Chapter 7

It’s Skin Deep: The Integumentary System

In This Chapter
- Going below the surface of the skin
- Getting on your nerves
- Checking out hair, nails, and glands

Did you know that the skin is the body’s largest organ? In an average person, its 17 to 20 square feet of surface area represents 15 percent of the body’s weight. Self-repairing and surprisingly durable, the skin is the first line of defense against the harmful effects of the outside world. It helps retain moisture; regulates body temperature; hosts the sense receptors for touch, pain, and heat; excretes excess salts and small amounts of waste; and even stores blood to be moved quickly to other parts of the body when needed.

Skin is jam-packed with components; it has been estimated that every square inch of skin contains 15 feet of blood vessels, 4 yards of nerves, 650 sweat glands, 100 oil glands, 1,500 sensory receptors, and over 3 million cells with an average lifespan of 26 days that are constantly being replaced.

In this chapter, we peel back the surface of this most-visible organ system. We also give you plenty of opportunities to test your knowledge.

Dermatology Down Deep

Skin — together with hair, nails, and glands — composes the integumentary system (shown in Figure 7-1). The name stems from the Latin verb integere, which means “to cover.” The relevant Greek and Latin roots include dermato and cutis, both of which mean “skin.”

The skin consists of two primary parts: the epidermis and the dermis. (Recall the Greek root epi-, which means “upon” or “above.”) Underlying the epidermis and dermis is the hypodermis or superficial fascia (also sometimes called subcutaneous tissue), which acts as a foundation but is not part of the skin. Composed of areolar (porous) and adipose (fat) tissue, it anchors the skin through fibers that extend from the dermis. Underneath, the hypodermis attaches loosely to tissues and organs so that muscles can move freely. Around elbow and knee joints, the hypodermis contains fluid-filled sacs called bursae. The fat in the hypodermis buffers deeper tissues and acts as insulation, preventing heat loss from within the body’s core. The hypodermis also is home to pressure-sensitive nerve endings called lamellated or Pacinian corpuscles that respond to a deeper poke in the skin.
Epidermis: Don’t judge this book by its cover

Epidermis, which contains no blood vessels, is made up of layers of closely packed epithelial cells. From the outside in, these layers are the following:

- **Stratum corneum** (literally the “horny layer”) is about 20 layers of flat, scaly, dead cells containing a type of water-repellent protein called keratin. These cells, which represent about three-quarters of the thickness of the epidermis, are said to be *cornified*, which means that they’re tough and horny like the cells that form hair or fingernails. Humans shed this layer of tough, durable skin at a prodigious rate; in fact, much of household dust consists of these flaked-off cells. Where the skin is rubbed or pressed more often, cell division increases, resulting in calluses and corns.

- **Stratum lucidum** (from the Latin word for “clear”) is found only in the thick skin on the palms of the hands and the soles of the feet. This translucent layer of dead cells contains *eleidin*, a protein that becomes keratin as the cells migrate into the stratum corneum, and it consists of cells that have lost their nuclei and cytoplasm.
Stratum granulosum is three to five layers of flattened cells containing kerato-hyalin, a substance that marks the beginning of keratin formation. No nourishment from blood vessels reaches this far into the epidermis, so cells are either dead or dying by the time they reach the stratum granulosum. The nuclei of cells found in this layer are degenerating; when the nuclei break down entirely, the cell can’t metabolize nutrients and dies.

Stratum spinosum (also sometimes called the spinous layer) has ten layers containing prickle cells, named for the spine-like projections that connect them with other cells in the layer. Langerhans cells, believed to be involved in the body’s immune response, are prevalent in the upper portions of this layer and sometimes the lower part of the stratum granulosum; they migrate from the skin to the lymph nodes in response to infection. Some mitosis (cell division) takes place in the stratum spinosum, but the cells lose the ability to divide as they mature.

Stratum basale (or stratum germinativum) is also referred to as the germinal layer because this single layer of mostly columnar stem cells generates all the cells found in the other epidermal layers. It rests on the papillary (rough or bumpy) surface of the dermis, close to the blood supply needed for nourishment and oxygen. The mitosis that constantly occurs here replenishes the skin; it takes about two weeks for the cells that originate here to migrate up to the stratum corneum, and it’s another two weeks before they’re shed. About a quarter of this layer’s cells are melanocytes, cells that synthesize a pale yellow to black pigment called melanin that contributes to skin color and provides protection against ultraviolet radiation (the kind of radiation found in sunlight). The remaining cells in this layer become keratinocytes, the primary epithelial cell of the skin. Melanocytes secrete melanin directly into the keratinocytes in a process called cytocrine secretion. Merkel’s cells, a large oval cell believed to be involved in the sense of touch, occasionally appear amid the keratinocytes.

In addition to melanin, the epidermis contains a yellowish pigment called carotene (the same one found in carrots and sweet potatoes). Found in the stratum corneum and the fatty layers beneath the skin, it produces the yellowish hue associated with Asian ancestry or increased carrot consumption. The pink to red color of Caucasian skin is caused by hemoglobin, the red pigment of the blood cells. Because Caucasian skin contains relatively less melanin, hemoglobin can be seen more easily through the epidermis. Sometimes the limited melanin in Caucasian skin pools in small patches. Can you guess the name of those patches of color? Yep, they’re freckles. Albinos, on the other hand, have no melanin in their skin at all, making them particularly sensitive to ultraviolet radiation.

Ridges and grooves form on the outer surface of the epidermis to increase the friction needed to grasp objects or move across slick surfaces. On hands and feet, these ridges form patterns of loops and whorls — fingerprints, palm prints, and footprints — that are unique to each person. You leave these imprints on smooth surfaces because of the oily secretions of the sweat glands on the skin’s surface. In addition to these finer patterns, the areas around joints develop patterns called flexion lines. Deeper and more permanent lines are called flexion creases.

**Dermis: It’s more than skin deep**

Beneath the epidermis is a thicker, fibrous structure called the dermis, or corium. It consists of the following two layers, which blend together:

- The outer, soft papillary layer contains elastic and reticular (net-like) fibers that project into the epidermis to bring blood and nerve endings closer. Papillae (finger-like projections) containing loops of capillaries increase the surface area of the dermis and anchor the epidermis. Some of these papillae contain
1. The layer of epidermis in which mitosis takes place is the stratum
   a. Corneum
   b. Lucidum
   c. Granulosum
   d. Spinosum
   e. Basale

2. The papillary layer of the dermis
   a. Is composed of numerous projections
   b. Extends into the epidermis
   c. Carries the blood and nerve endings close to the epidermis
   d. Aids in holding the epidermis and dermis together
   e. All of the above

3. The correct answer is corneum. Cornified, corns — think of how hard a kernel of popcorn can be.
3. The function of the epidermal ridges on the fingers is to
   a. Provide a means of identification
   b. Increase the friction of the epidermal surface
   c. Decrease water loss by the tissues
   d. Aid in regulating body temperature
   e. Prevent bacterial infection

4. The color of Caucasian skin is due to
   a. Carotene pigment in the dermis
   b. The high level of melanin in the epidermis
   c. Less melanin in the skin, allowing the blood pigment to be seen
   d. The absence of all pigment
   e. Melanin and carotene pigments

5. The sequence of layers in the epidermis from the dermis outward is
   a. Corneum, lucidum, granulosum, spinosum, basale
   b. Corneum, granulosum, lucidum, basale, spinosum
   c. Spinosum, basale, granulosum, corneum, lucidum
   d. Basale, spinosum, granulosum, lucidum, corneum
   e. Basale, lucidum, corneum, spinosum, granulosum

6. The subcutaneous layer of tissue can be called the
   a. Epidermis
   b. Superficial fascia
   c. Papillary layer
   d. Inner reticular layer
   e. Dermis

7. The lines in fingerprints are determined by
   a. The contours of the dermal papillae
   b. The thickness of the dermis
   c. The bundles of collagenous and elastic fibers in the epidermis
   d. The fibroblasts, macrophages, and adipose tissue surrounding the nerves
   e. The surface layer of cells that are constantly being shed

8. A function not pertaining to the skin is
   a. Aids in retaining water
   b. Regulates body temperature
   c. Contains sense receptors
   d. Excretes some waste materials
   e. Provides movement
9. A layer of dense, irregular connective tissue containing interlacing bundles of collagenous and elastic fibers is the
   a. Basal layer of the epidermis
   b. Reticular layer of the dermis
   c. Outer layer of the hypodermis
   d. Papillary layer of the dermis
   e. Inner layer of the hypodermis

10. The stratum corneum cells contain a tough, water-repellent protein called
    a. Keratohyalin
    b. Eleidin
    c. Keratin
    d. Cerumen
    e. Sweat

11. The epidermal layer containing keratohyalin is the
    a. Stratum germinativum
    b. Stratum spinosum
    c. Stratum lucidum
    d. Stratum granulosum
    e. Stratum corneum

12. The layer of skin attached to the superficial fascia is the
    a. Papillary layer of the dermis
    b. Stratum granulosum
    c. Stratum germinativum
    d. Holorine layer of the epidermis
    e. Reticular layer of the dermis

13. Flattened and irregular cells with small, spine-like projections that connect them with other cells in the layer are referred to as
    a. Prickle cells
    b. Langerhans cells
    c. Melanocytes
    d. Merkel’s cells
    e. Keratohyalin cells

14. If melanin forms into patches, it’s referred to as
    a. Flexion creases
    b. Freckles
    c. Dermal papillae
    d. Lamellated corpuscles
    e. Matrix
Touching a Nerve in the Integumentary System

At least four kinds of receptors are involved in creating the sensation of touch.

- **Free nerve endings**: These afferent nerve endings are dendrites (branched extensions) of sensory neurons that act primarily as pain receptors, although some sense temperature, touch, and muscles (including the sensation of “stretch”). Found all over the body, free nerve endings are especially prevalent in epithelial and connective tissue. These small-diameter fibers have a swelling at the end that responds to touch and sometimes heat, cold, or pain. Some of the endings are disc-shaped structures called **Merkel discs** that function as light-touch receptors within the deep layers of the epidermis.

- **Meissner’s corpuscles**: These light-touch mechanoreceptors lie within the dermal papillae. They’re small, egg-shaped capsules of connective tissue surrounding a spiraled end of a dendrite. Most abundant in sensitive skin areas such as the lips and fingertips, these corpuscles and free nerve endings can sense a quick touch but not a sustained one. That’s why your skin is able to ignore the touch sensation of your own clothing.

- **Pacinian corpuscles**: These deep-pressure mechanoreceptors are dendrites surrounded by concentric layers of connective tissue. Found deep within the dermis, they respond to deep or firm pressure and vibrations. Each is over 2 millimeters long and therefore visible to the naked eye.

- **Hair nerve endings**: These mechanoreceptors respond to a change in position of a hair. They consist of bare dendrites.

There are two primary temperature receptors, one for heat and one for cold:

- **End-bulbs of Krause**: Also known as **Krause’s corpuscles**, these cold receptors usually activate below 68 degrees F (20 degrees C). They consist of a bulbous capsule surrounding the dendrite and are commonly found throughout the body in the dermis as well as in the lips, the tongue, and the conjunctiva of the eyes.

- **Brushes of Ruffini**: Also known as **Ruffini cylinders** or **Ruffini’s corpuscles**, these warmth receptors respond to temperatures between 77 degrees and 113 degrees F (25 degrees to 45 degrees C). Found primarily in the dermis and subcutaneous tissue, they’re dendrite endings enclosed in a flattened capsule. Because there are fewer of them than Krause’s end-bulbs and because they lie in deeper tissue, the body is less sensitive to heat than to cold.

In addition to the receptors for touch and temperature, the dermis has neuromuscular spindles (also called ** proprioceptors**) that transmit information to the spinal cord and brain about the lengths and tensions of muscles. This information helps provide awareness of the body’s position and the relative position of body parts. The spindles also assist with muscle coordination and muscle action efficiency.
Test whether you’re staying in touch with this section:

15. The sensation of a soft touch is received by
   a. Ruffini’s corpuscles
   b. Pacinian corpuscles
   c. The Crypt of Lieberkuhn
   d. The end-bulbs of Krause
   e. Meissner’s corpuscles

16. End-bulbs of Krause are receptors for cold that usually are activated at temperatures below
   a. 98.6 degrees F
   b. 20 degrees F
   c. 68 degrees F
   d. 45 degrees F
   e. 77 degrees F

**Accessorizing with Hair, Nails, and Glands**

Mother Nature has accessorized your fashionable over-wrap with a variety of specialized structures that grow from the epidermis: hair, fingernails, toenails, sebaceous glands, and sweat glands.

**Wigging out about hair**

Like most mammals, hair covers the entire human body except for the lips, eyelids, palms of the hands, soles of the feet, nipples, and portions of external reproductive organs. But human body hair generally is sparser and much lighter in color than that sported by most other mammals. Animals have hair for protection and temperature control. For humans, however, body hair is largely a secondary sex characteristic.

A thick head of hair protects the scalp from exposure to the sun’s harmful rays and limits heat loss. Eyelashes block sunlight and deflect debris from the eyes. Hair in the nose and ears prevents airborne particles and insects from entering. Touch receptors connected to hair follicles respond to the lightest brush. The average adult has about 5 million hairs, with about 100,000 of those growing from the scalp. Normal hair loss from an adult scalp is about 70 to 100 hairs each day, although baldness can result from genetic factors, hormonal imbalances, scalp injuries, disease, dietary deficiencies, radiation, or chemotherapy.

Each hair grows at an angle from a follicle embedded in the epidermis and extending into the dermis; scalp hairs sometimes reach as far as the hypodermis. Nerves reach the hair at the follicle’s expanded base, called the bulb, where a nipple-shaped papilla of connective tissue and capillaries provide nutrients to the growing hair. Epithelial cells in the bulb divide to produce the hair’s shaft (the part that extends out of the follicle). (The part of the hair within the follicle is called the root.) The shape of a hair’s cross section can vary from round to oval or even flat; oval hairs grow out appearing wavy or curly, flat hairs appear kinky, and round hairs grow out straight. Each scalp hair grows for two to three years at a rate of about \( \frac{1}{2} \) to \( \frac{1}{2} \) millimeter per day, or 10 to 18 centimeters per year. When mature, the hair rests for three or four months before slowly losing its attachment. Eventually, it falls out and is replaced by a new hair.
Hair pigment (which is melanin, just as in the skin) is produced by melanocytes in the follicle and transferred to the hair's cortex and medulla cells. Three types of melanin — black, brown, and yellow — combine in different quantities for each individual to produce different hair colors ranging from light blonde to black. Gray and white hairs grow in when melanin levels decrease and air pockets form where the pigment used to be.

Wondering why you have to shampoo so often? Hair becomes oily over time thanks to sebum, a mixture of cholesterol, fats, and other substances secreted from a sebaceous (or holocrine) gland found next to each follicle. Sebum keeps both hair and skin soft, pliable, and waterproof. Attached to each follicle is a smooth muscle called an arrector pili (literally “raised hair”) that both applies pressure to the sebaceous gland and straightens the hair shaft, depressing the skin in a pattern called goose bumps or goose pimples.

Each hair is made up of three concentric layers of keratinized cells:

- A central core, called the medulla, consists of large cells containing eleidin that are separated by air spaces; in fine hair, the medulla may be small or entirely absent.
- A cortex surrounding the medulla forms the major part of the hair shaft with several layers of flattened cells. The cortex also has elongated pigment-bearing cells in dark hair and air pockets in white hair.
- The outermost cuticle is a single layer of overlapping cells with the free end pointing upward. The cuticle strengthens and compacts the inner layers, but abrasion tends to wear away the end of the shaft, exposing the medulla and cortex in a pattern known as split ends.

Nailing the fingers and toes

Human nails (which actually are vestigial claws) have three parts: a root bed at the nail base, a body that’s attached to the fingertip, and a free edge that grows beyond the end of the finger or toe. Heavily cornified tissue forms the nails from modified strata corneum and lucidum. A narrow fold of the stratum corneum turns back to form the eponychium, or cuticle. Under the nail, the nail bed is formed by the strata basale and spinosum. At the base of the nail, partially tucked under the cuticle, the strata thicken to form a whitish area called the lunula (literally “little moon”) that can be seen through the nail. Beneath the lunula is the nail matrix, a region of thickened strata where mitosis pushes previously formed cornified cells forward, making the nail grow. Under the free edge of the nail, the stratum corneum thickens to form the hyponychium. Nails are pinkish in color because of hemoglobin in the underlying capillaries, which are visible through the translucent cells of the nail.

On average, fingernails grow about 1 millimeter each week. Toenails tend to grow even more slowly. Nails function as an aid to grasping, as a tool for manipulating small objects, and as protection against trauma to the ends of fingers and toes.

Sweating the details

Humans perspire over nearly every inch of skin, but anyone with sweaty palms or smelly feet can attest to the fact that sweat glands are most numerous in the palms and soles, with the forehead running a close third. There are two types of sweat, or sudoriferous, glands: eccrine and apocrine. Both are coiled tubules embedded in the dermis or subcutaneous layer composed of simple columnar cells.

Eccrine glands are distributed widely over the body — an average adult has roughly 3 million of them — and produce the watery, salty secretion you know as sweat. Each gland’s duct passes through the epidermis to the skin’s surface, where it opens as a
sweat pore. The sympathetic division of the autonomic nervous system controls when and how much perspiration is secreted depending on how hot the body becomes. Sweat helps cool the skin’s surface by evaporating as fast as it forms. About 99 percent of eccrine-type sweat is water, but the remaining 1 percent is a mixture of sodium chloride and other salts, uric acid, urea, amino acids, ammonia, sugar, lactic acid, and ascorbic acid.

Apocrine sweat glands are located primarily in armpits (known as the axillary region) and the groin area. Usually associated with hair follicles, they produce a white, cloudy secretion that contains organic matter. Although apocrine-type sweat contains the same basic components as eccrine sweat and also is odorless when first secreted, bacteria quickly begin to break down its additional fatty acids and proteins — explaining the post-exercise underarm stench. In addition to exercise, sexual and other emotional stimuli can cause contraction of cells around these glands, releasing sweat.

Getting an earful

The occasionally troublesome yellowish substance known as earwax is secreted in the outer part of the ear canal from modified sudoriferous glands called ceruminous glands (the Latin word *cera* means “wax”). Lying within the subcutaneous layer of the ear canal, these glands have ducts that either open directly into the ear canal or empty into the ducts of nearby sebaceous glands. Technically called *cerumen*, earwax is the combined secretion of these two glands. Working with ear hairs, cerumen traps any foreign particles before they reach the eardrum. As the cerumen dries, it flakes and falls from the ear, carrying particles out of the ear canal.

Think you’ve got a grip on everything to do with hair, nails, and glands? Find out by answering the following practice questions:

17. The cuticle is also called the
   a. Lunula
   b. Hyponychium
   c. Eponychium
   d. Nail matrix
   e. Perinychium

18. Perspiration is formed by the
   a. Sebaceous glands
   b. Ceruminous glands
   c. Endocrine glands
   d. Merkel’s glands
   e. Sudoriferous glands

19. The cause of graying hair is
   a. Production of melanin in the shaft of the hair
   b. Production of carotene in the shaft of the hair
   c. Decrease in blood supply to the hair
   d. Lack of melanin in the shaft of the hair
   e. Parenthood
20. Hair develops from a(n)
   a. Arrector pili
   b. Shaft
   c. Follicle
   d. Sebaceous gland
   e. Lanugo

21. The nails are modifications of the epidermal layers
   a. Corneum and lucidum
   b. Lucidum and granulosisum
   c. Granulosum and spinosum
   d. Spinosum and basale

22. The muscle that straightens a hair and puts pressure on a gland causing it to secrete is the
   a. Terminalis muscle
   b. Arrector pili muscle
   c. Internal oblique muscle
   d. External transversus muscle
   e. Internal rectus muscle

23. A factor not associated with baldness is
   a. Genetics
   b. Hormonal imbalances
   c. Scalp injuries
   d. Lack of carotene
   e. Disease

24. Sebaceous glands
   a. Produce a watery solution called sweat
   b. Produce an oily mixture of cholesterol, fats, and other substances
   c. Produce a waxy secretion called cerumen
   d. Accelerate aging
   e. Are associated with endocrine glands

25. The bulb of the follicle of a hair contains epithelial cells (germinating cells) that are continuous with the
   a. Papillary layer of the dermis
   b. Stratum corneum
   c. Stratum germinativum
   d. Reticular layer of the dermis
   e. Statum lucidum
26. Cooling of the skin’s surface is aided by the
   a. Endocrine glands  
   b. Sebaceous glands  
   c. Ceruminous glands  
   d. Prickle glands  
   e. Sweat glands  

27. This gland contains true sweat, fatty acids, and proteins, and acquires an unpleasant odor when bacteria breaks down the organic molecules it secretes.
   a. Apocrine sweat gland  
   b. Sebaceous gland  
   c. Ceruminous gland  
   d. Eccrine sweat gland  
   e. Mammary gland  

28. Which of the following is true about fingernails?
   a. They’re derived from the hypodermis.  
   b. They contain carotene.  
   c. They grow more slowly than toenails.  
   d. They grow about 1 millimeter per week.  
   e. They’re not a skin accessory.  

29. The gland that secretes an oily mixture of cholesterol, fats, and other substances into hair follicles to keep hair and skin soft, pliable, and waterproof is the
   a. Sweat gland  
   b. Sebaceous gland  
   c. Ceruminous gland  
   d. Apocrine gland  
   e. Eccrine gland
Answers to Questions on the Skin

The following are answers to the practice questions presented in this chapter.

1. The layer of epidermis in which mitosis takes place is the stratum **e. basale**.

   This layer also is called the stratum germinativum, but a simpler memory tool is simply to associate it with the “base” of the epidermis.

2. The papillary layer of the dermis **e. all of the above**. Busy little finger-like projections, those papillae.

3. The function of the epidermal ridges on the fingers is to **b. increase the friction of the epidermal surface**. It’s Mother Nature’s way of helping you cling to tree branches or grab food.

4. The color of Caucasian skin is due to **c. less melanin in the skin, allowing the blood pigment to be seen**. Here’s a fun experiment: Turn off the lights, press your fingers together, and hold a flashlight under them. See the red glow? That’s hemoglobin, too.

5. The sequence of layers in the epidermis from the dermis outward is **d. basale, spinosum, granulosum, lucidum, corneum**.

   Memory tool time: Base, spine, grain, Lucy, corny. Or try the first letters of Be Super Greedy, Less Caring. Insensitive, yes, but effective.

6. The subcutaneous layer of tissue can be called the **b. superficial fascia**. Subcutaneous is the same as hypodermis (from the Greek hypo- for “beneath”).

7. The lines in fingerprints are determined by **a. the contours of the dermal papillae**.

8. A function not pertaining to the skin is **e. provides movement**. That would be in the realm of muscles.

9. A layer of dense, irregular connective tissue containing interlacing bundles of collagenous and elastic fibers is the **b. reticular layer of the dermis**. The description in this question sounds like a tough structure, so it may help you to remember that the reticular layer is what’s used to make leather from animal hides.

10. The stratum corneum cells contain a tough, water-repellant protein called **c. keratin**. Associate the words “corneum” and “keratin,” and you’re in great shape.

11. The epidermal layer containing keratohyalin is the **d. stratum granulosum**. Keratohyalin eventually becomes keratin, so think of the layer where the cells are starting to die off.

12. The layer of skin attached to the superficial fascia is the **e. reticular layer of the dermis**. Reticular means net-like; it makes sense that this netting lies between the dermis and the hypodermis.

13. Flattened and irregular cells with small, spine-like projections that connect them with other cells in the layer are referred to as **a. prickle cells**. The spines make them look prickly, hence the name.

14. If melanin forms into patches, it’s referred to as **b. freckles**. Ever noticed how kids have more freckles at the end of a long summer spent outdoors? That’s ultraviolet radiation working on those melanin patches.
The sensation of a soft touch is received by e. Meissner's corpuscles. While it's true that several different nerves are involved in the overall sense of touch, the Meissner's are the most responsive to touch.

End-bulbs of Krause are receptors for cold that usually are activated at temperatures below c. 68 degrees F. Specific temperatures may seem tough to remember, but look at it this way: When it's 45 degrees F, you definitely need a jacket. When it's 77 degrees F, you don't. But when it's 68 degrees F, you'll want to carry a light jacket in case it gets colder. Voila! A cold receptor activation temperature!

The cuticle is also called the c. eponychium. Recall that the prefix ep– refers to “upon” or “around,” whereas the prefix hypo– refers to “below” or “under.” The cuticle is around the base of the nail, so it’s the eponychium, not the hyponychium.

Perspiration is formed by the e. sudoriferous glands. The Latin word sudor means “sweat.”

The cause of graying hair is d. lack of melanin in the shaft of the hair. Despite the medical cause, people often suspect that answer “e. parenthood” has a lot to do with graying hair.

Hair develops from a(n) c. follicle. The Latin translation of this word is “small cavity” or “sac,” so it makes sense that this would be an origination place.

The nails are modifications of the epidermal layers a. corneum and lucidum. These are the two upper layers.

The muscle that straightens a hair and puts pressure on a gland causing it to secrete is the b. arrector pili muscle. “Arrector” is similar to “erector” (in fact, the muscle is sometimes called that), which implies straightening, and the Latin word for “hair” is pili.

A factor not associated with baldness is d. lack of carotene. This answer just means that your hair won’t turn orange, not necessarily that it will fall out of your scalp.

Sebaceous glands b. produce an oily mixture of cholesterol, fats, and other substances. That secretion’s called sebum — hence “sebaceous glands.”

The bulb of the follicle of a hair contains epithelial cells (germinating cells) that are continuous with the c. stratum germinativum. Germinating cells from the germinativum. Don’t forget, though, that this layer also is called the stratum basale, or base stratum.

Cooling of the skin’s surface is aided by the e. sweat glands. The evaporation of perspiration cools the skin naturally.

This gland contains true sweat, fatty acids, and proteins, and acquires an unpleasant odor when bacteria breaks down the organic molecules it secretes. a. Apocrine sweat gland. These are the truly stinky sweat glands.

Here’s a memory tool for the difference between apocrine and eccrine sweat glands: You may have to APOlogize for your APOcrine glands but not your eccrine glands.

Which of the following is true about fingernails? d. They grow about 1 millimeter per week. The other answer options are either just plain wrong or nonsensical.

The gland that secretes an oily mixture of cholesterol, fats, and other substances into hair follicles to keep hair and skin soft, pliable, and waterproof is the b. sebaceous gland. Sebum, sebaceous, oily — just don’t call it sweat.