This blue and green spiky hairstyle makes quite a fashion statement. Many people spend a lot of time and money on their hair, even if they don’t have such an exceptional hairstyle as this one. Besides its display value, hair actually has important physiological functions.

**Figure 1** (public domain; Jagvar; via Wikimedia.org)

**Hair** is a filament that grows from a **hair follicle** in the dermis of the skin. It consists mainly of tightly packed, keratin-filled cells called keratinocytes. The human body is covered with hair follicles except for a few areas, including the mucous membranes, lips, palms of the hands, and soles of the feet.
Structure of Hair

The part of the hair that is located within the follicle is called the **hair root**. The root is the only living part of the hair. The part of the hair that is visible above the surface of the skin is the hair shaft. The shaft of the hair has no biochemical activity and is considered dead.

Follicle and Root

![Follicle and Root Diagram](https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/13%3A_Integument...

Hair growth begins inside a follicle (Figure 1). Each hair follicle contains stem cells that can keep dividing and allow hair to grow. The stem cells can also regrow a new hair after one falls out. Another structure associated with a hair follicle is a sebaceous gland that produces oily sebum, which lubricates and helps to waterproof the hair. A tiny arrector pili muscle is also attached to the follicle. When it contracts, the follicle moves and the hair in the follicle stands up.

Shaft

The **hair shaft** is a hard filament that may grow to become very long. Hair normally grows in length by about half an inch a month. In cross-section, a hair shaft can be divided into three zones, called the cuticle, cortex, and medulla.

- The cuticle (or outer coat) is the outermost zone of the hair shaft. It consists of several layers of flat, thin keratinocytes that overlap one another like shingles on a roof. This arrangement helps the cuticle repel water. The cuticle is also covered with a layer of lipids, just one molecule thick, which increases its ability to repel water. This is the zone of the hair shaft that is visible to the eye.

- The cortex is the middle zone of the hair shaft. It is the widest part of the hair shaft. The cortex is highly structured and organized, consisting of keratin bundles in rod-like structures. These structures give hair its mechanical strength. The cortex also contains melanin, which gives hair its color.

- The medulla is the innermost zone of the hair shaft. This is a small, disorganized, and more open area at the center of the hair shaft. The medulla is not always present. When it is present, it contains highly pigmented cells full of keratin.
Functions of Hair

In humans, one function of head hair is to provide insulation and help the head retain heat. Head hair also protects the skin on the head from damage by UV light. The function of hair in other locations on the body is debated. One idea is that body hair helps to keep us warm in cold weather. When the body is too cold, the arrector pili muscles contract and cause hairs to stand up, trapping a layer of warm air above the epidermis. However, this is more effective in mammals that have thick hair or fur than it is in relatively hairless human beings.

![Figure 3](https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/13%3A_Integument...) This young child is using his eyebrows to good effect to convey his displeasure. (CC BY 2.0; Jon Eben Field; via Wikimedia.org)

Human hair has an important sensory function as well. Sensory receptors in the hair follicles can sense when the hair moves, whether it moves because of a breeze or the touch of a physical object. The receptors may also provide sensory awareness of the presence of parasites on the skin. Some hairs, such as the eyelashes, are especially sensitive to the presence of potentially harmful matter. The eyebrows protect the eyes from dirt, sweat, and rain. In addition, the eyebrows play a key role in nonverbal communication (Figure 3). They help express emotions such as sadness, anger, surprise, and excitement.

What Are Nails?

**Nails** are accessory organs of the skin. They are made of sheets of dead keratinocytes and are found on the far, or distal, ends of the fingers and toes. The keratin in nails makes them hard but flexible. Nails serve a number of purposes, including protecting the digits, enhancing sensations, and acting like tools.

**Nail Anatomy**

A nail has three main parts: the root, plate, and free margin. Other structures around or under the nail include the nail bed, cuticle, and nail fold. These structures are shown in the figure below.

- The **nail root** is the portion of the nail found under the surface of the skin at the near, or proximal, end of the nail.
is where the nail begins.

- The **nail plate** (or body) is the portion of the nail that is external to the skin. It is the visible part of the nail.
- The free margin is the portion of the nail that protrudes beyond the distal end of the finger or toe. This is the part that is cut or filed to keep the nail trimmed.
- The **nail bed** is the area of skin under the nail plate. It is pink in color due to the presence of capillaries in the dermis.
- The cuticle is a layer of dead epithelial cells that overlaps and covers the edge of the nail plate. It helps to seal the edges of the nail to prevent infection of the underlying tissues.
- The nail fold is a groove in the skin in which the side edges of the nail plate are embedded.

![Nail Diagram](image)

Figure \(\PageIndex{4}\): The top diagram in this figure shows the external, visible part of the nail and the cuticle. The bottom diagram shows internal structures in a cross-section of the nail and nail bed. (CC BY 3.0; Blausen.com staff, 2014; via Wikimedia.org)

### Nail Growth

Nails grow from a deep layer of living epidermal tissue, known as the **nail matrix**, at the proximal end of the nail. The nail matrix surrounds the nail root. It contains stem cells that divide to form keratinocytes, which are cells that produce keratin and make up the nail.

#### Formation of the Nail Root and Nail Plate

The keratinocytes produced by the nail matrix accumulate to form tough, hard, translucent sheets of dead cells filled with keratin. The sheets make up the nail root, which slowly grows out of the skin and becomes the nail plate when it reaches the skin surface. As the nail grows longer, the cells of the nail root and nail plate are pushed toward the distal end of the finger or toe by new cells being formed in the nail matrix. The upper epidermal cells of the nail bed also move along with the nail plate as it grows toward the tip of the digit. The proximal end of the nail plate near the root has a whitish crescent shape called the lunula. This is where a small amount of the nail matrix is visible through the nail plate. The lunula is most pronounced in the nails of the thumbs and may not be visible in the nails of the little fingers.

### Functions of Nails

Both fingernails and toenails protect the soft tissues of the fingers and toes from injury. Fingernails also serve to enhance sensation and precise movements of the fingertips through the counter-pressure exerted on the pulp of the fingers by the nails. In addition, fingernails can function as several different types of tools. For example, they enable a
fine precision grip like tweezers and can also be used for cutting and scraping.

**Nails and Health**

Healthcare providers, particularly EMTs, often examine the fingernail beds as a quick and easy indicator of oxygen saturation of the blood or the amount of blood reaching the extremities. If the nail beds are bluish or purple, it is generally a sign of low oxygen saturation. To see if blood flow to the extremities is adequate, a blanch test may be done. In this test, a fingernail is briefly depressed to turn the nail bed white by forcing the blood out of its capillaries. When the pressure is released, the pink color of the nail bed should return within a second or two if there is normal blood flow. If the return to a pink color is delayed, then it can be an indicator of low blood volume due to dehydration or shock. Nails — especially toenails — are common sites of fungal infections, causing nails to become thickened and yellowish in color. Toenails are more often infected than fingernails because they are often confined in shoes. This provides a dark, warm, moist environment where fungi can thrive. Toes also tend to have less blood flow than fingers, making it harder for the immune system to detect and stop infections in toenails. Although nails are harder and tougher than the skin, they are more permeable than skin. Harmful substances, such as herbicides may be absorbed through the nails and cause health problems.

**Feature: Reliable Sources**

Do you get regular manicures or pedicures from a nail technician? If so, there is a chance that you are putting your health at risk. Nail tools that are not properly disinfected between clients may transmit infections from one person to another. Cutting the cuticles with scissors may create breaks in the skin that let infective agents enter the body. Products such as acrylics, adhesives, and UV gels that are applied to the nails may be harmful, especially if they penetrate the nails and enter the skin.

Use the Internet and find several reliable sources that address the health risks of professional manicures or pedicures. Try to find answers to the following questions:

1. What training and certification are required for professional nail technicians?
2. What licenses and inspections are required for nail salons?
3. What hygienic practices should be followed in nail salons to reduce the risk of infections being transmitted to clients?
4. Which professional nail products are potentially harmful to the human body and which are safer?
5. How likely is it to have an adverse health consequence when you get a professional manicure or pedicure?
6. What steps can you take to ensure that a professional manicure or pedicure is safe?

**Summary**

- Hair is a filament that grows from a hair follicle in the dermis of the skin. It consists mainly of tightly packed, keratin-filled cells called keratinocytes. The human body is almost completely covered with hair follicles.
- The part of a hair that is within the follicle is the hair root. This is the only living part of a hair. The part of a hair that is visible above the skin surface is the hair shaft. It consists of dead cells.
- Hair growth begins inside a follicle when stem cells within the follicle divide to produce new keratinocytes. Individual hair may grow to be very long.
• A hair shaft has three zones: the outermost zone called the cuticle; the middle zone called the cortex, and the innermost zone called the medulla.

• Functions of head hair include providing insulation and protecting the skin on the head from UV light. Hair everywhere on the body has an important sensory function. Hair in eyelashes and eyebrows protects the eyes from dust, dirt, sweat, and other potentially harmful substances. The eyebrows also play a role in nonverbal communication.

• Nails are accessory organs of the skin, consisting of sheets of dead, keratin-filled keratinocytes. The keratin in nails makes them hard but flexible.

• A nail has three main parts: the nail root, which is under the epidermis; the nail plate, which is the visible part of the nail; and the free margin, which is the distal edge of the nail. Other structures under or around a nail include the nail bed, cuticle, and nail fold.

• A nail grows from a deep layer of living epidermal tissues, called the nail matrix, at the proximal end of the nail. Stem cells in the nail matrix keep dividing to allow nail growth, forming first the nail root and then the nail plate as the nail continues to grow longer and emerges from the epidermis.

• Functions of nails include protecting the digits, enhancing sensations and precise movements of the fingertips, and acting as tools.

• The color of the nail bed can be used to quickly assess oxygen and blood flow in a patient. How the nail plate grows out can reflect recent health problems, such as illness or nutrient deficiency. Nails — and especially toenails — are prone to fungus infections. Nails are more permeable than skin and can absorb several harmful substances such as herbicides.

Review

1. Compare and contrast the hair root and hair shaft.
2. Describe hair follicles.
3. Identify the three zones of a hair shaft.
4. Describe two functions of human hair.
5. True or False. Eyelashes can have a sensory function.
6. Hair consists mainly of:
   - A. Melanocytes
   - B. Keratinocytes
   - C. Epidermocytes
   - D. Hirocytes
7. What are the nails?
8. Describe three parts of the nail.
9. Explain why most of the nail plate looks pink.
10. Describe a lunula.
11. Explain how a nail grows.
12. Identify three functions of nails.
13. Give several examples of how nails are related to health.
14. True or False. Nails grow from the distal end to the proximal end of your fingers and toes.
15. True or False. The nail bed refers to the middle portion of the hard nail plate.
16. Nails are composed mainly of a protein called:

   A. Elastin
   B. Collagen
   C. Keratin
   D. Melanin

17. a. What is the cuticle of the nail composed of?
   b. What is the function of the cuticle?
   c. Why is it a bad idea to cut the cuticle during a manicure?

18. What is the name of the part of the nail that you trim?

19. Is the nail plate composed of living or dead cells?

Explore More
https://bio.libretexts.org/link?16798#Explore_More

Do you wonder what causes male pattern baldness? Watch this short video to find out.
Nails are not just for decoration, they can actually tell us a lot about our health. Learn more here:

https://youtu.be/aTSVHwzkYI4
Media, iframe, embed and object tags are not supported inside of a PDF.