

The Integumentary System

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Anatomy and Physiology

- The skin, also called *integument*, is the largest organ in the body. Together with its accessory organs (hair, nails, and glands), the skin makes up the **integumentary system**.
- It's a system of distinct tissues includes glands that produce several types of secretions, nerves that transmit impulses, and blood vessels that help regulate body temperature.

Connecting Body Systems–Integumentary System

The main function of the skin is to protect the entire body, including all of its organs, from the external environment. Specific functional relationships between the skin and other body systems are summarized below.



Blood, lymph, and immune

- Skin is the first line of defense against the invasion of pathogens in the body.



Cardiovascular

- Cutaneous blood vessels dilate and constrict to help regulate body temperature.



Digestive

- Skin absorbs vitamin D (produced when skin is exposed to sunlight) needed for intestinal absorption of calcium.
- Excess calories are stored as subcutaneous fat.



Endocrine

- Subcutaneous layer of the skin stores adipose tissue when insulin secretions cause excess carbohydrate intake to fat storage.



Female Reproductive

- Subcutaneous receptors provide pleasurable sensations associated with sexual behavior.
- Skin stretches to accommodate the growing fetus during pregnancy.



Genitourinary

- Receptors in the skin respond to sexual stimuli.
- Skin provides an alternative route for excreting salts and nitrogenous wastes in the form of perspiration.



Musculoskeletal

- Skin synthesizes vitamin D needed for absorption of calcium essential for muscle contraction.
- Skin also synthesizes vitamin D needed for growth, repair, and maintenance of bones.



Nervous

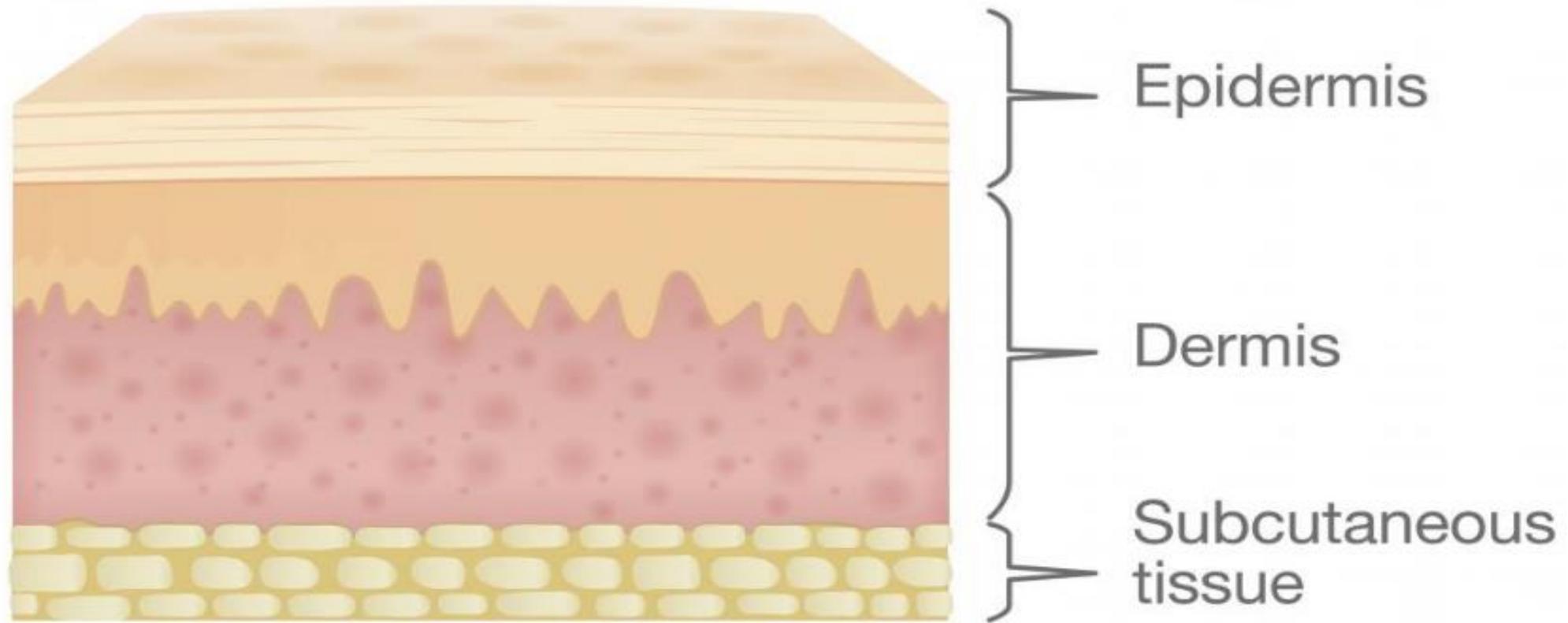
- Cutaneous receptors detect stimuli related to touch, pain, pressure, and temperature.



Respiratory

- Skin temperature may influence respiratory rate. As temperature increases, respiratory rate may also increase.
- Hairs of the nasal cavity filter particles from inspired air before it reaches the lower respiratory tract.

The Layers of Skin



Epidermis

- It is relatively thin over most areas but is thickest on the palms of the hands and the soles of the feet.
 - The epidermis is composed of several sublayers called ***strata*** (***only 2 are mentioned here for their importance***).
1. The **stratum corneum** is composed of dead flat cells that lack a blood supply and sensory receptors. Its thickness is correlated with normal wear of the area it covers.
 2. The **stratum basale** (deepest) is the only layer of the epidermis that is composed of living cells where new cells are formed. As these cells move toward the stratum corneum to replace the cells that have been sloughed off, they die and become filled with a hard protein material called ***keratin***. The entire process by which a cell forms in the basal layer, rises to the surface, becomes keratinized, and sloughs off takes about 1 month.

Functions of keratin:

It prevents body fluids from evaporating and moisture from entering the body due to its relative waterproof characteristics.

**Dead cells flaking off
at the skin surface**

Stratum corneum

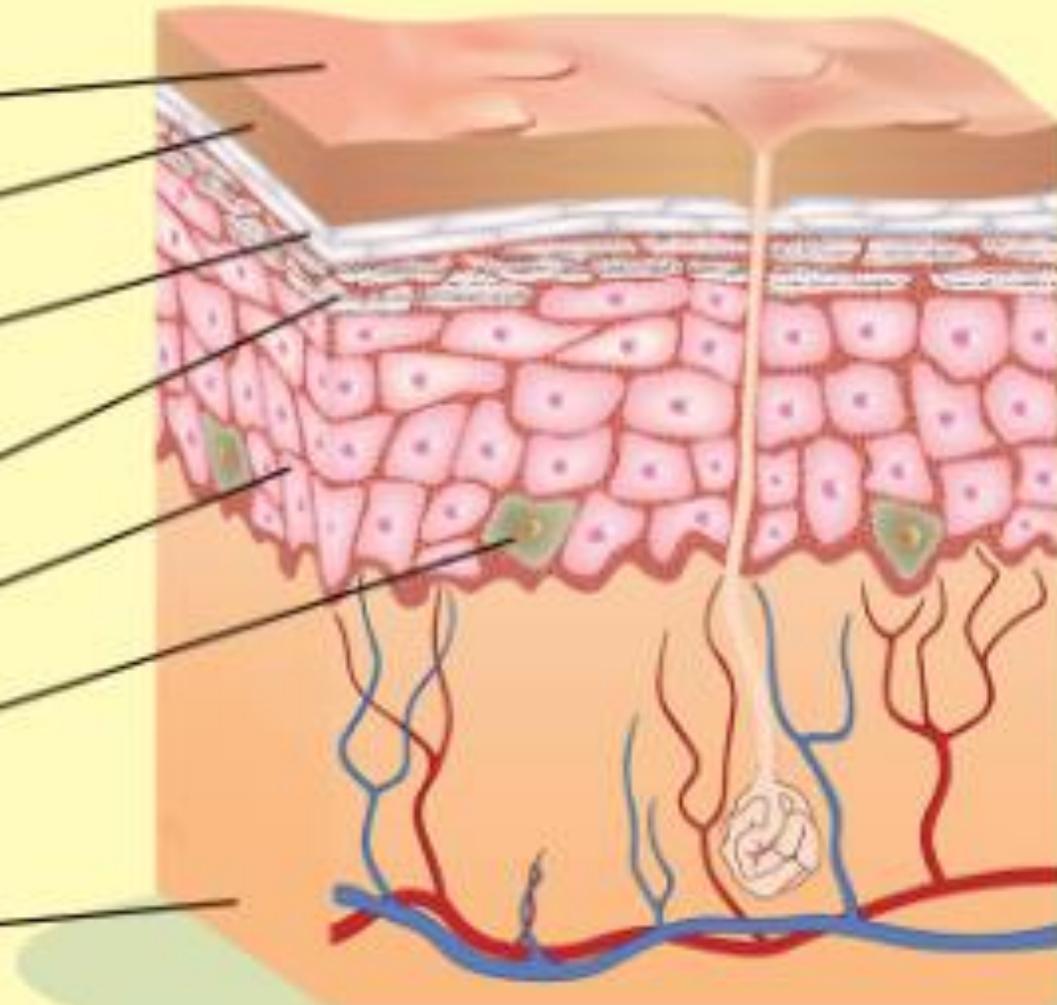
Stratum lucidum

Stratum granulosum

Stratum spinosum

Stratum basale

Dermis

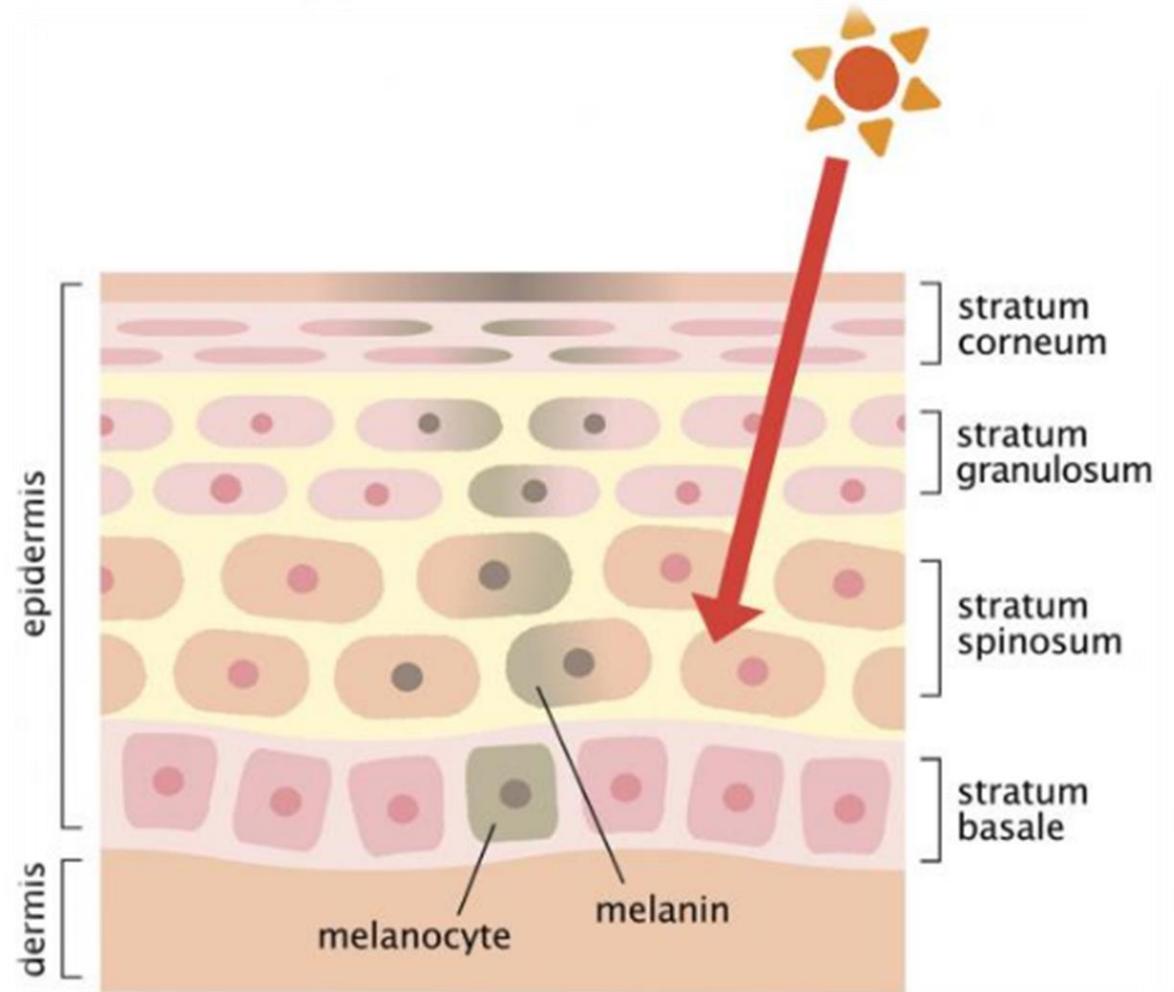


Epidermis

Melanocytes are special cells, found in the basal layer. It produce a black pigment called **melanin**.

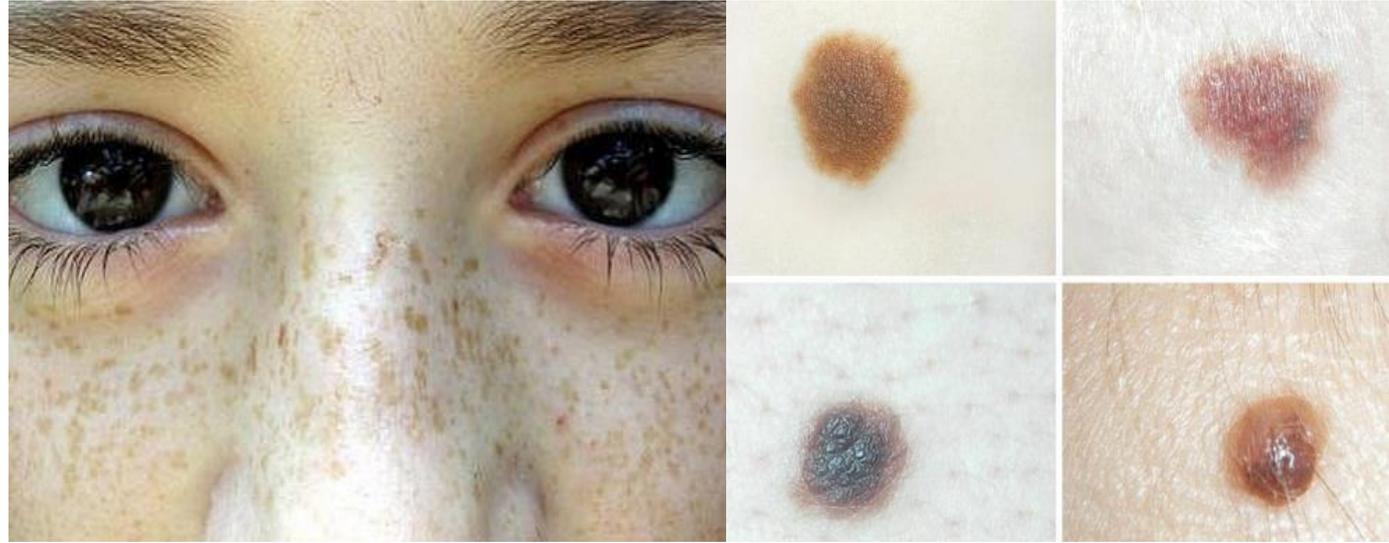
functions of Melanin

It provides a protective barrier from the damaging effects of the sun's ultraviolet radiation, which can cause skin cancer. Moderate sun exposure increases the rate of melanin production and results in a suntan. However, overexposure results in sunburn due to melanin's inability to absorb sufficient ultraviolet rays to prevent the burn.



Epidermis

- Production of melanocytes is genetically regulated and, thus, inherited.
- **Local** accumulations of melanin are seen in pigmented **moles** and **freckles**.
- An absence of pigment in the skin, eyes, and hair is most likely due to an inherited inability to produce melanin. An individual who cannot produce melanin has a marked deficiency of pigment in the eyes, hair, and skin and is known as an **albino**.



What's wrong,
melanocyte?

She's tanning
again...



melanin

Don't tan. It makes melanocytes cry.

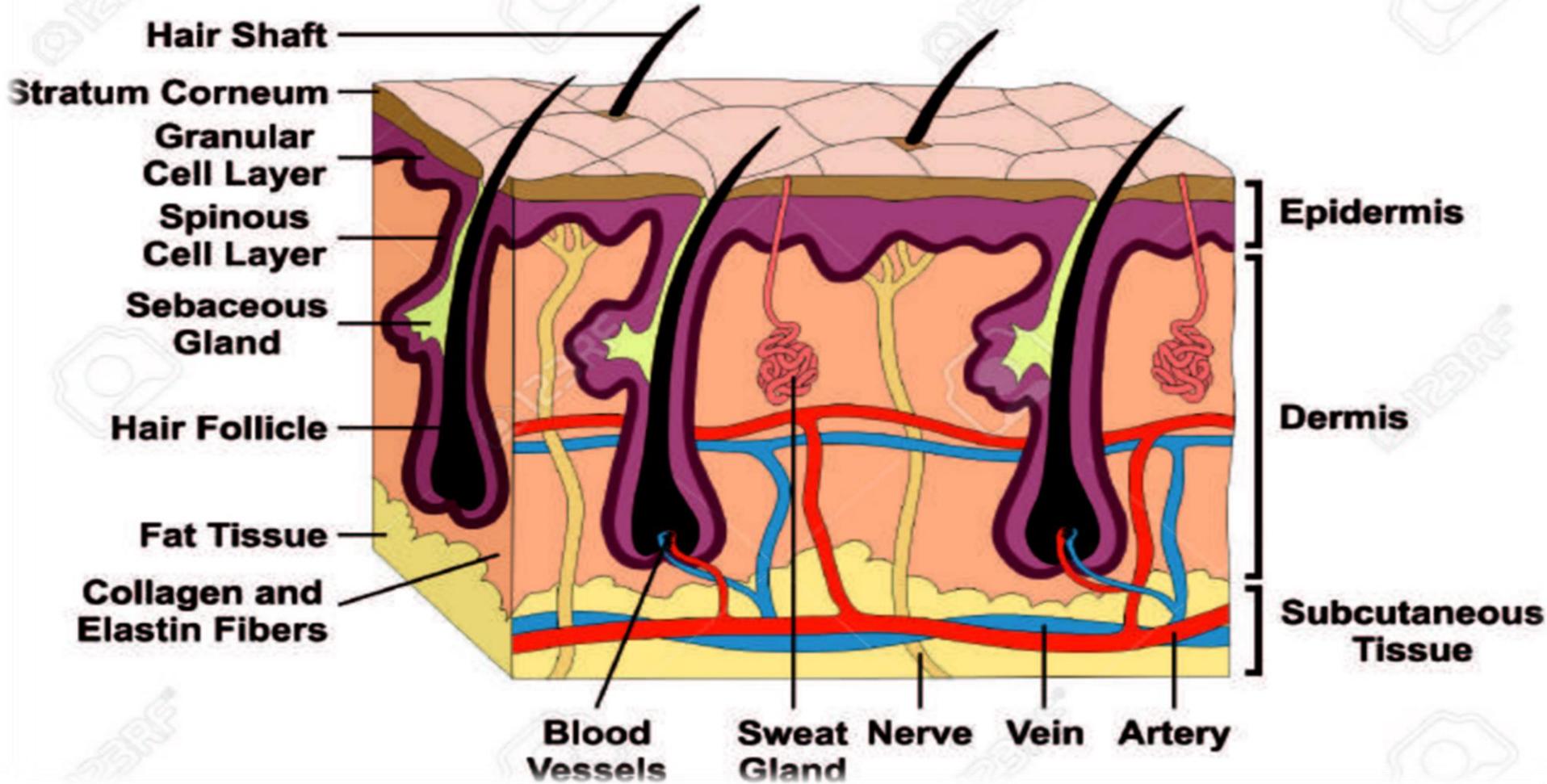
Dermis , also called *corium*

- The second layer of the skin
- It lies directly beneath the epidermis.
- It is composed of living tissue and contains numerous capillaries, lymphatic vessels, nerve endings, hair follicles, **sebaceous** (oil) glands, and **sudoriferous** (sweat) glands.

Subcutaneous layer, also called *hypodermis*

- It binds the dermis to underlying structures.
- It is composed primarily of loose connective tissue and **adipose** (fat) tissue interlaced with blood vessels.
- It stores fats, insulates and cushions the body, and regulates temperature.

Human Skin Anatomy



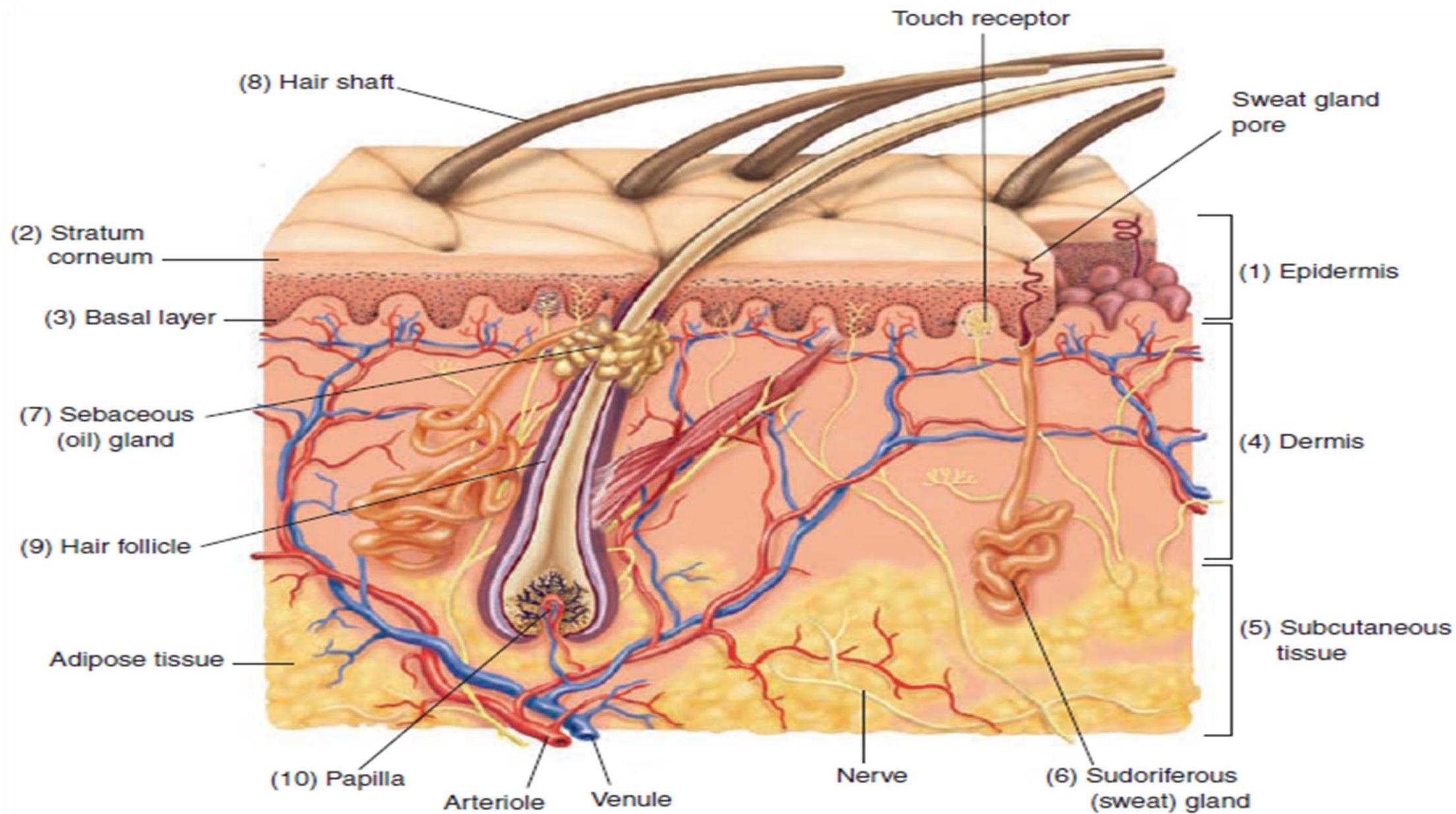


Figure 5-1. Structure of the skin and subcutaneous tissue.

Accessory Organs of the Skin

- Glands

- Two important glands located in the dermis produce secretions: the **sudoriferous (sweat) glands** produce sweat and the **sebaceous (oil) glands** produce oil.
- These two glands are **exocrine glands** because they secrete substances through ducts to an outer surface of the body rather than directly into the bloodstream.
- The sudoriferous glands secrete sweat onto the surface of the skin through pores. Pores are most plentiful on the palms, soles, forehead, and **axillae** (armpits). The main functions of the sudoriferous glands are to cool the body by evaporation, excrete waste products, and moisten surface cells.

Accessory Organs of the Skin

The sebaceous glands are filled with cells, the centers of which contain fatty droplets. As these cells disintegrate, they yield an oily secretion called **sebum**. The acidic nature of sebum helps destroy harmful organisms on the skin, thus preventing infection. When **ductules** of the sebaceous glands become blocked, acne may result.

Sex hormones, particularly **androgens** regulate production and secretion of sebum.



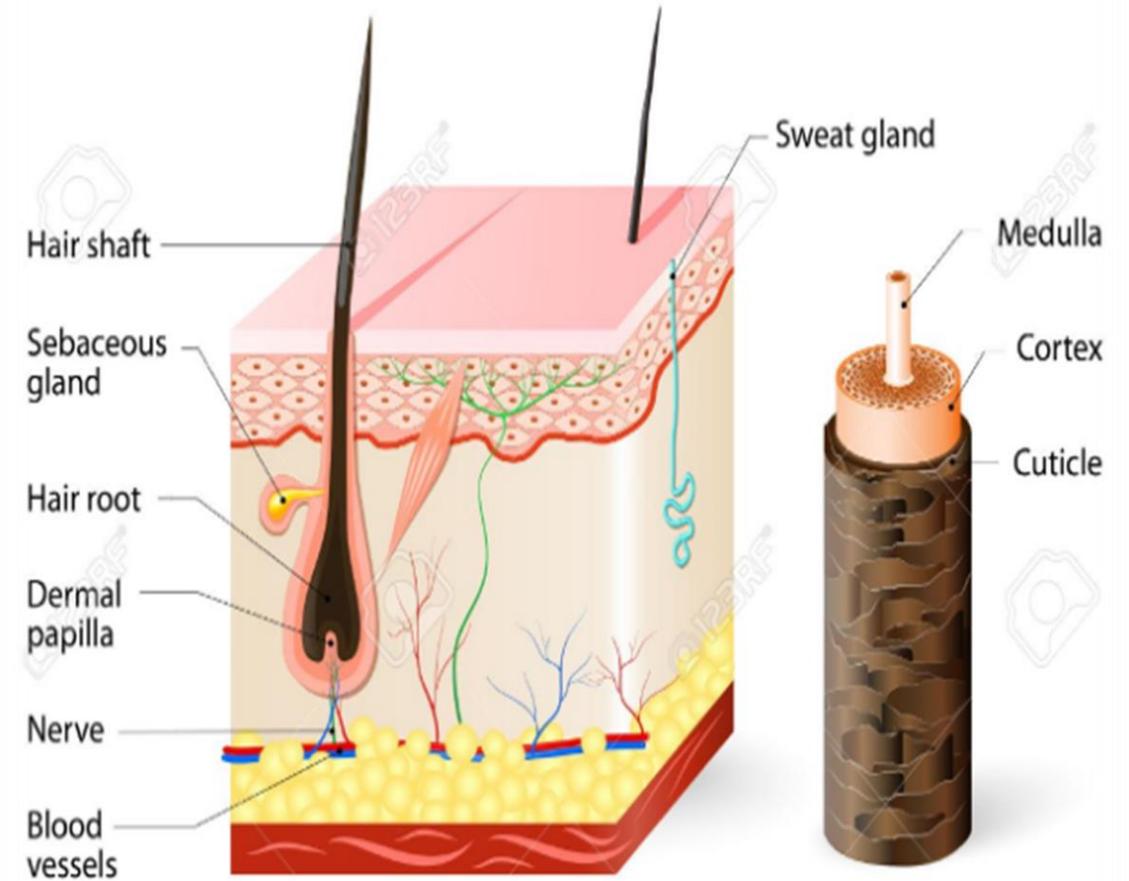
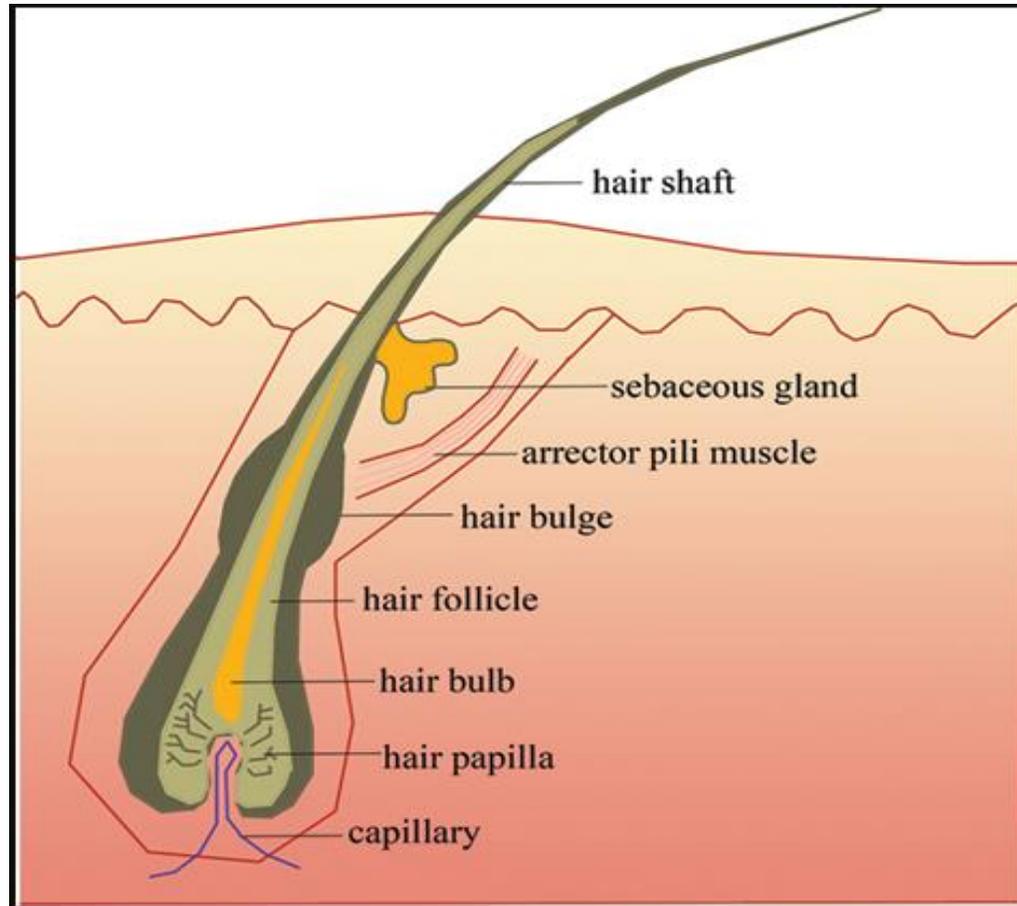
Hair

Hair is found on nearly all parts of the body except for the lips, nipples, palms of the hands, soles of the feet, and parts of the external genitalia. The visible part of the hair is the **hair shaft**; the part that is embedded in the dermis is the hair root.

The root, together with its coverings, forms the **hair follicle**. At the bottom of the follicle is a loop of capillaries enclosed in a covering called the **papilla**. The cluster of epithelial cells lying over the papilla reproduces and is responsible for the eventual formation of the hair shaft. As long as these cells remain alive, hair will regenerate even if it is cut, plucked, or otherwise removed.

Alopecia (baldness) occurs when the hairs of the scalp are not replaced because of death of the papillae (singular, *papilla*).

HAIR ANATOMY



Nails

Nails protect the tips of the fingers and toes from bruises and injuries. Each nail is formed in the **nail root** and is composed of keratinized stratified squamous epithelial cells producing a very tough covering. As the nail grows, it stays attached and slides forward over the layer of epithelium called the **nail bed**.

This epithelial layer is continuous with the epithelium of the skin. Most of the **nail body** appears pink because of the underlying vascular tissue. The half-moon–shaped area at the base of the nail, the **lunula**, is the region where new growth occurs. The lunula has a whitish appearance because the vascular tissue underneath does not show through.

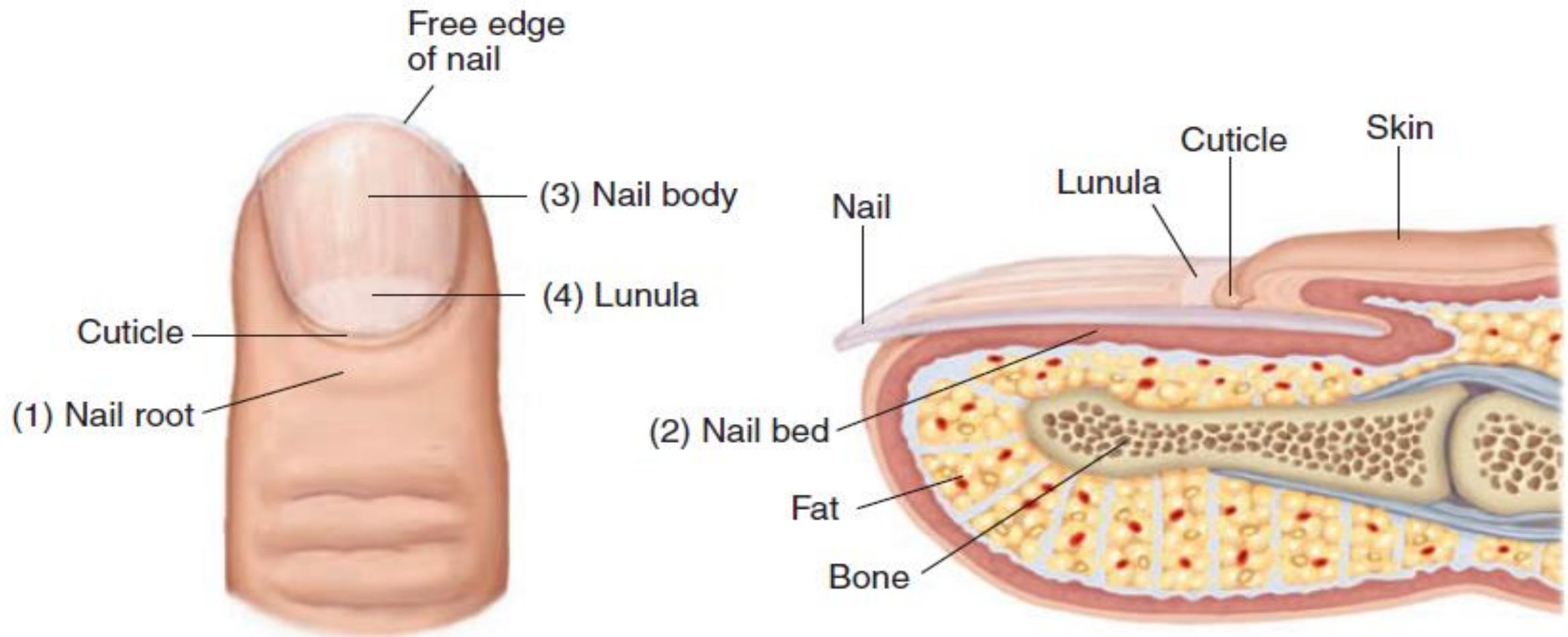


Figure 5-2. Structure of a fingernail.

adip/o	fat	<p>adip/osis (ăd-ĭ-PŌ-sĭs): abnormal condition of fat <i>-osis</i>: abnormal condition; increase (used primarily with blood cells) <i>Adiposis is an abnormal accumulation of fatty tissue in the body.</i></p>
lip/o		<p>lip/o/cele (LĪP-ō-sēl): hernia containing fat <i>-cele</i>: hernia, swelling</p>
steat/o	skin	<p>steat/itis (stē-ă-TĪ-tĭs): inflammation of fatty (adipose) tissue <i>-itis</i>: inflammation</p>
cutane/o		<p>sub/cutane/ous (sŭb-kŭ-TĀ-nē-ŭs): pertaining to beneath the skin <i>sub-</i>: under, below <i>-ous</i>: pertaining to</p>
dermat/o		<p>dermat/o/plasty (DĚR-mă-tō-plăs-tē): surgical repair of the skin <i>-plasty</i>: surgical repair</p>
derm/o		<p>hypo/derm/ic (hĭ-pō-DĚR-mĭk): pertaining to under the skin <i>hypo-</i>: under, below <i>-ic</i>: pertaining to</p>

hidr/o	sweat	<p>hidr/aden/itis (hī-drād-ě-NĪ-tīs): inflammation of the sweat glands <i>aden:</i> gland <i>-itis:</i> inflammation</p> <p><i>Do not confuse hidr/o (sweat) with hydr/o (water).</i></p>
sudor/o		<p>sudor/esis (soo-dō-RĒ-sīs): profuse sweating <i>-esis:</i> condition</p>
ichthy/o	dry, scaly	<p>ichthy/osis (ĭk-thē-Ō-sīs): abnormal condition of dry or scaly skin <i>-osis:</i> abnormal condition; increase (used primarily with blood cells)</p> <p><i>Ichthyosis can be any of several dermatological conditions in which the skin is dry and hardened (hyperkeratotic), resembling fish scales. A mild form of ichthyosis, called winter itch, is commonly seen on the legs of older patients, especially during the winter months.</i></p>
kerat/o	horny tissue; hard; cornea	<p>kerat/osis (kěr-ă-TŌ-sīs): abnormal condition of horny tissue <i>-osis:</i> abnormal condition; increase (used primarily with blood cells)</p> <p><i>Keratosis is a thickened area of the epidermis or any horny growth on the skin, such as a callus or wart.</i></p>

melan/o

black

melan/oma (mĕl-ă-NŌ-mă): black tumor
-oma: tumor

myc/o

fungus (plural,
fungi)

dermat/o/myc/osis (dĕr-mă-tō-mī-KŌ-sĭs): fungal infection of the skin
dermat/o: skin
-osis: abnormal condition; increase (used primarily with blood cells)

Melanoma is a malignant tumor of melanocytes that commonly begins in a darkly pigmented mole and can metastasize widely.

onych/o	nail	onych/o/malacia (ŏn-ĭ-kō-mă-LĀ-shē-ă): softening of the nails -malacia: softening
ungu/o		ungu/al (ŬNG-gwăł): pertaining to the nails -al: pertaining to
pil/o	hair	pil/o/nid/al (pī-lō-NĪ-dăł): pertaining to hair in a nest <i>nid</i> : nest -al: pertaining to <i>A pilonidal cyst commonly develops in the skin at the base of the spine. It develops as a growth of hair in a dermoid cyst.</i>
trich/o		trich/o/pathy (trĭk-ŎP-ă-thē): disease involving the hair -pathy: disease
scler/o	hardening; sclera (white of eye)	scler/o/derma (sklē-rō-DĚR-mă): hardening of the skin -derma: skin <i>Scleroderma is an autoimmune disorder that causes the skin and internal organs to become progressively hardened due to deposits of collagen. It may occur as a localized form or as a systemic disease.</i>

seb/o	sebum, sebaceous	seb/o/rrhea (sĕb-ō-RĒ-ă): discharge of sebum -rrhea: discharge, flow <i>Seborrhea is an excessive secretion of sebum from the sebaceous glands.</i>
squam/o	scale	squam/ous (SKWĀ-mŭs): pertaining to scales (or covered with scales) -ous: pertaining to
xen/o	foreign, strange	xen/o/graft (ZĔN-ō-grăft): skin transplantation from a foreign donor (usually a pig) for a human; also called <i>heterograft</i> . <i>Xenografts are used as a temporary graft to protect the patient against infection and fluid loss.</i> -graft: transplantation
xer/o	dry	xer/o/derma (zĕ-rō-DĔR-mă): dry skin -derma: skin <i>Xeroderma is a chronic skin condition characterized by dryness and roughness and is a mild form of ichthyosis.</i>
Suffixes		
-cyte	cell	lip/o/cyte (LĪP-ō-sīt): fat cell <i>lip/o: fat</i>

an-	without, not	an/hidr/osis (ăn-hĩ-DRŌ-sīs): abnormal condition of absence of sweat <i>hidr</i> : sweat <i>-osis</i> : abnormal condition; increase (used primarily with blood cells)
dia-	through, across	dia/phoresis (dī-ă-fă-RĒ-sīs): excessive or profuse sweating; also called <i>sudoresis</i> or <i>hyperhidrosis</i> <i>-phoresis</i> : carrying; transmission
epi-	above, upon	epi/derm/is (ěp-ĩ-DĚR-mīs): above the skin <i>derm</i> : skin <i>-is</i> : noun ending <i>Epidermis is the outermost layer of the skin.</i>
homo-	same	homo/graft (HŌ-mō-grăft): transplantation of tissue between individuals of the same species; also called <i>allograft</i> <i>-graft</i> : transplantation
hyper-	excessive, above normal	hyper/hidr/osis (hī-pěr-hī-DRO-sīs): excessive or profuse sweating; also called <i>diaphoresis</i> or <i>sudoresis</i> <i>hidr</i> : sweat <i>-osis</i> : abnormal condition; increase (used primarily with blood cells)
sub-	under, below	sub/ungu/al (süb-ŮNG-gwăl): pertaining to beneath the nail of a finger or toe <i>ungu</i> : nail <i>-al</i> : pertaining to

Thank you