes, potatoes	Healing, collagen maintenance, resistance to disease	Gum bleeding, bruising, slow healing of wounds, nosebleeds, poor digestion
D 400 IU	Egg yolks, organ meats, fish, fortified milk	Healthy bone formation, circulatory function, nervous system function	Rickets, osteoporosis, poor bone growth, nervous system irritability
E 30 IU	Green vegetables, wheat germ, organ meats, eggs, vegetable oils	Formation of red blood cells, inhibition of blood coagulation, cellular respiration	Muscular atrophy, abnormal fat deposits in muscles, gastrointestinal conditions, heart disease, impotency
F (no RDA)	Wheat germ, seeds, vegetable oils	Respiration of body organs, lubrication of cells, blood coagulation, glandular activity	Brittle nails and hair, dry dandruff, diarrhea, varicose veins, underweight, acne, gallstones
K (no RDA)	Green leafy vegetables, milk, kelp, safflower oil	Blood clotting; proper liver function, longevity	Hemorrhage
P Bioflavonoids (no RDA)	Fruits	Construction of healthy connective tissue; utilization of vitamin C	Tendency to bleed easily, gum bleeding, bruising
Calcium 1000–1400 mg	Dairy products, bone meal	Resilient bones, teeth, and muscle tissue; regulation of heartbeat; blood clotting	Soft, brittle bones; osteoporosis; heart palpitations
Chromium (no RDA)	Corn oil, yeast, clams, whole grains	Utilization of glucose, energy, effective use of insulin	Atherosclerosis, diabetic sugar intolerance
Copper 2 mg	Whole grains, green leafy vegetables, seafood, almonds	Healthy red blood cells, bone growth and formation, elastin formation (when joined with vitamin C)	Skin lesions, general weakness, labored respiration

Table 7–1 RDA Chart for Vitamins and Minerals: Natural Sources, Functions, and Deficiency Symptoms. *(Continued)*

VITAMIN/ MINERAL RDA	NATURAL SOURCES	FUNCTIONS	DEFICIENCY SYMPTOMS
Iodine 150 mcg	Iodized table salt, shellfish	Metabolism control	Dry skin and hair, obesity, nervousness, goiters
Iron 18 mg	Meats, fish, green leafy vegetables	Hemoglobin formation, blood quality, resistance to stress and disease	Anemia, constipation, breathing difficulties
Magnesium 400 mg	Nuts, green vegetables, whole grains	Metabolism	Nervousness, agitation, disorientation, blood clots
Manganese 2 mg	Egg yolks, legumes, whole grains	Carbohydrate and fat production, sex hormone production, bone development	Dizziness, loss of muscle coordination
Phosphorus 800 mg	Proteins, grains	Bone development; utilization of protein, fat, and carbohydrates	Soft bones, rickets, loss of appetite, irregular breathing
Potassium 2000 mg	Grains, vegetables, bananas, fruits, legumes	Fluid balance; control of heart muscle, nervous system, kidneys	Irregular heartbeat, muscle cramps (legs), dry skin, general weakness
Sodium 500 mg	Table salt, shellfish, meat, poultry	Maintenance of circulatory, lymphatic, and nervous systems; regulation of body fluid	Muscle weakness, muscle atrophy, nausea, dehydration
Sulphur (no RDA)	Fish, eggs, nuts, cabbage, meat	Formation of collagen, body tissues, and keratin	N/A
Zinc 15 mg	Whole grains, wheat bran	Healthy digestion and metabolism, reproductive system, healing	Stunted growth, delayed sexual maturity, prolonged wound healing
Selenium 70 mcg	Whole grains, liver, meat, fish	Immune system strength	Heart damage, chronic illness
Fluoride	Fluoridated water, toothpaste	Bone formation, tooth formation	Increased tooth decay

Table 7–1 RDA Chart for Vitamins and Minerals: Natural Sources, Functions, and Deficiency Symptoms.

Review Questions

1. Define dermatology.
2. Briefly describe healthy skin.
3. Name the two main divisions of the skin and the layers within each division.
4. List the three types of nerve fibers found in the skin.
5. Can the skin be nourished with cosmetic products?
6. What are collagen and elastin?
7. Explain how collagen and elastin can be weakened.
8. Name the two types of glands contained within the skin and describe their functions.
9. What are the six important functions of the skin?
10. What are the six classes of nutrients that the body needs and how are they obtained?
11. What are the five basic food groups?
12. Name four vitamins that can help the skin and describe how they help.
13. What is the one essential item that no person can live without? Why is it essential to the skin and body?

Chapter Glossary

acne	Also known as *acne vulgaris*; skin disorder characterized by chronic inflammation of the sebaceous glands from retained secretions and Propionibacterium acnes (P. acnes) bacteria.
arrector pili muscles	Small, involuntary muscles in the base of the hair follicle that cause goose flesh, sometimes called *goose bumps*, and papillae.
callus	Thickening of the skin caused by continued, repeated pressure on any part of the skin, especially the hands and feet.
collagen	Fibrous protein that gives the skin form and strength.
comedo (plural: comedones)	Also known as *blackhead*; hair follicle filled with keratin and sebum.
dermal papillae (singular: dermal papilla)	Small, cone-shaped elevations at the base of the hair follicles that fit into the hair bulb.
dermatologist	Physician who specializes in diseases and disorders of the skin, hair, and nails.
dermatology	Medical branch of science that deals with the study of skin and its nature, structure, functions, diseases, and treatment.
dermis	Also known as *derma*, *corium*, *cutis*, or *true skin*; underlying or inner layer of the skin.
elastin	Protein base similar to collagen that forms elastic tissue.

Chapter Glossary

epidermal–dermal junction	The top of the papillary layer where it joins the epidermis.
epidermis	Outermost and thinnest layer of the skin; it is made up of five layers: stratum corneum, stratum lucidum, stratum granulosum, stratum spinosum, and stratum germinativum.
esthetician	A specialist in the cleansing, beautification, and preservation of the health of skin on the entire body, including the face and neck.
eumelanin	A type of melanin that is dark brown to black in color. People with dark-colored skin mostly produce eumelanin. There are two types of melanin; the other type is pheomelanin.
keratin	Fibrous protein of cells that is also the principal component of hair and nails.
melanin	Tiny grains of pigment (coloring matter) that are produced by melanocytes and deposited into cells in the stratum germinativum layer of the epidermis and in the papillary layers of the dermis. There are two types of melanin: pheomelanin, which is red to yellow in color, and eumelanin, which is dark brown to black.
melanocytes	Cells that produce the dark skin pigment called melanin.
motor nerve fibers	Fibers of the motor nerves that are distributed to the arrector pili muscles attached to hair follicles. Motor nerves carry impulses from the brain to the muscles.
papillary layer	Outer layer of the dermis, directly beneath the epidermis.
papule	Also known as *pimple*; small elevation on the skin that contains no fluid but may develop pus.
pheomelanin	A type of melanin that is red to yellow in color. People with light-colored skin mostly produce pheomelanin. There are two types of melanin; the other type is eumelanin.
Propionibacterium acnes	Abbreviated P. acnes; technical term for acne bacteria.
pustule	Raised, inflamed papule with a white or yellow center containing pus in the top of the lesion referred to as the head of the pimple.
reticular layer	Deeper layer of the dermis that supplies the skin with oxygen and nutrients; contains fat cells, blood vessels, sudoriferous (sweat) glands, hair follicles, lymph vessels, arrector pili muscles, sebaceous (oil) glands, and nerve endings.
sebaceous glands	Also known as *oil glands*; glands connected to hair follicles. Sebum is the fatty or oily secretion of the sebaceous glands.
sebum	A fatty or oily secretion that lubricates the skin and preserves the softness of the hair.
secretory coil	Coiled base of the sudoriferous (sweat) gland.
secretory nerve fibers	Fibers of the secretory nerve that are distributed to the sudoriferous glands and sebaceous glands. Secretory nerves, which are part of the autonomic nervous system (ANS), regulate the excretion of perspiration from the sweat glands and control the flow of sebum to the surface of the skin.
sensory nerve fibers	Fibers of the sensory nerves that react to heat, cold, touch, pressure, and pain. Sensory receptors that send messages to the brain.

Chapter Glossary

stratum corneum	Also known as *horny layer*; outer layer of the epidermis.
stratum germinativum	Also known as *basal cell layer*; deepest, live layer of the epidermis that produces new epidermal skin cells and is responsible for growth.
stratum granulosum	Also known as *granular layer*; layer of the epidermis composed of cells that look like granules and are filled with keratin; replaces cells shed from the stratum corneum.
stratum lucidum	Clear, transparent layer of the epidermis under the stratum corneum.
stratum spinosum	The spiny layer just above the stratum germinativum layer.
subcutaneous tissue	Also known as *adipose* or *subcutis tissue*; fatty tissue found below the dermis that gives smoothness and contour to the body, contains fat for use as energy, and also acts as a protective cushion for the outer skin.
sudoriferous glands	Also known as *sweat glands*; excrete perspiration and detoxify the body by excreting excess salt and unwanted chemicals.
tactile corpuscles	Small epidermal structures with nerve endings that are sensitive to touch and pressure.
vitamin A	Supports the overall health of the skin; aids in the health, function, and repair of skin cells; has been shown to improve the skin's elasticity and thickness.
vitamin C	An important substance needed for proper repair of the skin and tissues; promotes the production of collagen in the skin's dermal tissues; aids in and promotes the skin's healing process.
vitamin D	Enables the body to properly absorb and use calcium, the element needed for proper bone development and maintenance. Vitamin D also promotes rapid healing of the skin.
vitamin E	Helps protect the skin from the harmful effects of the sun's UV light.