

11 Properties of the Hair and Scalp

Chapter Outline

Why Study Properties of the Hair and Scalp?

Structure of the Hair

Chemical Composition of Hair

Hair Growth

Hair Loss

Disorders of the Hair

Disorders of the Scalp

Hair and Scalp Analysis

Learning Objectives

After completing this chapter, you will be able to:

- ✓ **LO1** Name and describe the structures of the hair root.
- ✓ **LO2** List and describe the three main layers of the hair shaft.
- ✓ **LO3** Describe the three types of side bonds in the cortex.
- ✓ **LO4** Describe the hair growth cycles.
- ✓ **LO5** Discuss the types of hair loss and their causes.
- ✓ **LO6** Describe the options for hair loss treatment.
- ✓ **LO7** Recognize hair and scalp disorders commonly seen in the salon and school and know which ones can be treated by cosmetologists.
- ✓ **LO8** List and describe the factors that should be considered in a hair and scalp analysis.

Key Terms

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

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alopecia areata pg. 231	fragilitas crinium pg. 233	hypertrichosis (hirsuties) pg. 232	salt bond pg. 224
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From 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 hair's well-being.

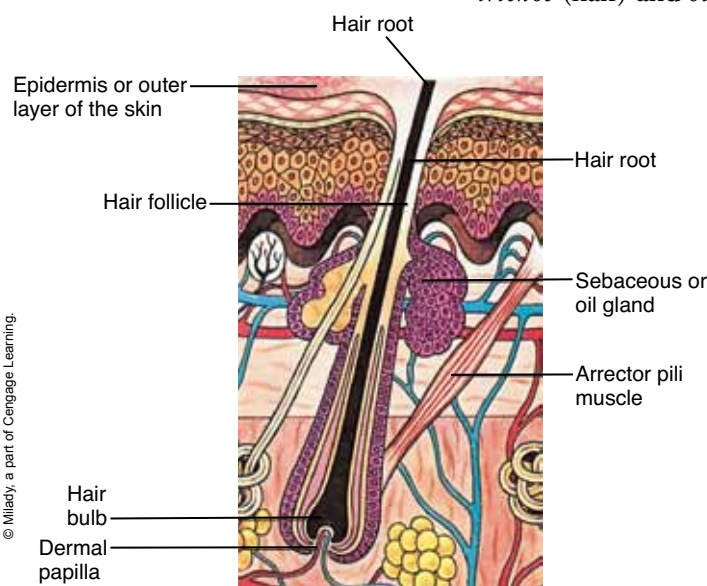
Structure of the Hair

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.



▲ 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 mainly true that what you eat will affect your hair and scalp. The body can produce 11 of the 20 amino acids that make up hair, but your daily diet must include the remaining 9 essential amino acids that the hair and scalp need. This is why crash dieting and anorexia can cause hair loss, lackluster hair, and unhealthy scalp conditions. Proteins in meat, fish, eggs, and dairy products are good sources of these amino acids, as are food combinations such as peanut butter and bread, rice and beans, and beans and corn.

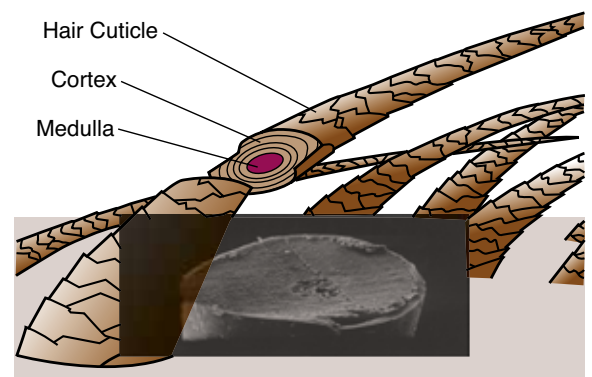
- The **hair follicle** (HAYR FAWL-ih-kul) is the tube-like depression or pocket in the skin or scalp that contains the hair root. Hair follicles are distributed all over the body, with the exception of the palms of the hands and the soles of the feet. The follicle extends downward from the epidermis 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 (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. **LO1**

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



▲ **Figure 11–2**
Cross-section of hair cuticle.



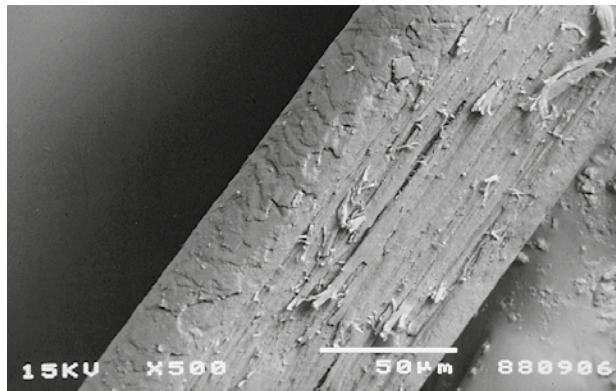
▲ **Figure 11-3**
Hair cuticle layer.

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.

- 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. ✓ **LO2**



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

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 COHNS ELEMENTS

ELEMENT	PERCENTAGE IN NORMAL HAIR
CARBON	51%
OXYGEN	21%
HYDROGEN	6%
NITROGEN	17%
SULFUR	5%

Table 11-1 The COHNS Elements.

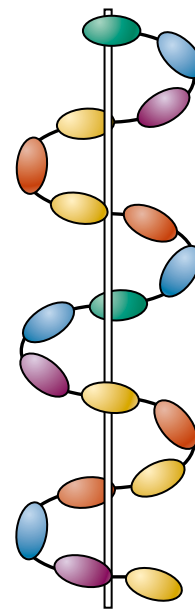
The major elements that make up human hair are carbon, oxygen, hydrogen, nitrogen, and sulfur and are often referred to as the **COHNS elements** (KOH-nz EL-uh-ments). These five elements are also found in skin and nails. **Table 11-1** shows the percentages of each element in a typical strand of hair.

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**).

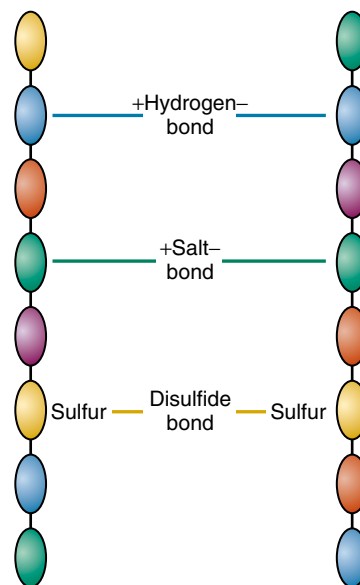
Side Bonds of the Cortex

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



▲ **Figure 11-5**
Polypeptide chains intertwine in a spiral shape called a helix.

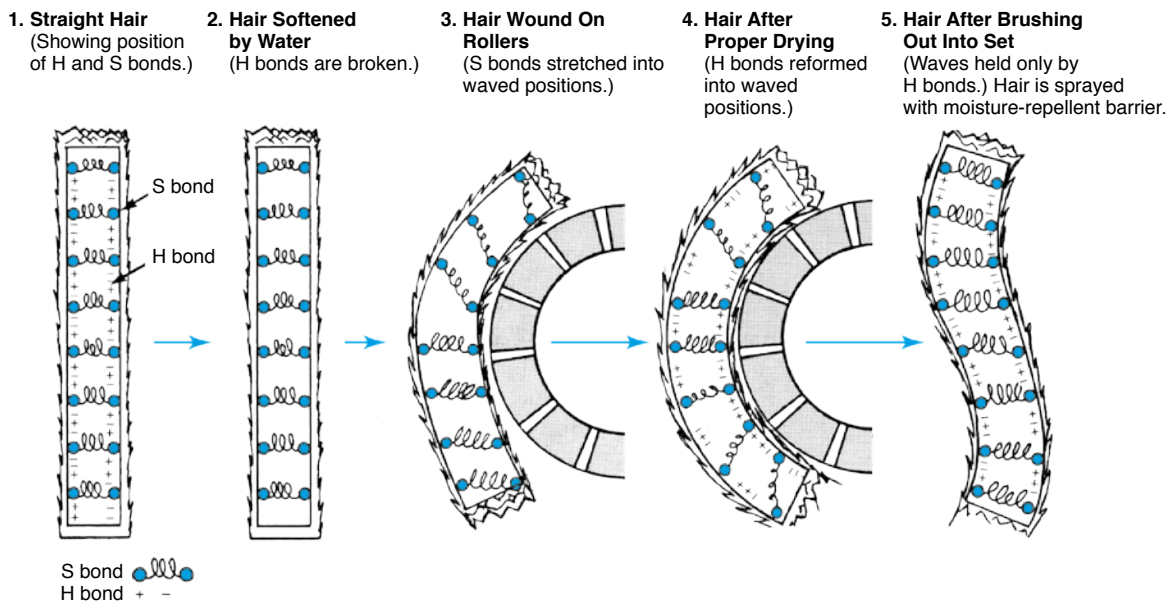


▲ **Figure 11-6**
Side bonds between polypeptide chains.

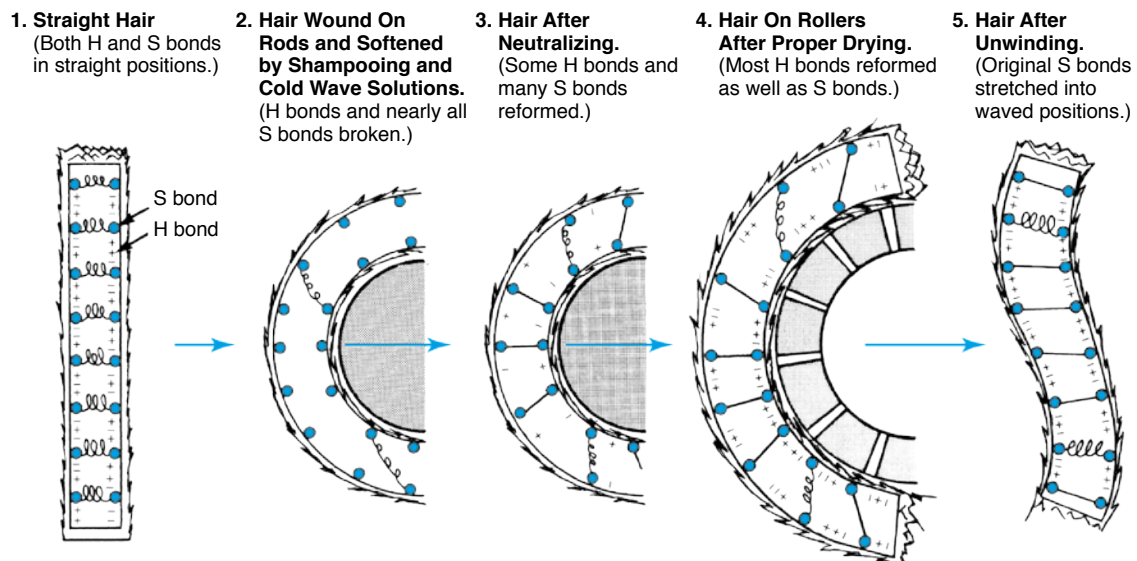
by wetting the hair with water (Figure 11-7). That allows the hair to be stretched and wrapped around rollers. The hydrogen bonds reform when the hair dries.

- 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-ee) amino acids to create one

▼ **Figure 11-7**
Changes in hair cortex during wet setting.



▼ **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

Table 11–2 Bonds of the Hair.

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 (**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.

Thio 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-need 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). **LO3**

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 hair.
- Pheomelanin provides natural colors ranging from red and ginger to yellow and blond tones.

All natural hair color is the result of the ratio of eumelanin to pheomelanin, along with the total number and size of pigment granules.

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**).



▲ Figure 11–9
Straight, wavy, curly, and extremely curly hair strands.

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.

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.

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**).

Another theory that attempts to explain varying degrees of curl is that, in curly hair, one side of the hair strand grows faster than the other side. Since the side that grows faster will be slightly longer than the slower-growing side, tension within the strand causes the long side to curl around the short side. Hair that grows uniformly on both sides does not create tension and results in straight hair. However, this theory is still unproven.

It is true that cross-sections of straight hair tend to be round and curly hair tends to be more oval, but modern microscopes have shown that a cross-section of hair can be almost any shape. So the shape of the cross-section does not always relate to the amount of curl.

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

WAVE PATTERN AND CROSS-SECTIONS

WAVE PATTERN

SHAPE OF CROSS-SECTION

STRAIGHT HAIR

round cross-section

WAVY OR CURLY

oval to flattened oval cross-section

EXTREMELY CURLY HAIR

flattened cross-section

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Table 11–3 Wave Pattern and Cross-Sections.

a telephone cord. Coiled hair 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.

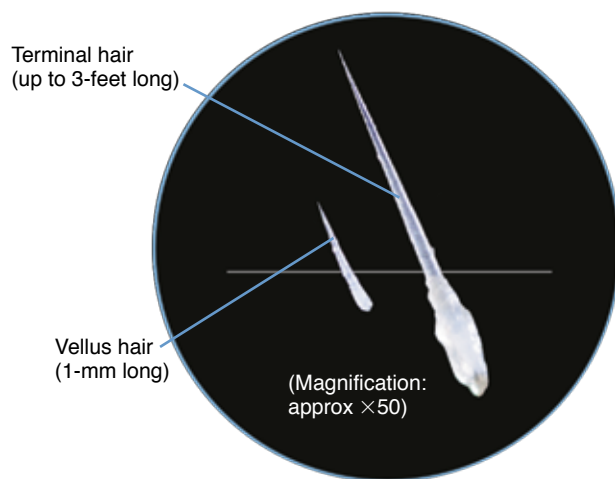
Hair Growth

The two main types of hair found on the body are vellus hair and terminal hair (**Figure 11–10**).

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. 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.



▲ **Figure 11–10**
Vellus hair and terminal hair.

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 (**Figure 11–11**).

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 healthy scalp hair is about $\frac{1}{2}$ (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.




Telogen phase **Return to anagen phase**

▲ **Figure 11–11**
Cycles of hair growth.

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. About 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 four to five years.  **LO4**

Hair Growth Patterns

It is important when shaping and styling hair to consider the hair's growth patterns. Hair follicles usually do not grow out of the head at a perpendicular, 90-degree angle or in a straight direction out from the head. When they do, these growth patterns result in hair streams, whorls, and cowlicks.

Hair growth patterns will be more fully discussed later in this chapter in the Hair Analysis section.

The Truth 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.



Hair Loss

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:

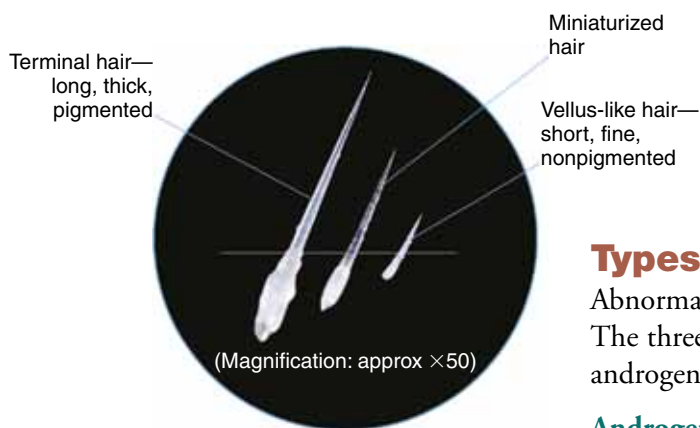
- less physically attractive (by both sexes).
- less assertive.
- less successful.
- less personally likable.
- older (by about five years).

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.



▲ Figure 11-12
Miniaturization of the hair follicle.

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-NETik 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 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 from three to nine months after delivery. 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. **LO5**

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®.

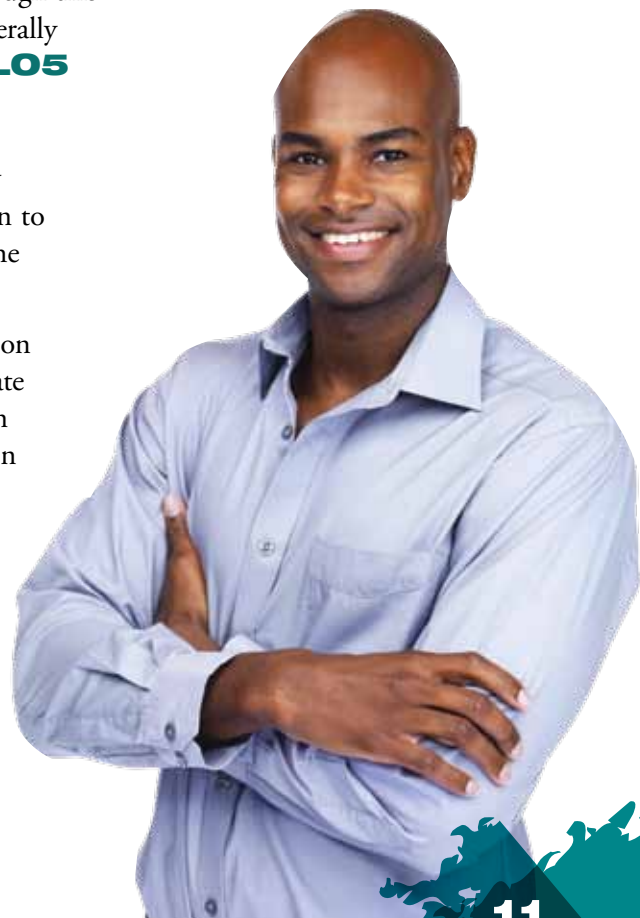
Finasteride is an oral prescription medication for men only. Although finasteride is more effective and convenient than Minoxidil, possible side effects include weight gain and loss of sexual function. Women may not use this treatment, and pregnant women or those who might become pregnant are

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 <http://www.alopeciaareata.com>.



▲ **Figure 11–13**
Alopecia areata.




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



cautioned not to even touch finasteride tablets because of the strong potential for birth defects.

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.) 

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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:

H 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 six 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), twenty-four hours a day, seven days a week, or through the Web at <http://www.lookgoodfeelbetter.org>.

- **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.

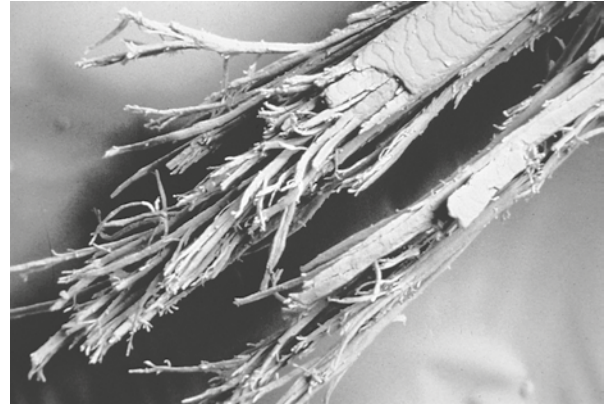
Congenital canities exists at or before birth. It occurs in albinos, who are born without pigment in the skin, hair, and eyes, and occasionally in individuals with normal hair. A patchy type of congenital canities may develop either slowly or rapidly, depending on the cause of the condition.

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.
- **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

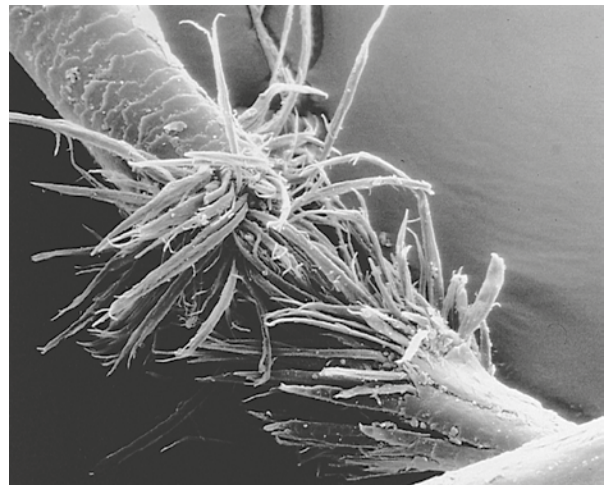
hair in areas of the body that normally grow only vellus hair. Mustaches or light beards on women are examples of hypertrichosis.

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.



▲ **Figure 11–14**
Trichoptilosis.



▲ **Figure 11–15**
Trichorrhexis nodosa.

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 9 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.



▲ **Figure 11–16**
Monilethrix.

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 her scalp. If you feel that you cannot perform the service on your client and need help communicating with her 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 clients 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.

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.

Although the cause of dandruff has been debated for over 150 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.

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 either of these conditions. A client with these conditions must be referred to a physician.



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.

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 uncleaned 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, the most frequently encountered fungal infection resulting from hair services is tinea barbae, also known as barber's itch. 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 capitis is another type of fungal infection characterized by red papules, or spots, at the opening of the hair follicles (**Figure 11-17**). 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.

Tinea favosa (TIN-ee-uh fah-VOH-suh), also known as **tinea favus** (TIN-ee-uh FAH-vus), is characterized by dry, sulfur-yellow, cup-like 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.

Remember: You should never perform a service on anyone who has or who 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 scratches the infected areas and makes the condition worse. Practicing approved cleaning and disinfection procedures is very important to prevent the spread of this disease.

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 11-18 and 11-19**).

did you know?

Tinea barbae (barber's itch) is the most frequently encountered infection resulting from hair services. It affects the coarse hairs in the mustache and beard area or hairs on the neck and scalp. It is usually seen on men.



▲ **Figure 11-17**
Tinea capitis.



▲ **Figure 11-18**
Head lice.



▲ **Figure 11-19**
Nits (lice eggs).

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

Courtesy of The National Pediculosis Association®, Inc.

Courtesy of Hugel Pharmaceutical Corporation.

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.

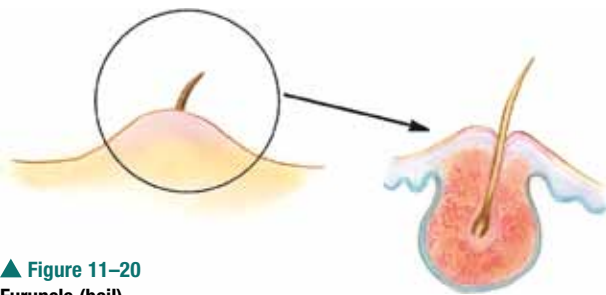
Staphylococci Infections

Staphylococci are bacteria that infect the skin or scalp. The two most common types of staphylococci infections are furuncles and carbuncles.

- 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 (Figure 11–20). 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.

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 or a carbuncle. A client with either condition must be referred to a physician for medical treatment. **LO7**

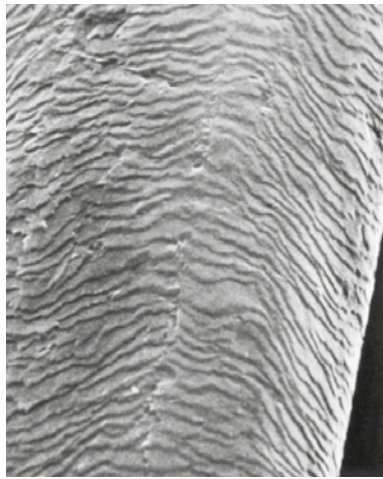


▲ Figure 11–20
Furuncle (boil).

Hair and Scalp Analysis

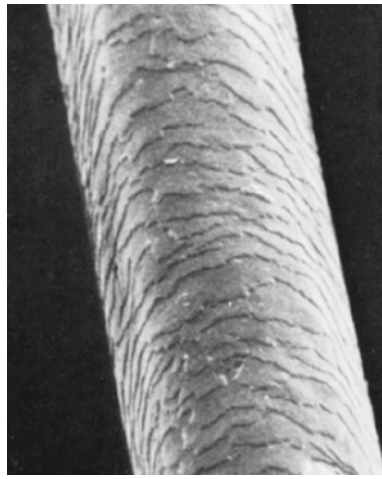
All successful salon services must begin with a thorough analysis of the condition of the client's scalp and client's hair type. Knowing the client's scalp condition and the client's hair type allows you to prepare and make decisions about the results that can be expected from the service.

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, hearing, 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.



Courtesy of The Gillette Research Institute.

▲ Figure 11-21
Coarse hair.



Courtesy of The Gillette Research Institute.

▲ Figure 11-22
Medium hair.



Courtesy of The Gillette Research Institute.

▲ Figure 11-23
Fine hair.

Texture

Hair texture is the thickness or diameter of the individual hair strand. Hair texture can be classified as coarse, medium, or fine (Figures 11-21, 11-22, and 11-23) 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 11-24).



▲ Figure 11-24
Testing for hair texture.

FOCUS ON

RETAILING

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.

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

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Table 11-4 Average Number of Hairs on the Head by Hair Color.

Density

Hair density measures the number of individual hair strands on 1 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 1 square inch. Hair with high density (thick or dense hair) has more hairs per 1 square inch, and hair with low density (thin hair) has fewer hairs per 1 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).

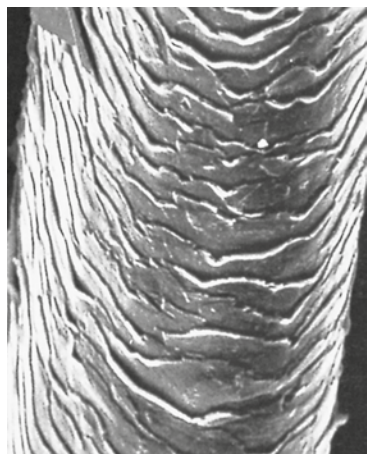
Hair with low porosity is considered resistant (**Figure 11-25**). Chemical services performed on hair with low porosity require a more alkaline solution than those on hair with high porosity. Alkaline solutions raise the cuticle and permit uniform saturation and processing on resistant hair.

Hair with average porosity is considered to be normal hair (**Figure 11-26**). Chemical services performed on this type of hair will usually process as expected, according to the texture.



Courtesy of The Gillette Research Institute.

▲ Figure 11-25
Low porosity (resistant hair).



Courtesy of The Gillette Research Institute.

▲ Figure 11-26
Average porosity (normal hair).

Hair with high porosity is considered overly porous hair and is often the result of previous overprocessing (Figure 11–27). Overly porous hair is 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.

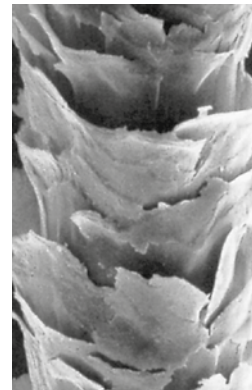
You can check porosity on dry hair by taking a strand of several hairs from four different areas of the head (front hairline, temple, crown, and nape). Hold the strand securely with one hand while sliding the thumb and forefinger of the other hand from the end to the scalp. If the hair feels smooth and 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 11–28).

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 11–29). 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.



Courtesy of The Gillette Research Institute.

▲ Figure 11–27
High porosity (overly porous hair).



© Milady a part of Cengage Learning. Photography by Paul Casale, Casale Photography.

▲ Figure 11–28
Testing for hair porosity.



© Milady a part of Cengage Learning. Photography by Paul Casale, Casale Photography.

▲ Figure 11–29
Testing for hair elasticity.

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?

Hair Growth Patterns

As mentioned earlier in the chapter, 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) is hair that forms in a circular pattern, as on the crown of the head. A whorl normally forms in the crown with all the hair from that point growing down.
- A **cowlick** (KOW-lik) is a tuft of hair that stands straight up. Cowlicks are usually more noticeable at the front hairline but they may be located anywhere on the head.

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 hair loss treatments approved by the FDA?
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?

Chapter Glossary

alopecia	Abnormal hair loss.
alopecia areata	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.
alopecia totalis	Total loss of scalp hair.
alopecia universalis	Complete loss of body hair.
amino acids	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.
anagen phase	Also known as <i>growth phase</i> ; phase during which new hair is produced.
androgenic alopecia	Also known as <i>androgenetic alopecia</i> ; hair loss characterized by miniaturization of terminal hair that is converted to vellus hair; in men, it is known as male pattern baldness.
canities	Technical term for gray hair; results from the loss of the hair's natural melanin pigment.
carbuncle	Inflammation of the subcutaneous tissue caused by staphylococci; similar to a furuncle but larger.
catagen phase	The brief transition period between the growth and resting phases of a hair follicle. It signals the end of the growth phase.
COHNS elements	The five elements—carbon, oxygen, hydrogen, nitrogen, and sulfur—that make up human hair, skin, tissue, and nails.
cortex	Middle layer of the hair; a fibrous protein core formed by elongated cells containing melanin pigment.

Chapter Glossary

cowlick	Tuft of hair that stands straight up.
cysteine	An amino acid joined with another cysteine amino acid to create cystine amino acid.
cystine	An amino acid that joins together two peptide strands.
disulfide bond	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.
fragilitas crinium	Technical term for brittle hair.
furuncle	Boil; acute, localized bacterial infection of the hair follicle that produces constant pain.
hair bulb	Lowest part of a hair strand; the thickened, club-shaped structure that forms the lower part of the hair root.
hair cuticle	Outermost layer of hair; consisting of a single, overlapping layer of transparent, scale-like cells that look like shingles on a roof.
hair density	The number of individual hair strands on 1 square inch (2.5 square centimeters) of scalp.
hair elasticity	Ability of the hair to stretch and return to its original length without breaking.
hair follicle	The tube-like depression or pocket in the skin or scalp that contains the hair root.
hair porosity	Ability of the hair to absorb moisture.
hair root	The part of the hair located below the surface of the epidermis.
hair shaft	The portion of hair that projects above the epidermis.
hair stream	Hair flowing in the same direction, resulting from follicles sloping in the same direction.
hair texture	Thickness or diameter of the individual hair strand.
helix	Spiral shape of a coiled protein created by polypeptide chains that intertwine with each other.
hydrogen bond	A weak, physical, cross-link side bond that is easily broken by water or heat.
hydrophilic	Easily absorbs moisture; in chemistry terms, capable of combining with or attracting water (water-loving).
hydrophobic	Naturally resistant to being penetrated by moisture.
hypertrichosis	Also known as <i>hirsuties</i> ; condition of abnormal growth of hair, characterized by the growth of terminal hair in areas of the body that normally grow only vellus hair.
keratinization	Process by which newly formed cells in the hair bulb mature, fill with keratin, move upward, lose their nucleus, and die.
lanthionine bonds	The bonds created when disulfide bonds are broken by hydroxide chemical hair relaxers after the relaxer is rinsed from the hair.
malassezia	Naturally occurring fungus that is present on all human skin, but is responsible for dandruff when it grows out of control.

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medulla	Innermost layer of the hair that is composed of round cells; often absent in fine and naturally blond hair.
monilethrix	Technical term for beaded hair.
pediculosis capitis	Infestation of the hair and scalp with head lice.
peptide bond	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.
pityriasis	Technical term for dandruff; characterized by excessive production and accumulation of skin cells.
pityriasis capitis simplex	Technical term for classic dandruff; characterized by scalp irritation, large flakes, and itchy scalp.
pityriasis steatoides	Severe case of dandruff characterized by an accumulation of greasy or waxy scales mixed with sebum, that stick to the scalp in crusts.
polypeptide chain	A long chain of amino acids linked by peptide bonds.
postpartum alopecia	Temporary hair loss experienced at the conclusion of a pregnancy.
proteins	Long, coiled complex polypeptides made of amino acids.
ringed hair	Variety of canities characterized by alternating bands of gray and pigmented hair throughout the length of the hair strand.
salt bond	A weak, physical, cross-link side bond between adjacent polypeptide chains.
scutula	Dry, sulfur-yellow, cup-like crusts on the scalp in tinea favosa or tinea favus.
side bonds	Bonds that cross-link the polypeptide chains together and are responsible for the extreme strength and elasticity of human hair.
telogen phase	Also known as <i>resting phase</i> ; the final phase in the hair cycle that lasts until the fully grown hair is shed.
terminal hair	Long, coarse, pigmented hair found on the scalp, legs, arms, and bodies of males and females.
tinea	Technical term for ringworm, a contagious condition caused by fungal infection and not a parasite; characterized by itching, scales, and, sometimes, painful lesions.
tinea favosa	Also known as <i>tinea favus</i> ; fungal infection characterized by dry, sulfur-yellow, cup-like crusts on the scalp called scutula.
trichology	Scientific study of hair and its diseases and care.
trichoptilosis	Technical term for split ends.
trichorrhhexis nodosa	Technical term for knotted hair; it is characterized by brittleness and the formation of nodular swellings along the hair shaft.
vellus hair	Also known as <i>lanugo hair</i> ; short, fine, unpigmented downy hair that appears on the body, with the exception of the palms of the hands and the soles of the feet.
wave pattern	The shape of the hair strands; described as straight, wavy, curly, and extremely curly.
whorl	Hair that forms in a circular pattern on the crown of the head.