

11



# PROPERTIES OF THE HAIR AND SCALP

# LEARNING OBJECTIVES

After completing this chapter, you will be able to:

## LO 1

Identify and distinguish the different structures of the hair root.

## LO 2

Point out and differentiate the differences among the three main layers of the hair shaft.

## LO 3

Identify and explain the three types of side bonds in the cortex.

## LO 4

Name and compare the differences among the three cycles of hair growth.

## LO 5

Give examples of the common types of hair loss and explain what can cause hair loss.

## LO 6

Identify and explain at least three options for hair loss treatment.

## LO 7

Learn to identify the most common hair and scalp disorders seen in the salon and school, and then name which ones a physician should treat.

## LO 8

Compare and describe the different factors that should be considered during a hair and scalp analysis.

## OUTLINE

WHY STUDY PROPERTIES OF THE HAIR AND SCALP? 224

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**F**rom Lady Godiva's infamous horseback ride to the sought-after celebrity styles that make headlines every day, hair has been one of humanity's most enduring obsessions. The term *crowning glory* aptly describes the importance placed on hair, how good we feel when our hair looks great, and just how distressing a bad hair day really can be. This is why hairstylists play such an important role in many people's lives. All professional hair services must be based on a thorough understanding of the growth, structure, and composition of hair.

why study

## PROPERTIES OF THE HAIR AND SCALP?

**Cosmetologists should study and have a thorough understanding of the properties of the hair and scalp because:**

- > You need to know how and why hair grows and how and why it falls out in order to be able to differentiate between normal and abnormal hair loss.
- > Knowing what creates natural color and texture is a vital part of being able to offer a variety of chemical services to clients.
- > Spotting an unhealthy scalp condition that could be harboring a communicable disease or even be causing permanent hair loss is a way to aid your client in caring for their scalp and their hair's well-being.

*After reading the next few sections, you will be able to:*

**LO1** Identify and distinguish the different structures of the hair root.



## Discover the Structure of Hair

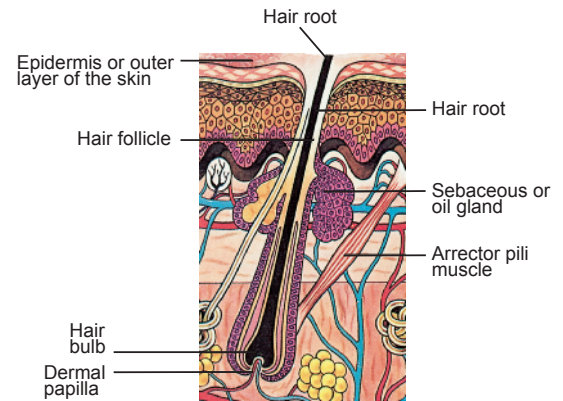
The scientific study of hair and its diseases and care is called **trichology** (trih-KAHL-uh-jee), which comes from the Greek words *trichos* (hair) and *ology* (the study of). The hair, skin, nails, and glands are part of the integumentary system. Although we no longer need hair for warmth and protection, hair still has an enormous impact on our psychology.

A mature strand of human hair is divided into two parts: the hair root and the hair shaft. The **hair root** is the part of the hair located below the surface of the epidermis (outer layer of the skin). The **hair shaft** is the portion of the hair that projects above the epidermis (**figure 11-1**).

## Structures of the Hair Root

The five main structures of the hair root include the hair follicle, hair bulb, dermal papilla, arrector pili muscle, and sebaceous (oil) glands.

- The **hair follicle** (HAYR FAWL-ih-kul) is the tube-like depression or pocket in the skin or scalp that contains the hair root. Hair follicles are distributed all over the body, with the exceptions of the palms of the hands and the soles of the feet. The follicle extends downward from the epidermis into the dermis (the inner layer of skin), where it surrounds the dermal papilla. Sometimes more than one hair will grow from a single follicle.
- The **hair bulb** (HAYR BULB) is the lowest part of a hair strand. It is the thickened, club-shaped structure that forms the lower part of the hair root. The lower part of the hair bulb fits over and covers the dermal papilla.
- The **dermal papilla** (DERMAL puh-PIL-uh) (plural: dermal papillae) is a small, cone-shaped elevation located at the base of the hair follicle that fits into the hair bulb. The dermal papilla contains the blood and nerve supply that provides the nutrients needed for hair growth. Some people refer to the dermal papilla as the “mother” of the hair because it contains the blood and nerve supply that provides the nutrients needed for hair growth.
- The **arrector pili muscle** is the small, involuntary muscle in the base of the hair follicle. Strong emotions or a cold sensation cause it to contract, which makes the hair stand up straight and results in what we call *goose bumps*.
- **Sebaceous glands** are the oil glands in the skin that are connected to the hair follicles. The sebaceous glands secrete a fatty or an oily substance called **sebum**. Sebum lubricates the skin.



**figure 11-1**  
Structures of the hair

### DID YOU KNOW?

Have you heard the expression “You are what you eat”? Although a healthy diet does not always guarantee a healthy hair and scalp, it is true that what you eat will affect your hair and scalp. Your body can naturally produce 11 of the 20 amino acids that make up hair, but your daily diet must include a variety of foods that supply the remaining 9 essential amino acids that the hair and scalp need. This is why crash or fad dieting can cause hair loss, lackluster hair, and unhealthy skin and scalp conditions. Following are just a few examples of an infinite variety of non-meat food sources that contain significant amounts of proteins and essential amino acids:

- Proteins in plant-based foods such as nuts, soy, and whole (unrefined) wheat and grains
- Nitrogen-fixing, seed-bearing plants, such as peas and all varieties of legumes (beans), are very good sources of proteins and amino acids.

Food combinations such as the following are also examples of non-meat food sources that contain plenty of proteins and amino acids:

- Whole wheat (or other whole grain) pasta and mushrooms, and fruits such as tomato, eggplant, and zucchini
- Peanut butter and whole grain or whole wheat bread
- Whole grain rice and beans
- Beans and corn

After reading the next few sections, you will be able to:

- LO 2** Point out and differentiate the differences among the three main layers of the hair shaft.

## Structures of the Hair Shaft

The three main layers of the hair shaft are the hair cuticle, cortex, and medulla (figure 11-2).

- The **hair cuticle** (HAYR KYOO-ti-kul) is the outermost layer of the hair. It consists of a single overlapping layer of transparent, scale-like cells that look like shingles on a roof. The cuticle layer provides a barrier that protects the inner structure of the hair as it lies tightly against the cortex. It is responsible for creating the shine and the smooth, silky feel of healthy hair.

To feel the cuticle, pinch a single healthy strand of hair between your thumb and forefinger. Starting near the scalp, pull upward on the strand. The strand should feel sleek and smooth. Next, hold the end of the hair strand with one hand, and then pinch the strand with the thumb and forefingers of your other hand. Move your fingers down the hair shaft. In this direction, the hair feels rougher because you are going against the natural growth of the cuticle layer. A healthy, compact cuticle layer is the hair's primary defense against damage. A lengthwise cross-section of hair shows that although the hair cuticle scales overlap, each individual cuticle scale is attached to the cortex (figure 11-3). These overlapping scales make up the cuticle layer. Swelling the hair by applying substances such as haircolor raises the cuticle layer and opens the space between the scales, which allows liquids to penetrate into the cortex.

A healthy hair cuticle layer protects the hair from penetration and prevents damage to hair fibers. Oxidation haircolors, permanent waving solutions, and chemical hair relaxers must have an alkaline pH to penetrate the cuticle layer because a high pH swells the cuticle and causes it to lift and expose the cortex.

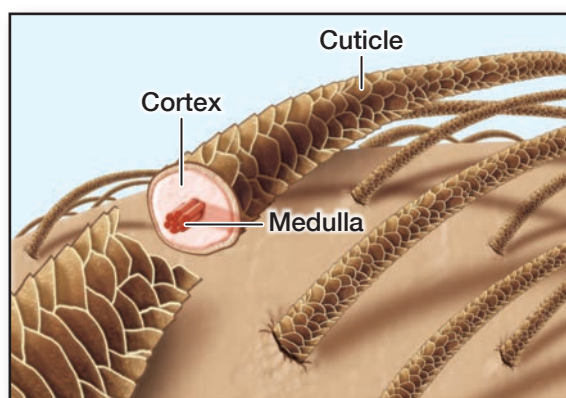
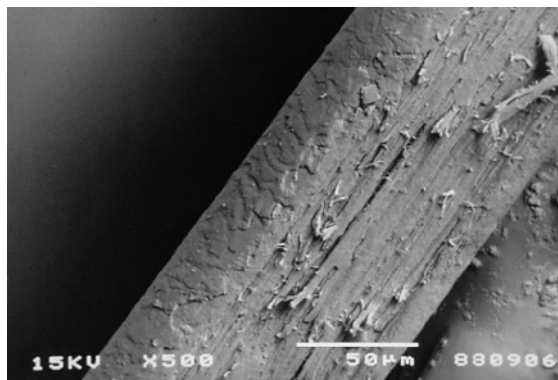


figure 11-2  
Cross-section of hair cuticle



figure 11-3  
Hair cuticle layer



**figure 11-4**  
Hair shaft with part of the hair cuticle stripped off, exposing the cortex

- The **cortex** (KOR-teks) is the middle layer of the hair. It is a fibrous protein core formed by elongated cells containing melanin pigment. About 90 percent of the total weight of hair comes from the cortex. The elasticity of the hair and its natural color are the result of the unique protein structures located within the cortex. The changes involved in oxidation haircoloring, wet setting, thermal styling, permanent waving, and chemical hair relaxing take place within the cortex (**figure 11-4**).
- The **medulla** (muh-DUL-uh) is the innermost layer of the hair and is composed of round cells. It is quite common for very fine and naturally blond hair to entirely lack a medulla. Generally, only thick, coarse hair contains a medulla. All male beard hair contains a medulla. The medulla is not involved in salon services.

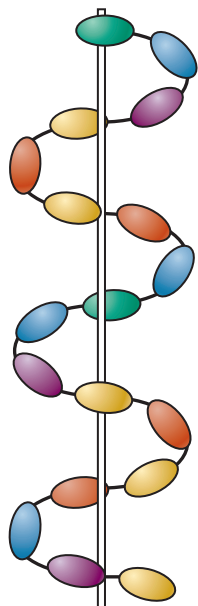
## Learn About the Chemical Composition of Hair

Hair is composed of protein that grows from cells originating within the hair follicle. This is where the hair begins. As soon as these living cells form, they begin their journey upward through the hair follicle. They mature in a process called **keratinization** (kair-uh-ti-ni-ZAY-shun). As these newly formed cells mature, they fill up with a fibrous protein called **keratin**. After they have filled with keratin, the cells move upward, lose their nucleus, and die. By the time the hair shaft emerges from the scalp, the cells of the hair are completely keratinized and are no longer living. The hair shaft that emerges is a nonliving fiber composed of keratinized protein.

Hair is approximately 90 percent protein. The protein is made up of long chains of amino acids, which, in turn, are made up of elements. The major elements that make up human hair are carbon, oxygen, hydrogen, nitrogen, and sulfur and are often referred to as the **COHNS elements** (KOH-nz EL-uh-ments). These five elements are also found in skin and nails. **Table 11-1** shows the percentages of each element in a typical strand of hair.

table 11-1  
THE COHNS ELEMENTS

Element	Percentage in Normal Hair
Carbon	51%
Oxygen	21%
Hydrogen	6%
Nitrogen	17%
Sulfur	5%



**figure 11-5**  
Polypeptide chains intertwine in a spiral shape called a helix

Proteins are made of long chains of **amino acids** (uh-MEE-noh AS-udz), units that are joined together end-to-end like pop beads. The strong, chemical bond that joins amino acids is a **peptide bond** (PEP-tyd BAHND), also known as end bond. A long chain of amino acids linked by peptide bonds is called a **polypeptide chain** (pahl-ee-PEP-tyd CHAYN). **Proteins** (PROH-teenz) are long, coiled complex polypeptides made of amino acids. The spiral shape of a coiled protein is called a **helix** (HEE-licks), which is created when the polypeptide chains intertwine with each other (**figure 11-5**).

*After reading the next few sections, you will be able to:*

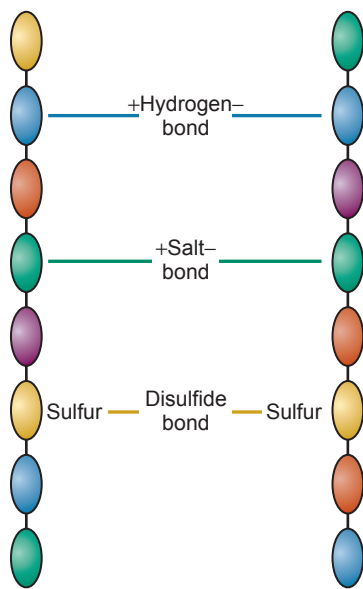
**LO3** Identify and explain the three types of side bonds in the cortex.

## Side Bonds of the Cortex

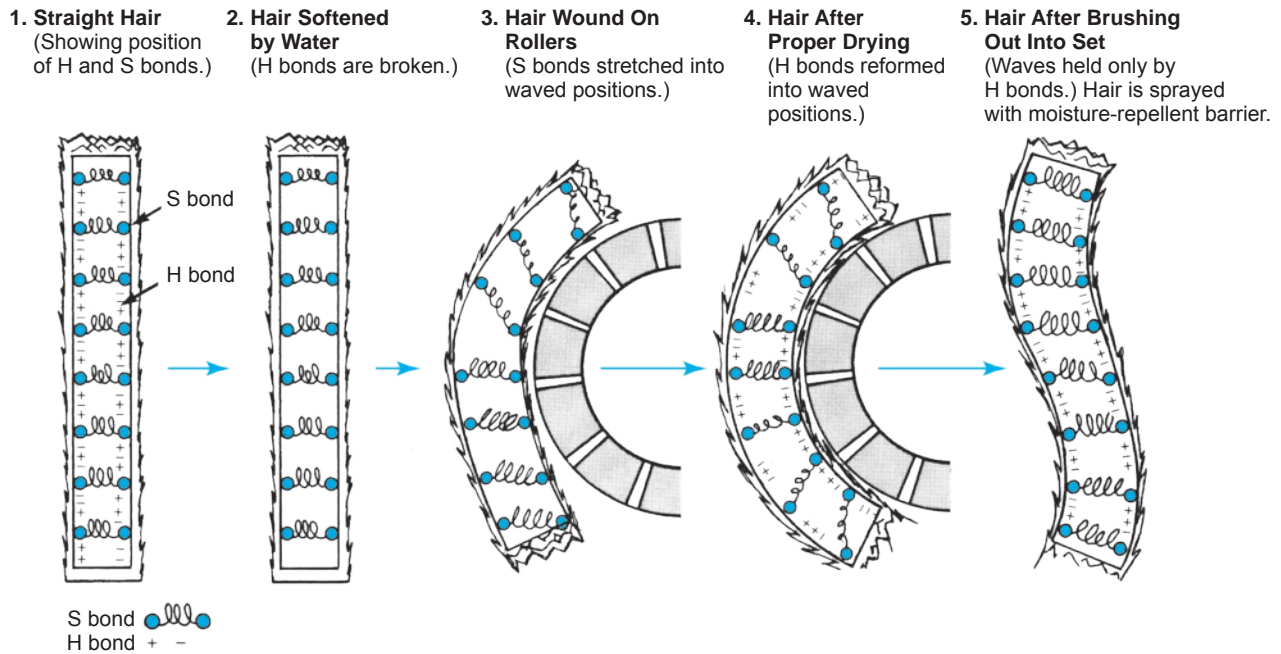
The cortex is made up of millions of polypeptide chains. Polypeptide chains are cross-linked like the rungs on a ladder by three different types of **side bonds** that link the polypeptide chains together and are responsible for the extreme strength and elasticity of human hair. They are essential to services such as wet setting, thermal styling, permanent waving, and chemical hair relaxing (see Chapter 20, Chemical Texture Services). The three types of side bonds are hydrogen, salt, and disulfide bonds (**figure 11-6**).

- A **hydrogen bond** is a weak, physical, cross-link side bond that is easily broken by water or heat. Although individual hydrogen bonds are very weak, there are so many of them that they account for about one-third of the hair's overall strength. Hydrogen bonds are broken by wetting the hair with water (**figure 11-7**). That allows the hair to be stretched and wrapped around rollers. The hydrogen bonds reform when the hair dries.
- A **salt bond** is also a weak, physical, cross-link side bond between adjacent polypeptide chains. Salt bonds depend on pH, so they are easily broken by strong alkaline or acidic solutions (**figure 11-8**). Even though they are weak bonds, there are so many of them that they account for about one-third of the hair's overall strength.
- A **disulfide bond** (dy-SUL-fyd BAHND) is a strong, chemical, side bond that is very different from the physical side bond of a hydrogen bond or salt bond. The disulfide bond joins the sulfur atoms of two neighboring **cysteine** (SIS-ti-een) amino acids to create one **cystine** (SIS-teen). The cystine joins together two polypeptide strands. Although there are far fewer disulfide bonds than hydrogen or salt bonds, disulfide bonds are so much stronger that they also account for about one-third of the hair's overall strength.

Disulfide bonds are not broken by water. They are broken by permanent waves and chemical hair relaxers that alter the shape of hair



**figure 11-6**  
Side bonds between polypeptide chains

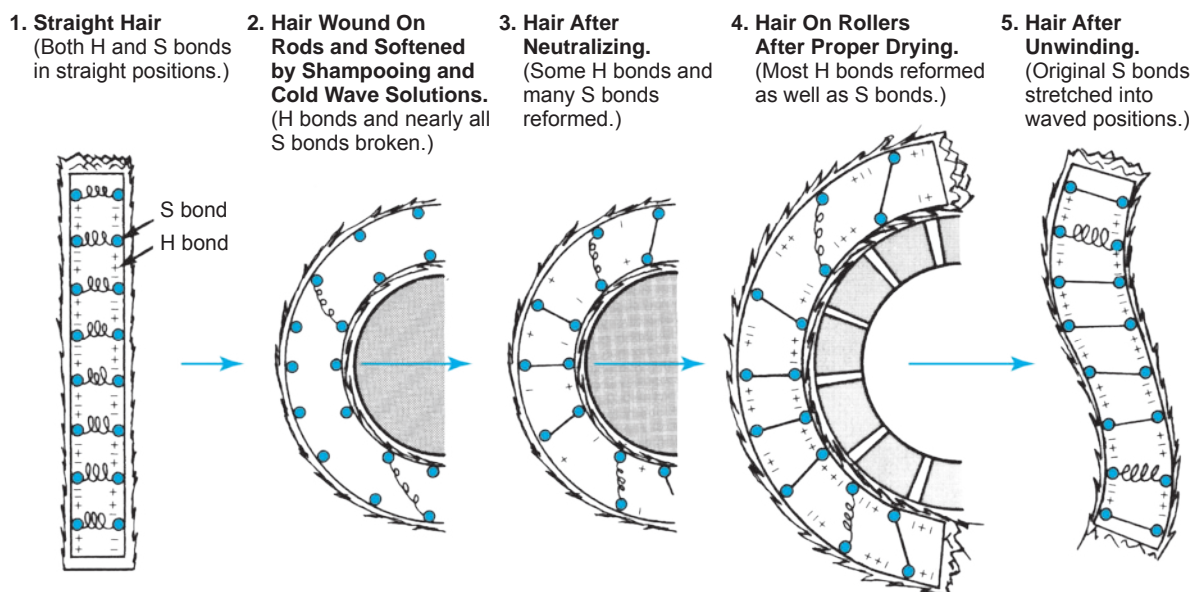


**figure 11-7**  
Changes in hair cortex during wet setting

(table 11-2). Additionally, normal amounts of heat, such as the heat used in conventional thermal styling, do not break disulfide bonds. The bonds can be broken by extreme heat produced by boiling water and some high-temperature thermal styling tools such as straightening or flat irons.

This permanent waves break disulfide bonds and reform the bonds with thio neutralizers. Hydroxide chemical hair relaxers break disulfide bonds and then convert them to **lanthionine bonds** (lan-THY-oh-noon BAHNDZ) when the relaxer is rinsed from the hair. The disulfide bonds that are treated with hydroxide relaxers are broken permanently and can never be reformed (see Chapter 20, Chemical Texture Services).

**figure 11-8**  
Changes in hair cortex during permanent waving





## BONDS OF THE HAIR

Bond	Type	Strength	Broken By	Reformed By
Hydrogen	Side bond	Weak, physical	Water or heat	Drying or cooling
Salt	Side bond	Weak, physical	Changes in pH	Normalizing pH
Disulfide	Side bond	Strong, chemical	1. Thio perms and thio relaxers 2. Hydroxide relaxers 3. Extreme heat	1. Oxidation with neutralizer 2. Converted to lanthionine bonds
Peptide	End bond	Strong, chemical	Chemical depilatories	Not reformed; hair dissolves

## Hair Pigment

All natural hair color is the result of the pigment located within the cortex. **Melanin** are the tiny grains of pigment in the cortex that give natural color to the hair. The two types of melanin are eumelanin and pheomelanin.

- **Eumelanin** provides natural dark brown to black color to the hair and is the dark pigment predominant in black and brunette hair.
- **Pheomelanin** is the lighter pigment that provides natural colors ranging from red and ginger to yellow and blond tones.

Natural hair color in a person's hair is due to the presence of the mixture of these pigments. More eumelanin gives darker hair and the amount can vary from person to person and also across a person's head. When we look at a hair under the microscope, the eumelanin pigment granules are oval (elliptical) in shape and the pheomelanin pigments are partly oval and partly rod-shaped. Gray hair contains only a few scattered melanin granules and white hair does not contain any melanin.



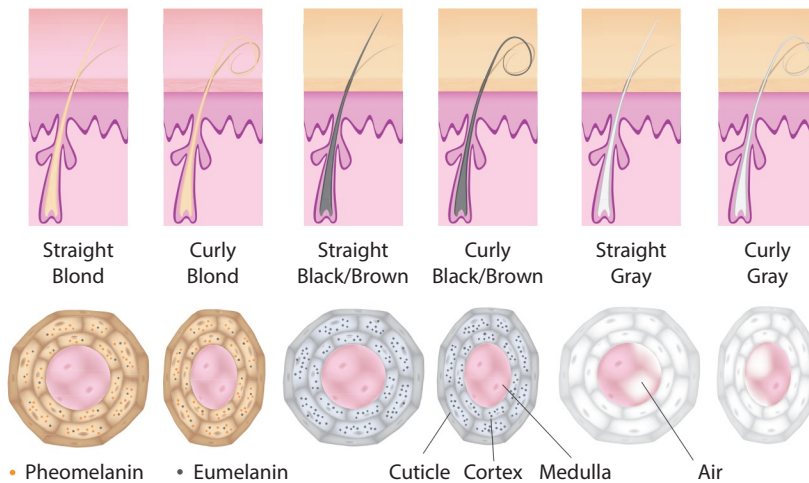
**figure 11-9**  
Straight, wavy, curly, and extremely curly hair strands

## Wave Pattern

The **wave pattern** of hair refers to the shape of the hair strand. It is described as straight, wavy, curly, or extremely curly (**figure 11-9**).

Natural wave patterns are the result of genetics. Although there are many exceptions, as a general rule, Asians and Native Americans tend to have extremely straight hair, Caucasians tend to have straight, wavy, or curly hair, and African Americans tend to have extremely curly hair. But straight, wavy, curly, and extremely curly hair occur in all races—anyone of any race, or mixed race, can have hair with varying degrees of curl from straight to extremely curly. The wave pattern may also vary from strand to strand on the same person's head. It is not uncommon for an individual to have different amounts of curl in different areas of the head. Individuals with curly hair often have straighter hair in the crown and tighter curl in other areas. Straight blond hair is round with more pheomelanin, straight black hair is round with mostly eumelanin, and straight gray hair lack melanin. Curly hair is oval in shape (**figure 11-10**).

## Basis of Hair Color and Texture



**figure 11-10**

Individuals with curly hair often have straighter hair in the crown and tighter curl in other areas.

Several theories attempt to explain the cause of natural curly hair, but there is no single, definite answer that explains why some hair grows straight and other hair grows curly. The most popular theory claims that the shape of the hair's cross-section determines the amount of curl. This theory claims that hair with a round cross-section is straight, hair with an oval to flattened oval cross-section is wavy or curly, and hair with a flattened to flattened oval cross-section is extremely curly (table 11-3).

### Extremely Curly Hair




Extremely curly hair grows in long twisted spirals. Cross-sections appear flattened and vary in shape and thickness along their length. Compared to straight or wavy hair, which tends to possess a fairly regular and uniform diameter along a single strand, extremely curly hair is fairly irregular, showing varying diameters along a single strand. Some extremely curly hair has a natural tendency to form a coil like a telephone cord. Coiled hair

**?** **DID YOU KNOW?**

The term *hair color* (two words) refers to the color of hair created by nature. *Haircolor* (one word) is the term used in the beauty industry to refer to artificial haircoloring products. Gray hair is caused by the absence of melanin. Gray hair grows from the hair bulb in exactly the same way that pigmented hair grows. It has the same structure, but without the melanin pigment.

table 11-3

### WAVE PATTERN AND CROSS-SECTIONS

	Wave Pattern	Shape of Cross-Section
	Straight Hair	Round cross-section
	Wavy or Curly Hair	Oval to round cross-section
	Extremely Curly Hair	Elliptical cross-section

usually has a fine texture, with many individual strands winding together to form the coiled locks. Extremely curly hair often has low elasticity, breaks easily, and has a tendency to knot, especially on the ends. Gentle scalp manipulations, conditioning shampoo, and a detangling rinse help minimize tangles.

After reading the next few sections, you will be able to:

**LO 4** Name and compare the differences among the three cycles of hair growth.

## The Truth About Hair Growth

The two main types of hair found on the body are vellus hair and terminal hair (figure 11-11).

**Vellus hair** (VEL-us HAYR), also known as *lanugo hair* (luh-NOO-goh HAYR), is short, fine, unpigmented, and downy hair that appears on the body. Vellus hair almost never has a medulla. It is commonly found on infants and can be present on children until puberty. On adults, vellus hair is usually found in places that are normally considered hairless (forehead, eyelids, and bald scalp), as well as nearly all other areas of the body except the palms of the hands and the soles of the feet. The follicles that produce vellus hairs do not have sebaceous glands. Women normally retain 55 percent more vellus hair than men. Vellus hair helps with the evaporation of perspiration.

**Terminal hair** (TUR-mih-nul HAYR) is the long, coarse, pigmented hair found on the scalp, legs, arms, and bodies of males and females. Terminal hair is coarser than vellus hair, and, with the exception of gray hair, it is pigmented. It usually has a medulla.

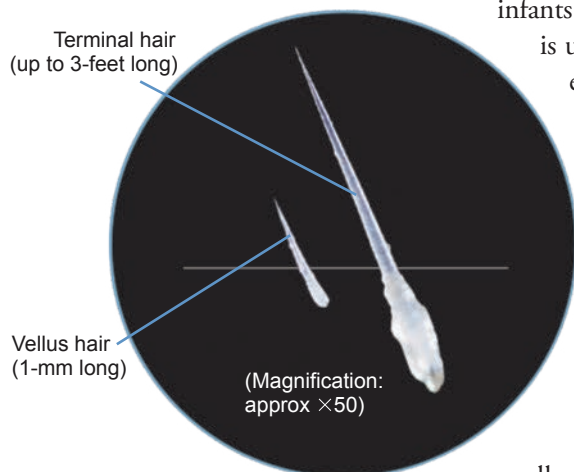
Hormonal changes during puberty cause some areas of fine vellus hair to be replaced with thicker terminal hair. All hair follicles are capable of producing either vellus or terminal hair, depending on genetics, age, and hormones.

### Growth Cycles of Hair

Hair growth occurs in cycles. Each complete cycle has three phases that are repeated over and over again throughout life. The three phases are anagen, catagen, and telogen.

1. During the **anagen phase** (AN-uh-jen FAYZ), also known as *growth phase*, new hair is produced. New cells are actively manufactured in the hair follicle. During this phase, hair cells are produced faster than any other normal cell in the human body. The average growth of

**figure 11-11**  
Vellus hair and terminal hair



healthy scalp hair is about ½ (0.5) inch (1.25 centimeters) per month. The rate of growth varies on different parts of the body, between sexes, and with age. Scalp hair grows faster on women than on men. Scalp hair grows rapidly between the ages of 15 and 30, but slows down sharply after the age of 50.

About 90 percent of scalp hair is growing in the anagen phase at any time. The anagen phase generally lasts from three to five years, but in some cases, it can last as long as 10 years. The longer the anagen cycle is, the longer the hair is able to grow. This is why some people can only grow their hair down to their shoulders, while others can grow it down to the floor!

2. The **catagen phase** (KAT-uh-jen FAYZ) is the brief transition period between the growth and resting phases of a hair follicle. It signals the end of the anagen phase. During the catagen phase, the follicle canal shrinks and detaches from the dermal papilla. The hair bulb disappears and the shrunken root end forms a rounded club. Less than one percent of scalp hair is in the catagen phase at any time. The catagen phase is very short, lasting from one to two weeks.
3. The **telogen phase** (TEL-uh-jen FAYZ), also known as resting phase, is the final phase in the hair cycle and lasts until the fully grown hair is shed. The hair is either shed during the telogen phase or remains in place until the next anagen phase, when the new hair growing in pushes it out. A little less than 10 percent of scalp hair is in the telogen phase at any one time.

The telogen phase lasts for approximately three to six months. As soon as the telogen phase ends, the hair returns to the anagen phase and begins the entire cycle again. On average, the entire growth cycle repeats itself once every 4 to 5 years.

## Myths and Facts about Hair Growth

As a stylist, you may hear opinions about hair growth from your clients or from other stylists. Here are some myths and facts about hair growth:

**Myth.** Shaving, clipping, and cutting the hair on the head makes it grow back faster, darker, and coarser.

**Fact.** Shaving or cutting the hair on the head has no effect on hair growth. When hair is blunt cut to the same length, it grows back more evenly. Although it may seem to grow back faster, darker, and coarser, shaving or cutting hair on the head has no effect on hair growth.

**Myth.** Scalp massage increases hair growth.

**Fact.** Scalp massages are very stimulating to the scalp and can increase blood circulation, relax the nerves in the scalp, and tighten the scalp muscles. However, it has not been scientifically proven that any type of stimulation or scalp massage increases hair growth. Minoxidil and finasteride are the only treatments that have been scientifically proven to increase hair growth and are approved for that purpose by the Food and Drug Administration (FDA). Products that claim to increase hair growth are regulated as drugs and are not cosmetics.





**Myth.** Gray hair is coarser and more resistant than pigmented hair.

**Fact.** Other than the lack of pigment, gray hair is exactly the same as pigmented hair. Although gray hair may be resistant, it is not resistant simply because it is gray. Pigmented hair on the same person's head is just as resistant as the gray hair. Gray hair is simply more noticeable than pigmented hair.

**Myth.** The amount of natural curl is always determined by racial background.

**Fact.** Anyone of any race, or mixed race, can have hair from straight to extremely curly. It is also true that within races individuals have hair with varying degrees of curl in different areas of the head.

**Myth.** Hair with a round cross-section is straight, hair with an oval cross-section is wavy, and hair with a flattened cross-section is curly.

**Fact.** In general, cross-sections of straight hair are often round, cross-sections of wavy and curly hair tend to be more oval to flattened oval, and cross-sections of extremely curly hair have a flattened cross-section.

However, cross-sections of hair can be almost any shape, and the shape of the cross-section does not always relate to the amount of curl or the shape of the follicle.

*After reading the next few sections, you will be able to:*

**LO5** Give examples of the common types of hair loss and what can cause hair loss.

## Understand Hair Loss Causes and Treatments

Under normal circumstances, we all lose some hair every day. Normal, daily hair loss is the natural result of the anagen, catagen, and telogen phases of the hair's growth cycle that were explained earlier in this chapter.

The growth cycle provides for the continuous growth, fall, and replacement of individual hair strands. A hair that is shed in the telogen phase is replaced by a new hair, in that same follicle, in the next anagen phase. This natural shedding of hair accounts for normal daily hair loss. Although estimates of the rate of hair loss have long been quoted at 100 to 150 hairs per day, recent measurements indicate that the average rate of hair loss is closer to 35 to 40 hairs per day.

### The Emotional Impact of Hair Loss

Although the medical community does not always recognize hair loss as a medical condition, the anguish felt by many of those who suffer from abnormal hair loss is very real and all too often overlooked. Results from a study that investigated perceptions of bald and balding men showed that compared to men who had hair, bald men were perceived as:

- Less physically attractive (by both sexes).
- Less assertive.

- Less successful.
- Less personally likable.
- Older (by about 5 years).

A study of how bald men perceive themselves showed that greater hair loss had a more significant impact than moderate hair loss. Men with more severe hair loss:

- Experience significantly more negative social and emotional effects.
- Are more preoccupied with their baldness.
- Make some effort to conceal or compensate for their hair loss.

Abnormal hair loss is not as common in women as it is in men, but it can be very traumatic and devastating for women who experience it because, as studies indicate, women have a greater emotional investment in their appearance. Many women with abnormal hair loss feel anxious, helpless, and less attractive. They may think that they are the only ones who have the problem. They also tend to worry that their hair loss is a symptom of a serious illness and sometimes try to disguise it from everyone, even their doctors, which is usually a mistake.

Over 63 million people in the United States suffer from abnormal hair loss. As a professional hairstylist, it is likely that you will be the first person that a hair loss sufferer will confide in, so it is important that you have a basic understanding of the different types of hair loss and the products and services that are available.

## Types of Abnormal Hair Loss

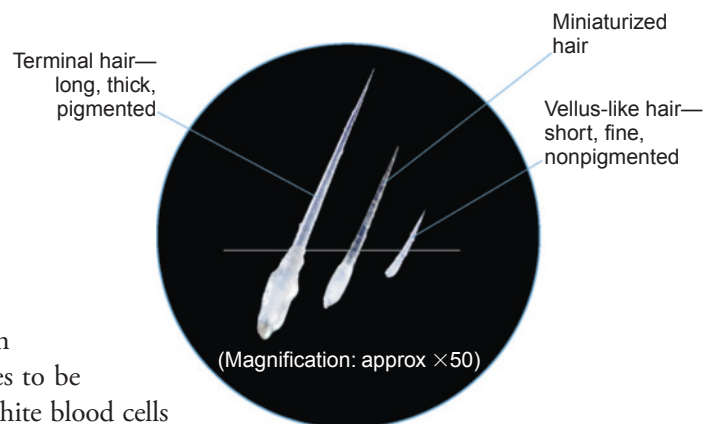
Abnormal hair loss is called **alopecia** (al-oh-PEE-shah). The three most common types of abnormal hair loss are androgenic alopecia, alopecia areata, and postpartum alopecia.

**Androgenic alopecia** (an-druh-JEN-ik al-oh-PEE-shah), also known as *androgenetic alopecia* (an-druh-je-NET-ik al-oh-PEE-shah), is hair loss that is characterized by miniaturization of terminal hair that is converted into vellus hair. It is usually the result of genetics, age, or hormonal changes that cause terminal hair to miniaturize (**figure 11-12**).

Androgenic alopecia can begin as early as the teens and is frequently seen by the age of 40. By age 35, almost 40 percent of both men and women, show some degree of hair loss.

In men, androgenic alopecia is known as male pattern baldness and usually progresses to the familiar horseshoe-shaped fringe of hair. In women, it shows up as generalized thinning over the entire crown area. Androgenic alopecia affects millions of men and women in the United States.

**Alopecia areata** (al-oh-PEE-shah air-ee-AH-tah) is an autoimmune disorder that causes the affected hair follicles to be mistakenly attacked by a person's own immune system. White blood cells stop the hair growth during the anagen phase. It is a highly unpredictable skin disease that affects an estimated 5 million people in the United States



**figure 11-12**  
Miniaturization of the hair follicle



### HERE'S A TIP

The mission of the National Alopecia Areata Foundation (NAAF) is to support research to find a cure or acceptable treatment for alopecia areata, to support those with the disease, and to educate the public.

The NAAF can be contacted at 14 Mitchell Boulevard, San Rafael, CA 94903, telephone: (415) 472-3780, fax: (415) 472-5343, e-mail: info@NAAF.org, or on the Web at alopeciaareata.com.



**figure 11-13**  
Alopecia areata

alone. This hair disorder usually begins with one or more small, round, smooth bald patches on the scalp and can progress to total scalp hair loss, known as **alopecia totalis** (al-oh-PEE-shah toh-TAHL-us), or complete body hair loss, called **alopecia universalis** (al-oh-PEE-shah yoo-nih-vur-SAA-lis).

Alopecia areata occurs in males and females of all ages, races, and ethnic backgrounds and most often begins in childhood. The scalp usually shows no obvious signs of inflammation, skin disorder, or disease (**figure 11-13**).

**Postpartum alopecia** (POHST-pahr-tum al-oh-PEE-shah) is temporary hair loss experienced at the end of a pregnancy. For some women, pregnancy seems to disrupt the normal growth cycle of hair. There is very little normal hair loss during pregnancy, but then there is sudden and excessive shedding towards the end and sometimes up to 12 months after the pregnancy. Although this is usually very traumatic to the new mother, the growth cycle generally returns to normal within one year after the baby is delivered.

*After reading the next few sections, you will be able to:*

**LO6** Identify and explain at least three options for hair loss treatment.

## Hair Loss Treatments

Of all treatments that are said to counter hair loss, there are only two products—minoxidil and finasteride—that have been proven to stimulate hair growth and are approved by the FDA for sale in the United States.

Minoxidil is a topical (applied to the surface of the body) medication that is put on the scalp twice a day and has been proven to stimulate hair growth. It is sold over the counter (OTC) as a nonprescription drug. Minoxidil is available for both men and women and comes in two different strengths: 2 percent regular-strength solution and 5 percent extra-strength solution. It is not known to have any serious negative side effects. The most well-known minoxidil product on the market is Rogaine®.

Finasteride is an oral prescription medication for men only. Although finasteride is more effective and convenient than minoxidil, possible side effects include weight gain and loss of sexual function. Women may not use this treatment, and pregnant women or those who might become pregnant are cautioned not to even touch finasteride tablets because of the

strong potential for birth defects. These over-the-counter medications slow the rate of hair loss and, in some cases, grow new hair. But once you stop using it, hair loss returns. In addition to the treatments described above, there are also several surgical options available to treat alopecia. A hair transplant is the most common permanent hair replacement technique. This process consists of removing small sections of hair, including the follicle, papilla, and hair bulb, from an area where there is a lot of hair (usually in the back) and transplanting them into the bald area. These sections grow normally in the new location. Only licensed surgeons may perform this procedure, and several surgeries are usually necessary to achieve the desired results. The cost of each surgery can range from \$8,000 to over \$20,000.

Hairstylists can offer a number of nonmedical options to counter hair loss. Some salons specialize in nonsurgical hair replacement systems such as wigs, toupees, hair weavings, and hair extensions. With proper training, you can learn to fit, color, cut, and style wigs and toupees. Hair weavings and hair extensions allow you to enhance a client's natural hair and create a look that boosts self-esteem (see Chapter 19, Wigs and Hair Additions).

*After reading the next few sections, you will be able to:*

**LO7** Learn to identify the most common hair and scalp disorders seen in the salon and school, and then name which ones a physician should treat.

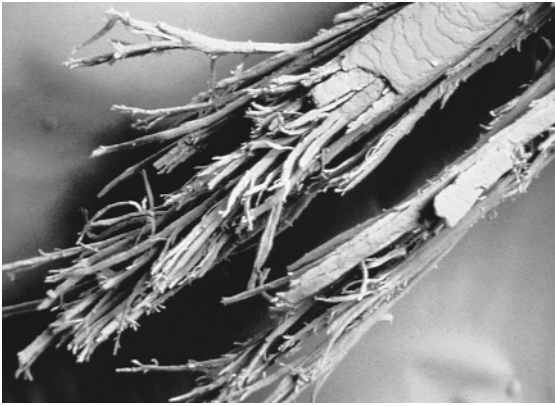
## Recognize Disorders of the Hair

The following disorders of the hair range from those that are commonplace and not particularly troublesome to those that are far more unusual or distressing:

- **Canities** (kah-NIT-eez) is the technical term for gray hair. Canities results from the loss of the hair's natural melanin pigment. Other than the absence of pigment, gray hair is exactly the same as pigmented hair. The two types of canities are congenital and acquired.
- Congenital canities exists at or before birth. It occurs in albinos, who are born without pigment in the skin, hair, and eyes, and occasionally in individuals with normal hair. A patchy type of congenital canities may develop either slowly or rapidly, depending on the cause of the condition.
- Acquired canities develops with age and is the result of genetics. Although genetics is also responsible for premature canities, acquired canities may develop due to prolonged anxiety or illness.
- **Ringed hair** is a variety of canities, characterized by alternating bands of gray and pigmented hair throughout the length of the hair strand.

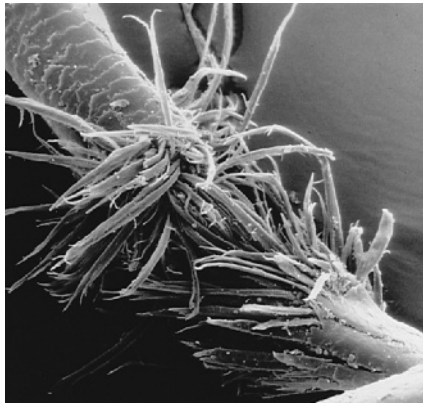






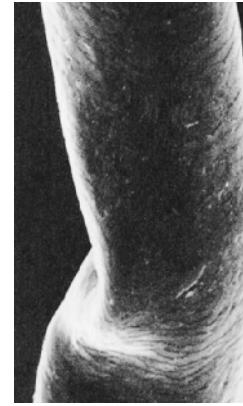
Courtesy of P&G Beauty, from the World of Hair by John Gray.

**figure 11-14**  
Trichoptilosis



Courtesy of P&G Beauty, from the World of Hair by John Gray.

**figure 11-15**  
Trichorrhhexis nodosa



The Gillette Research Institute.

**figure 11-16**  
Monilethrix

### HERE'S A TIP

An unwanted side effect of chemotherapy or radiation cancer treatments is abnormal hair loss. Look Good . . . Feel Better® (LGFB) is a free, global public service program founded in 1989 that is available in 19 countries on 6 continents. It teaches beauty techniques to cancer patients, helping them to boost their self-image and camouflage their hair loss. The program is open to women, men, and teenage cancer patients. More than one million women have been served by the organization since it was founded. Contact the LGFB program at 800-395-LOOK (800-395-5665), 24 hours a day, seven days a week, or through the Web at [lookgoodfeelbetter.org](http://lookgoodfeelbetter.org).

- **Hypertrichosis** (hi-pur-trih-KOH-sis), also known as *hirsuties* (hur-SOO-shee-eez), is a condition of abnormal growth of hair. It is characterized by the growth of terminal hair in areas of the body that normally grow only vellus hair. Mustaches or light beards on women are examples of hypertrichosis.

Treatments for hypertrichosis include electrolysis, photoepilation, laser hair removal, shaving, tweezing, electronic tweezers, depilatories, epilators, threading, and sugaring (see Chapter 22, Hair Removal).

- **Trichoptilosis** (trih-kahp-tih-LOH-sus) is the technical term for split ends (**figure 11-14**). Hair conditioning treatments will soften and lubricate dry ends but will not repair split ends. The only way to remove split ends is by cutting them.
- **Trichorrhexis nodosa** (trik-uh-REK-sis nuh-DOH-suh) is the technical term for knotted hair (**figure 11-15**). It is characterized by brittleness and the formation of nodular swellings along the hair shaft. The hair breaks easily, and the broken fibers spread out like a brush along the hair shaft. Treatments include softening the hair with conditioners and moisturizers.
- **Monilethrix** (mah-NIL-ee-thriks) is the technical term for beaded hair (**figure 11-16**). The hair breaks easily between the beads or nodes. Treatments include hair and scalp conditioning.
- **Fragilitas crinium** (fruh-JIL-ih-tus KRI-nee-um) is the technical term for brittle hair. The hairs may split at any part of their length. Treatments include hair and scalp conditioning and haircutting above the split to prevent further damage.

## Recognize Disorders of the Scalp

The skin is in a constant state of renewal. The outer layer of skin that covers your body is constantly being shed and replaced by new cells from below. The average person sheds about nine pounds of dead skin each year.

The skin cells of a normal, healthy scalp fall off naturally as small, dry flakes, without being noticed.

Dandruff can be easily mistaken for dry scalp because the symptoms of both conditions are a flaky, irritated scalp, but there is a difference. Dandruff commonly produces an oily scalp, but—just as the name indicates—the scalp is dry with the condition of dry scalp. The flakes from a dry scalp are much smaller and less noticeable than the larger flakes seen with dandruff. Dry scalp can result from contact dermatitis, sunburn, or extreme age, and is usually made worse by a cold, dry climate.

## Dandruff

**Pityriasis** (pit-ih-RY-uh-sus) is the technical term for dandruff, which is characterized by the excessive production and accumulation of skin cells. Instead of the normal, one-at-a-time shedding of tiny individual skin cells, dandruff is the shedding of an accumulation of large, visible clumps of skin cells (figure 11-17).

Although the cause of dandruff has been debated for many years, current research confirms that dandruff is the result of a fungus called *malassezia* (mal-uh-SEEZ-ee-uh). **Malassezia** is a naturally occurring fungus that is present on all human skin but causes the symptoms of dandruff when it grows out of control. Some individuals are also more susceptible to *malassezia*'s irritating effects. Factors such as stress, age, hormones, and poor hygiene can cause the fungus to multiply and dandruff symptoms to worsen.

Modern antidandruff shampoos contain the antifungal agents pyrithione zinc, selenium sulfide, or ketoconazole that control dandruff by suppressing the growth of *malassezia*. Antidandruff shampoos that contain pyrithione zinc are available in a variety of formulas for all hair types and are gentle enough to be used every day, even on color-treated hair. Frequent use of an antidandruff shampoo is essential for controlling dandruff. And although good personal hygiene and proper cleaning and disinfecting are important, dandruff is not contagious.



**figure 11-17**  
Pityriasis, more commonly known as dandruff



### CAUTION

You may find it difficult to speak with your client about a scalp disorder. After all, it is not easy to tell a client that you cannot perform a scheduled service because there may be something wrong with their scalp. If you feel that you cannot perform the service on your client and need help speaking with them about it, seek guidance from your instructor or salon manager.

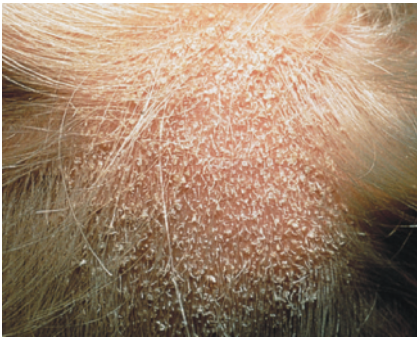
If you encounter such a situation and feel you are ready to discuss the situation with your client, try this approach.

“Mrs. Smith, I noticed that your scalp looks different today. I am not licensed to diagnose any scalp disorders, but I am concerned and think you should see a physician about it as soon as possible. For your safety, I should not continue with the service you have scheduled.”

Do not let your client try to talk you into performing the service. It could put you, your other clients, and the salon at risk of spreading the scalp disorder.

There are two principal types of dandruff:

- **Pityriasis capitis simplex** (pit-ih-RY-uh-sus KAP-ih-tis SIM-pleks) is the technical term for classic dandruff that is characterized by scalp irritation, large flakes, and an itchy scalp. The scales may attach to the scalp in masses, scatter loosely in the hair, or fall to the shoulders. Regular use of antidandruff shampoos, conditioners, and topical lotions are the best treatment.
- **Pityriasis steatoides** (pit-ih-RY-uh-sus stee-uh-TOY-deez) is a more severe case of dandruff characterized by an accumulation of greasy or waxy scales, mixed with sebum, that stick to the scalp in crusts. As explained in Chapter 8, Skin Disorders and Diseases, when this condition is accompanied by redness and inflammation, it is called seborrheic dermatitis. Seborrheic dermatitis also can be found in the eyebrows or beard. You should not perform a service on anyone who has dandruff, as the scalp is irritated and itchy. Antidandruff shampoo can be recommended to a client with mild conditions, but anyone with severe conditions must be referred to a physician.



Courtesy of Robert A. Silverman, M.D.,  
Clinical Associate Professor, Department  
of Pediatrics, Georgetown University.

**figure 11-18**  
Tinea capitis

## Fungal Infections (Tinea)

**Tinea** (TIN-ee-uh) is the technical term for ringworm. It is characterized by itching, scales, and, sometimes, painful circular lesions. Several patches may be present at one time. Tinea is caused by a fungal organism and not a parasite, as the old-fashioned term *ringworm* seems to suggest. Tinea infections are named for the part or location of the body they infect.

All forms of tinea are contagious and can be easily transmitted from one person to another. Infected skin scales or hairs that contain the fungi are known to spread the disease. Bathtubs, swimming pools, and unclean personal articles are also sources of transmission. Practicing approved cleaning and disinfection procedures will help prevent the spread of this disease in the salon.

As you read in Chapter 5, Infection Control: Principles and Practices, *tinea capitis*, sometimes called “ringworm of the scalp,” is another type of fungal infection characterized by red papules, or spots, at the opening of the hair follicles. The patches spread and the hair becomes brittle. Hair often breaks off leaving only a stump or the hair may be shed from the enlarged open follicle (**figure 11-18**). Tinea barbae is a superficial fungal infection caused by a variety of dermatophytes that commonly affects the skin. It is primarily limited to the bearded areas of the face and neck or around the scalp (**figure 11-19**). It is similar to tinea capitis in appearance. You should not perform a service on anyone who has or who you suspect may have tinea barbae. A client with this condition must be referred to a physician for medical treatment.

**Tinea favosa** (TIN-ee-uh fah-VOH-suh), also known as *tinea favus* (TIN-ee-uh FAH-vus), is characterized by dry, sulfur-yellow, cuplike crusts on the scalp called **scutula** (SKUCH-ul-uh). Scutula has a distinctive odor. Scars from tinea favosa are bald patches that may be pink or white and shiny (**figure 11-20**).



www.dermnet.com

**figure 11-19**  
Folliculitis barbae or tinea (ringworm) barbae



www.dermnet.com

**figure 11-20**  
Tinea favosa, also known as tinea favus



**figure 11-21**  
Scabies infestation on wrist and arm

Remember: You should never perform a service on anyone who has or you suspect may have a fungal infection. If you are not certain about whether the condition is a fungal infection, be safe and refer your client to a physician.

## Parasitic Infections

Scabies is a highly contagious skin disease caused by a parasite called a mite that burrows under the skin. Vesicles (blisters) and pustules (inflamed pimples with pus) usually form on the scalp from the irritation caused by this parasite. Excessive itching accompanies this condition and scratching the infected areas makes the affected area worse. Practicing approved cleaning and disinfection procedures is very important to prevent the spread of this disease (**figure 11-21**).

You should not perform a service on anyone who has scabies. A client with this condition must be referred to a physician for medical treatment.

**Pediculosis capitis** (puh-dik-yuh-LOH-sis KAP-ih-tis) is the infestation of the hair and scalp with head lice (**figures 11-22** and **11-23**). As these parasites feed on the scalp, it begins to itch. If the scalp is scratched, it can cause an infection. Head lice are transmitted from one person to another by contact with infested hats, combs, brushes, and other personal articles. You can distinguish head lice from dandruff flakes by looking closely at the scalp with a magnifying glass.

Properly practicing state board-approved cleaning and disinfection procedures will prevent the spread of this infestation. Several nonprescription medications are available.

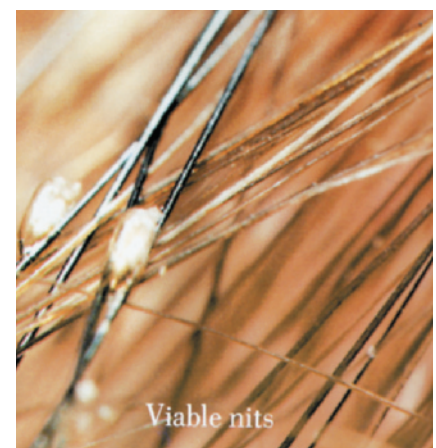
You should not perform a service on anyone who has head lice. A client with this condition must be referred to a physician or a pharmacist.

## Bacterial Infections

Bacterial infections of the scalp are caused by two strains of bacteria known as staphylococci and streptococci. Most common types of staphylococci infections are furuncles, carbuncles, and folliculitis.



**figure 11-22**  
Head lice



**figure 11-23**  
Nits (lice eggs)

Courtesy of The National Pediculosis Association, Inc.

Courtesy of Hogil Pharmaceutical Corporation.

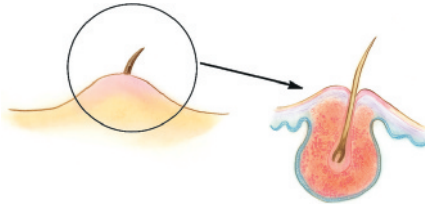


figure 11-24a  
Furuncle (boil)



figure 11-24b

#### HERE'S A TIP

Remember to re-schedule the appointment if you refer a client to a physician. Follow up with a call two to three days before the appointment.

- A **furuncle** (FYOO-rung-kul) is the technical term for a boil, an acute, localized bacterial infection of the hair follicle that produces constant pain (figures 11-24a and 11-24b). It is limited to a specific area and produces a pustule perforated by a hair.
- A **carbuncle** (KAHR-bung-kul) is an inflammation of the subcutaneous tissue caused by staphylococci. It is similar to a furuncle but is larger.
- Folliculitis is an infection of the hair follicles frequently caused by staphylococcus or other bacteria. Infections are seen as small, white-headed pimples around one or more follicles. Mild folliculitis may heal by itself in few days but deep or recurring ones need medical attention. One common example seen in hair salons is folliculitis barbae, also known as *pseudofolliculitis barbae*. It is an inflammation of hair follicles caused by a bacterial infection often caused by *Staphylococcus aureus*. Outside of healthcare, this is regularly referred to as *barber's itch* or *hot tub folliculitis*.

Properly practicing state board-approved cleaning and disinfection procedures will prevent the spread of these infections.

You should not perform a service on anyone who has a boil, carbuncle, or folliculitis. A client with any of these conditions must be referred to a physician for medical treatment.

After reading the next few sections, you will be able to:

- LO 8** Compare and describe the different factors that should be considered during a hair and scalp analysis.

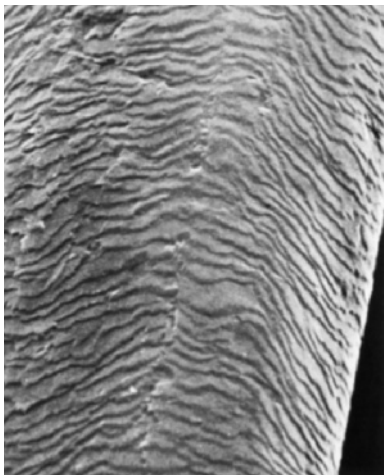
## Learn How To Perform a Thorough Hair and Scalp Analysis

All successful salon services must begin with a thorough analysis of the condition of the client's scalp and client's hair type. Knowing the client's scalp condition and the client's hair type allows you to prepare and make decisions about the results that can be expected from the service.

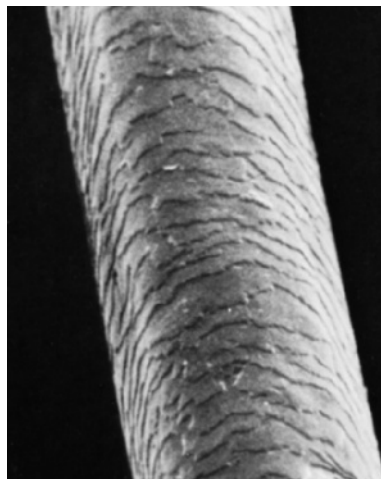
Because different types of hair react differently to the same service, it is essential that a thorough analysis be performed before all salon services. Hair analysis is performed by observation using the senses of sight, touch, sound, and smell. The four most important factors to consider in hair analysis are texture, density, porosity, and elasticity. Other factors that you should also be aware of are growth pattern and dryness versus oiliness.

### Texture

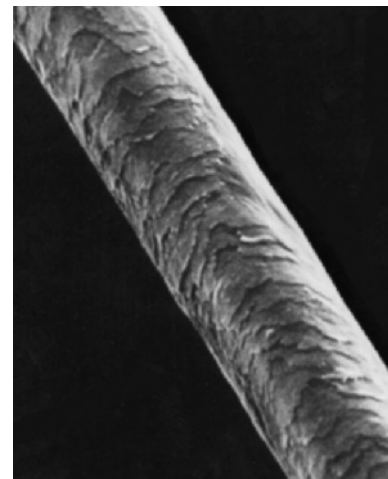
**Hair texture** is the thickness or diameter of the individual hair strand. Hair texture can be classified as coarse, medium, or fine (figures 11-25, 11-26,



**figure 11-25**  
Coarse hair



**figure 11-26**  
Medium hair



**figure 11-27**  
Fine hair

and 11-27) and can vary from strand to strand on the same person's head. It is not uncommon for hair from different areas of the head to have different textures. Hair on the nape (back of the neck), crown, temples, and front hairline of the same person may have different textures.

Coarse hair texture has the largest diameter. It is stronger than fine hair for the same reason that a thick rope is stronger than a thin rope. It is often more resistant to processing than medium or fine hair, so it usually requires more processing when you are applying products such as hair lighteners, haircolors, permanent waving solutions, and chemical hair relaxers.

Medium hair texture is the most common texture and is the standard to which other hair is compared. Medium hair does not pose any special problems or concerns.

Fine hair has the smallest diameter and is more fragile, easier to process, and more susceptible to damage from chemical services than coarse or medium hair.

As with hair cuticle analysis, hair texture can be determined by feeling a single dry strand between the fingers. Take an individual strand from four different areas of the head—front hairline, temple, crown, and nape—and hold each strand securely with one hand while feeling it with the thumb and forefinger of the other hand. With a little practice, you will be able to feel the difference between coarse, medium, and fine hair diameters (figure 11-28).



#### FOCUS ON

Selling retail products increases client retention. A client who takes home a retail product is more than twice as likely to return for services. Recommending products for home use is an important part of a successful career as a hairstylist. Your client needs to know what products to use and how to use them.

A complete hair analysis will enable you to recommend the right products for your client with confidence. It is your job to know more about your client's specific needs than anyone else and to recommend the right products to satisfy those needs. Your clients consider you to be their expert in hair care, so do not be shy about analyzing their needs and making recommendations to them since they genuinely benefit from your advice.



**figure 11-28**  
Testing for hair texture

table 11-4

AVERAGE NUMBER OF HAIRS ON THE HEAD BY HAIR COLOR

Hair Color	Average Number of Hairs on Head
Blond	140,000
Brown	110,000
Black	108,000
Red	80,000

## Density

**Hair density** measures the number of individual hair strands on one square inch (2.5 square centimeters) of scalp. It indicates how many hairs there are on a person’s head. Hair density can be classified as low, medium, or high (also known as thin, medium, or thick/dense). Hair density is different from hair texture—individuals with the same hair texture can have different densities.

Some individuals may have coarse hair texture (each hair has a large diameter), but low hair density (a low number of hairs on the head). Others may have fine hair texture (each hair has a small diameter), but high hair density (a high number of hairs on the head).

The average hair density is about 2,200 hairs per one square inch. Hair with high density (thick or dense hair) has more hairs per one square inch, and hair with low density (thin hair) has fewer hairs per one square inch. The average head of hair contains about 100,000 individual hair strands. The number of hairs on the head generally varies with the color of the hair. Blonds usually have the highest density, and people with red hair tend to have the lowest. **Table 11-4** shows hair density by hair color.

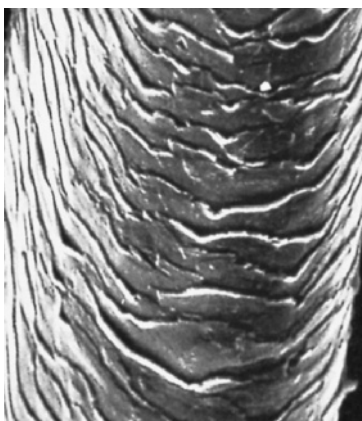
## Porosity

**Hair porosity** is the ability of the hair to absorb moisture. The degree of porosity is directly related to the condition of the cuticle layer. Healthy hair with a compact cuticle layer is naturally resistant to being penetrated by moisture and is referred to as **hydrophobic** (hy-druh-FOHB-ik). Porous hair has a raised cuticle layer that easily absorbs moisture and is called **hydrophilic** (hy-druh-FIL-ik).

Hair with average porosity is considered to be normal hair (**figure 11-29**). Chemical services performed on this type of hair will usually process as expected, according to the texture.

Hair with low porosity is considered resistant (**figure 11-30**). Chemical services performed on hair with low porosity require a more alkaline solution than those on hair with high porosity. Alkaline solutions raise the cuticle and permit uniform saturation and processing on resistant hair.

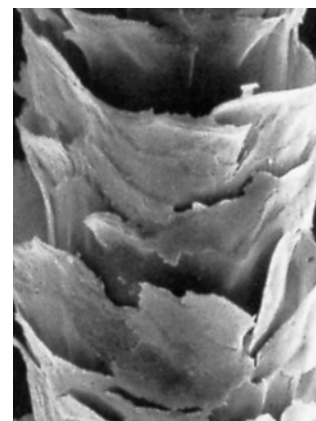
Hair with high porosity is considered overly porous hair and is often the result of previous overprocessing (**figure 11-31**). Overly porous hair is



**figure 11-29**  
Average porosity (normal hair)



**figure 11-30**  
Low porosity (resistant hair)



**figure 11-31**  
High porosity (overly porous hair)

The Gillette Research Institute.



**figure 11-32**  
Testing for hair porosity



**figure 11-33**  
Testing for hair elasticity

damaged, dry, fragile, and brittle. Chemical services performed on overly porous hair require less alkaline solutions with a lower pH, which help prevent additional overprocessing and damage.

The texture of the hair can be an indication of its porosity, but it is only a general rule of thumb. Different degrees of porosity can be found in all hair textures. Although coarse hair normally has a low porosity and is resistant to chemical services, in some cases coarse hair will have high porosity, perhaps as the result of previous chemical services.

You can check porosity on dry hair by taking a strand of several hairs from four different areas of the head (front hairline, temple, crown, and nape). Hold the strand securely with one hand while sliding the thumb and forefinger of the other hand from the end to the scalp. If the hair feels smooth and the cuticle is compact, dense, and hard, it is considered resistant. If you can feel a slight roughness, it is considered porous. If the hair feels very rough, dry, or breaks, it is considered highly porous and may have been overprocessed (**figure 11-32**).

## Elasticity

**Hair elasticity** is the ability of the hair to stretch and return to its original length without breaking. Hair elasticity is an indication of the strength of the side bonds that hold the hair's individual fibers in place. Wet hair with normal elasticity will stretch up to 50 percent of its original length and return to that same length without breaking. Dry hair stretches about 20 percent of its length.

Hair with low elasticity is brittle and breaks easily. It may not be able to hold the curl from wet setting, thermal styling, or permanent waving. Hair with low elasticity is the result of weak side bonds that usually are a result of overprocessing. Chemical services performed on hair with low elasticity require a milder solution with a lower pH to minimize further damage and prevent additional overprocessing.

Check elasticity on wet hair by taking an individual strand from four different areas of the head (front hairline, temple, crown, and nape). Hold a single strand of wet hair securely and try to pull it apart (**figure 11-33**).





## ACTIVITY

Divide into groups of two or more in the classroom and analyze each other's hair. Hair analysis includes evaluating texture, density, porosity, and elasticity. Wave patterns, growth patterns, and the oiliness or dryness of the hair and scalp also should be noted. Follow the procedures in this textbook and use the same terminology. Write down results and present an oral report to the class. What is the most common texture among your classmates? What is the most common density?

If the hair stretches and returns to its original length without breaking, it has normal elasticity. If the hair breaks easily or fails to return to its original length, it has low elasticity.

## Hair Growth Patterns

Hair growth patterns are important to identify and consider, especially when preparing to shape and style the hair. During your hair analysis, you should identify any and all hair growth patterns and take them into consideration when creating the overall look, haircut, or hairstyle the client wants to achieve.

Hair follicles that grow out of the head at a perpendicular, 90-degree angle or in a straight direction from the head may cause the following growth patterns to result:

- A **hair stream** is hair flowing in the same direction, resulting from follicles sloping in the same direction. Two streams flowing in opposite directions from the head form a natural part in the hair.
- A **whorl** (WHORL) occurs when hair leaves the follicles at an angle; the hair will lie in a particular direction forming patterns or streams on the head. Often the streams spiral outward from a central point. Usually they run in a clockwise direction and sometimes more than one whorl can be seen in certain individuals ([figure 11-34](#)).



**figure 11-34**  
Example of a whorl

- A **cowlick** (KOW-lik) is due to a particular pattern of hair stream on the forehead. Cowlicks are usually more noticeable at the front hairline in people with short, thick hair but they may be located anywhere on the head (figure 11-35).



figure 11-35  
Example of a cowlick

## Dry Hair and Scalp

Dry hair and scalp can be caused by inactive sebaceous glands. These conditions are aggravated by excessive shampooing or by a dry climate. The lack of natural oils (sebum) leads to hair that appears dull, dry, and lifeless. Dry hair and scalp should be treated with products that contain moisturizers and emollients.

People with dry hair and scalp should avoid frequent shampooing along with the use of strong soaps, detergents, or products with a high alcohol content because these products could aggravate existing conditions. Dry hair should not be confused with overly porous hair that has been damaged by thermal styling, chemical services, or environmental conditions.

## Oily Hair and Scalp

Oily hair and scalp, characterized by a greasy buildup on the scalp and an oily coating on the hair, are caused by improper shampooing or overactive sebaceous glands. Oily hair and scalp can be treated by properly washing with a normalizing shampoo. A well-balanced diet, exercise, regular shampooing, and good personal hygiene are essential to controlling oily hair and scalp.

## Healthy Hair, Happy Clients

The more you learn about the structure of hair and how to keep it healthy, the more you will understand how salon services affect different hair types. This is the key to consistent results with your services and happy clients who recommend you to their friends.

## REVIEW QUESTIONS

- 1 Name and describe the five main structures of the hair root.
- 2 Name and describe the three layers of the hair shaft.
- 3 Explain the process of keratinization.
- 4 What are polypeptide chains?
- 5 List and describe the three types of side bonds. Indicate whether they are strong or weak and why.
- 6 Name and describe the two types of melanin responsible for natural hair color.
- 7 Name and describe the two types of hair and their locations on the body.
- 8 What are the three phases of the hair growth cycle? What occurs during each phase?
- 9 What is the reason for normal daily hair loss?
- 10 What are the most common types of abnormal hair loss?
- 11 What are the only two approved hair loss treatments?
- 12 Name the two main types of dandruff. Can either one be treated in the salon?
- 13 Which hair and scalp disorders cannot be treated in the salon?
- 14 What four factors about the hair should be considered in a hair analysis?

## STUDY TOOLS

- **Reinforce what you just learned:** Complete the activities and exercises in your Theory or Practical Workbook, or your Study Guide.
- **Expand your knowledge:** Search for websites about the topics in this chapter and make a list of additional resources.
- **Study and prepare for your quiz:** Take the chapter test in your Exam Review or your Milady U: Online Licensing Prep.
- **Re-Test your knowledge:** Take the Chapter 11 Quizzes!
- **Learn even more:** Look up in a dictionary or search the internet for the definitions of any additional terms you want to learn about.

## CHAPTER GLOSSARY

<b>alopecia</b> al-oh-PEE-shah	p. 235	Abnormal hair loss.
<b>alopecia areata</b> al-oh-PEE-shah air-ee-AH-tah	p. 235	Autoimmune disorder that causes the affected hair follicles to be mistakenly attacked by a person's own immune system; usually begins with one or more small, round, smooth bald patches on the scalp.
<b>alopecia totalis</b> al-oh-PEE-shah toh-TAHL-us	p. 236	Total loss of scalp hair.
<b>alopecia universalis</b> al-oh-PEE-shah yoo-nih-vur-SAA-lis	p. 236	Complete loss of body hair.
<b>amino acids</b> uh-MEE-noh AS-udz	p. 228	Units that are joined together end-to-end like pop beads by strong, chemical peptide bonds (end bonds) to form the polypeptide chains that comprise proteins.

<b>anagen phase</b> AN-uh-jen FAYZ	p. 232	Also known as <i>growth phase</i> ; phase during which new hair is produced.
<b>androgenic alopecia</b> an-druh-JEN-ik al-oh-PEE-shah	p. 235	Also known as <i>androgenetic alopecia</i> (an-druh-je-NET-ik al-oh-PEE-shah); hair loss characterized by miniaturization of terminal hair that is converted to vellus hair; in men, it is known as male pattern baldness.
<b>arrector pili muscle</b>	p. 225	The small, involuntary muscle in the base of the hair follicle.
<b>canities</b> kah-NIT-eez	p. 237	Technical term for gray hair; results from the loss of the hair's natural melanin pigment.
<b>carbuncle</b> KAHR-bung-kul	p. 242	Inflammation of the subcutaneous tissue caused by staphylococci; similar to a furuncle but larger.
<b>catagen phase</b> KAT-uh-jen FAYZ	p. 233	The brief transition period between the growth and resting phases of a hair follicle. It signals the end of the growth phase.
<b>COHNS elements</b> KOH-nz EL-uh-ments	p. 227	The five elements—carbon, oxygen, hydrogen, nitrogen, and sulfur—that make up human hair, skin, tissue, and nails.
<b>cortex</b> KOR-teks	p. 227	Middle layer of the hair; a fibrous protein core formed by elongated cells containing melanin pigment.
<b>cowlick</b> KOW-lik	p. 247	Tuft of hair that stands straight up.
<b>cysteine</b> SIS-ti-eeen	p. 228	An amino acid with a sulfur atom (S) that joins together two peptide strands.
<b>cystine</b> SIS-teen	p. 228	An amino acid formed when 2 cysteine amino acids (with single sulfur) are joined by their sulfur groups or disulfide bond.
<b>dermal papilla</b> DERMAL puh-PIL-uh	p. 225	Plural: dermal papillae. A small, cone-shaped elevation located at the base of the hair follicle that fits into the hair bulb.
<b>disulfide bond</b> dy-SUL-fyd BAHND	p. 228	Strong chemical side bond that joins the sulfur atoms of two neighboring cysteine amino acids to create one cystine, which joins together two polypeptide strands like rungs on a ladder.
<b>eumelanin</b> you-mell-ee-non	p. 230	Provides natural dark brown to black color to the hair and is the dark pigment predominant in black and brunette hair.
<b>fragilitas crinium</b> fruh-JIL-ih-tus KRI-nee-um	p. 238	Technical term for brittle hair.
<b>furuncle</b> FYOO-rung-kul	p. 242	Boil; acute, localized bacterial infection of the hair follicle that produces constant pain.
<b>hair bulb</b>	p. 225	Lowest part of a hair strand; the thickened, club-shaped structure that forms the lower part of the hair root.
<b>hair cuticle</b> HAYR KYOO-ti-kul	p. 226	Outermost layer of hair; consisting of a single, overlapping layer of transparent, scale-like cells that look like shingles on a roof.
<b>hair density</b>	p. 244	The number of individual hair strands on 1 square inch (2.5 square centimeters) of scalp.
<b>hair elasticity</b> HAYR ee-las-TIS-ut-ee	p. 245	Ability of the hair to stretch and return to its original length without breaking.
<b>hair follicle</b> HAYR FAWL-ih-kul	p. 225	The tube-like depression or pocket in the skin or scalp that contains the hair root.
<b>hair porosity</b> HAYR puh-RAHS-ut-ee	p. 244	Ability of the hair to absorb moisture.

<b>hair root</b>	p. 224	The part of the hair located below the surface of the epidermis.
<b>hair shaft</b>	p. 224	The portion of hair that projects above the epidermis.
<b>hair stream</b>	p. 246	Hair flowing in the same direction, resulting from follicles sloping in the same direction.
<b>hair texture</b>	p. 242	Thickness or diameter of the individual hair strand.
<b>helix</b> HEE-licks	p. 228	Spiral shape of a coiled protein created by polypeptide chains that intertwine with each other.
<b>hydrogen bond</b> HY-druh-jun BAHND	p. 228	A weak, physical, cross-link side bond that is easily broken by water or heat.
<b>hydrophilic</b> hy-druh-FIL-ik	p. 244	Easily absorbs moisture; in chemistry terms, capable of combining with or attracting water (water-loving).
<b>hydrophobic</b> hy-druh-FOHB-ik	p. 244	Naturally resistant to being penetrated by moisture.
<b>hypertrichosis</b> hi-pur-trih-KOH-sis	p. 238	Also known as <i>hirsuties</i> (hur-SOO-shee-eez); condition of abnormal growth of hair, characterized by the growth of terminal hair in areas of the body that normally grow only vellus hair.
<b>keratin</b>	p. 227	A fibrous protein that grows from cells originating within the hair follicle.
<b>keratinization</b> kair-uh-ti-ni-ZAY-shun	p. 227	Process by which newly formed cells in the hair bulb mature, fill with keratin, move upward, lose their nucleus, and die.
<b>lanthionine bonds</b> lan-THY-oh-neen BAHNDZ	p. 229	The bonds created when disulfide bonds are broken by hydroxide chemical hair relaxers after the relaxer is rinsed from the hair.
<b>malassezia</b> mal-uh-SEEZ-ee-uh	p. 239	Naturally occurring fungus that is present on all human skin, but is responsible for dandruff when it grows out of control.
<b>medulla</b> muh-DUL-uh	p. 227	Innermost layer of the hair that is composed of round cells; often absent in fine and naturally blond hair.
<b>melanin</b>	p. 230	The tiny grains of pigment in the cortex that give natural color to the hair.
<b>monilethrix</b> mah-NIL-ee-thriks	p. 238	Technical term for beaded hair.
<b>pediculosis capitis</b> puh-dik-yuh-LOH-sis KAP-ih-tis	p. 241	Infestation of the hair and scalp with head lice.
<b>peptide bond</b> PEP-tyd BAHND	p. 228	Also known as an <i>end bond</i> ; chemical bond that joins amino acids to each other, end-to-end, to form a polypeptide chain.
<b>pheomelanin</b>	p. 230	The lighter pigment that provides natural colors ranging from red and ginger to yellow and blond tones.
<b>pityriasis</b> pit-ih-RY-uh-sus	p. 239	Technical term for dandruff; characterized by excessive production and accumulation of skin cells.
<b>pityriasis capitis simplex</b> pit-ih-RY-uh-sus KAP-ih-tis SIM-pleks	p. 240	Technical term for classic dandruff; characterized by scalp irritation, large flakes, and itchy scalp.
<b>pityriasis steatoides</b> pit-ih-RY-uh-sus stee-uh-TOY-deez	p. 240	Severe case of dandruff characterized by an accumulation of greasy or waxy scales mixed with sebum that stick to the scalp in crusts.
<b>polypeptide chain</b> pahl-ee-PEP-tyd CHAYN	p. 228	A long chain of amino acids linked by peptide bonds.
<b>postpartum alopecia</b> POHST-pahr-tum al-oh-PEE-shah	p. 236	Temporary hair loss experienced towards the end and after the pregnancy.

<b>proteins</b> PROH-teenz	p. 228	Long, coiled complex polypeptides made of amino acids.
<b>ringed hair</b>	p. 237	Variety of canities characterized by alternating bands of gray and pigmented hair throughout the length of the hair strand.
<b>salt bond</b>	p. 228	A weak, physical, cross-link side bond between adjacent polypeptide chains.
<b>scutula</b> SKUCH-ul-uh	p. 240	Dry, sulfur-yellow, cuplike crusts on the scalp in tinea favosa or tinea favus.
<b>sebaceous glands</b>	p. 225	The oil glands in the skin that are connected to the hair follicles.
<b>sebum</b>	p. 225	A fatty or oily substance secreted by the sebaceous glands that lubricates the skin.
<b>side bonds</b>	p. 228	Bonds that cross-link the polypeptide chains together and are responsible for the extreme strength and elasticity of human hair.
<b>telogen phase</b> TEL-uh-jen FAYZ	p. 233	Also known as <i>resting phase</i> ; the final phase in the hair cycle that lasts until the fully grown hair is shed.
<b>terminal hair</b> TUR-mih-nul HAYR	p. 240	Long, coarse, pigmented hair found on the scalp, legs, arms, and bodies of males and females.
<b>tinea</b> TIN-ee-uh	p. 240	Technical term for ringworm—a contagious condition caused by fungal infection and not a parasite; characterized by itching, scales, and, sometimes, painful lesions.
<b>tinea favosa</b> TIN-ee-uh fah-VOH-suh	p. 240	Also known as <i>tinea favus</i> ; fungal infection characterized by dry, sulfur-yellow, cuplike crusts on the scalp called scutula.
<b>trichology</b> trih-KAHL-uh-jee	p. 224	Scientific study of hair and its diseases and care.
<b>trichoptilosis</b> trih-kahp-tih-LOH-sus	p. 238	Technical term for split ends.
<b>trichorrhexis nodosa</b> trik-uh-REK-sis nuh-DOH-suh	p. 238	Technical term for knotted hair; it is characterized by brittleness and the formation of nodular swellings along the hair shaft.
<b>vellus hair</b> VEL-us HAYR	p. 232	Also known as <i>lanugo hair</i> ; short, fine, unpigmented, and downy hair that appears on the body, with the exception of the palms of the hands and the soles of the feet.
<b>wave pattern</b>	p. 230	The shape of the hair strands; described as straight, wavy, curly, and extremely curly.
<b>whorl</b> WHORL	p. 246	Hair that forms in a circular pattern on the crown of the head.