



# **FISIOLOGI SISTEM INTEGUMEN**

# KULIT (INTEGUMEN)

- KULIT BERFUNGSI SEBAGAI ORGAN EKSKRESI KARENA MENGANDUNG KELENJAR KERINGAT (*GLANDULA SUDORIFERA*) YANG MENGELUARKAN 5% SAMPAI 10% DARI SELURUH SISA METABOLISME
- PUSAT PENGATUR SUHU PADA SUSUNAN SARAF PUSAT AKAN MENGATUR AKTIFITAS KELENJAR KERINGAT DALAM MENGELUARKAN KERINGAT
- KERINGAT MENGANDUNG AIR, LARUTAN GARAM, DAN UREA. PENGELUARAN KERINGAT YANG BERLEBIHAN (MISAL: PEKERJA BERAT) MENIMBULKAN HILANGNYA BANYAK GARAM-GARAM MINERAL → MENYEBABKAN KEJANG OTOT BAHKAN PINGSAN.
- SELAIN BERFUNGSI MENGEKSKRESIKAN KERINGAT → KULIT JUGA BERFUNGSI SEBAGAI PELINDUNG TERHADAP KERUSAKAN FISIK, PENYINARAN, SERANGAN KUMAN, PENGUAPAN, SEBAGAI ORGAN PENERIMA RANGSANG (RESEPTOR), SERTA PENGATUR SUHU TUBUH.



- Kulit juga berperan dalam sistem pertahanan tubuh nonspesifik.

### Skin and mucous membranes form external barriers to invasion

An ideal defense strategy prevents invaders from entering the body in the first place. In animal bodies, the first line of defense consists of the two surfaces with direct exposure to the environment: **the skin and the mucous membranes** of the digestive, respiratory and urogenital tracts.

### The skin and its secretions block entry and provide an inhospitable environment for microbial growth

Any virus and bacteria droplets from your neighbor's sneeze that land on your skin will encounter an outer surface of dry, dead cells. Most microbes that come in contact with the skin **do not obtain the water and nutrients they need to survive**. The few bacteria and fungi that manage to gain a foothold on skin will usually be shed before they can do harm, because skin cells are **constantly sloughed off and replaced**. Secretions from sweat glands, sebaceous glands, and wax-secreting glands in the external ear canal all contain **natural antibiotics** that inhibit the growth of bacteria foreign to the body. These multiple defenses make the unbroken skin an extremely effective barrier against microbial invasion.



# KULIT TERDIRI ATAS DUA BAGIAN UTAMA YAITU: EPIDERMIS DAN DERMIS.

## ○ **A. EPIDERMIS (LAPISAN TERLUAR) DIBEDAKAN LAGI ATAS:**

1. STRATUM KORNEUM → BERUPA ZAT TANDUK (SEL MATI) DAN SELALU MENGELUPAS
2. STRATUM LUSIDUM
3. STRATUM GRANULOSUM → MENGANDUNG PIGMEN
4. STRATUM GERMINATIVUM → LAPISAN YANG SELALU MEMBENTUK SEL-SEL KULIT KE ARAH LUAR

## ○ **B. DERMIS**

PADA BAGIAN INI TERDAPAT AKAR RAMBUT, KELENJAR MINYAK, PEMBULUH DARAH, SERABUT SARAF, SERTA OTOT PENEGAK RAMBUT.

- KELENJAR KERINGAT AKAN MENYERAP AIR DAN GARAM MINERAL DARI KAPILER DARAH KARENA LETAKNYA YANG BERDEKATAN
- SELANJUTNYA, AIR DAN GARAM MINERAL INI AKAN DIKELUARKAN DI PERMUKAAN KULIT (PADA PORI) SEBAGAI KERINGAT. KERINGAT YANG KELUAR AKAN MENYERAP PANAS TUBUH SEHINGGA SUHU TUBUH AKAN TETAP

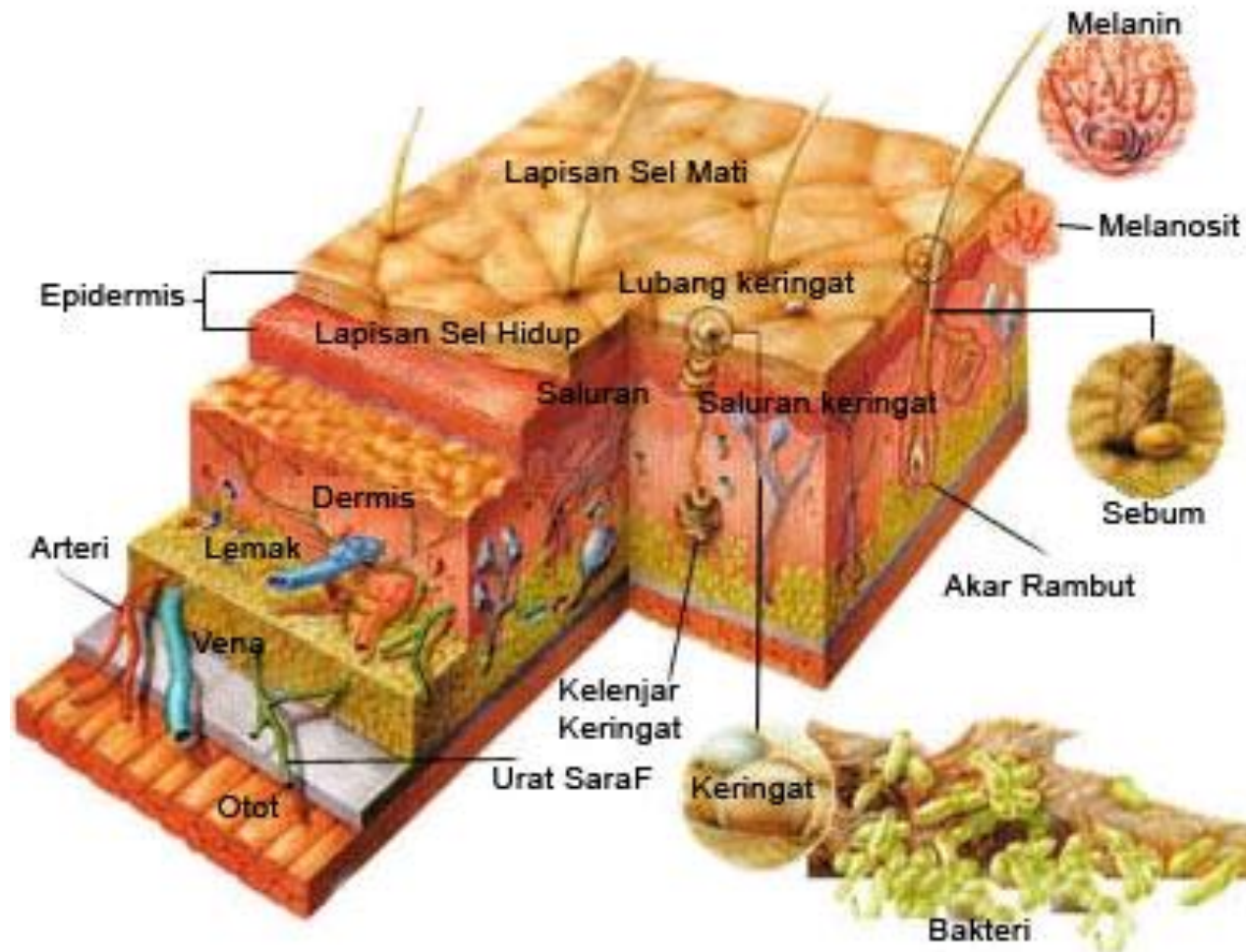


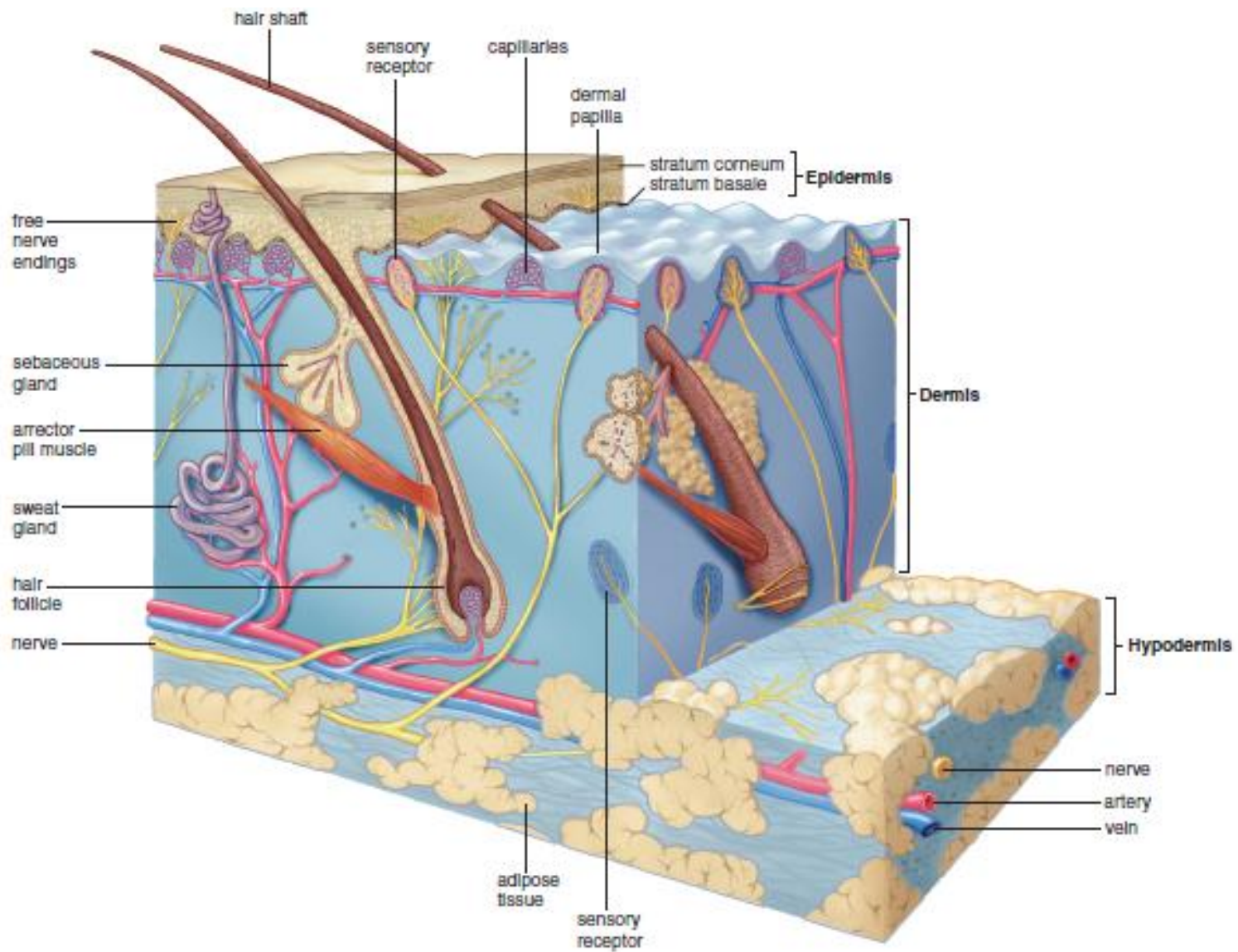
DALAM KONDISI NORMAL, KERINGAT YANG KELUAR SEKITAR 50 CC PER JAM. JUMLAH INI AKAN BERKURANG ATAU BERTAMBAH JIKA ADA FAKTOR-FAKTOR BERIKUT :

- SUHU LINGKUNGAN YANG TINGGI,
- GANGGUAN DALAM PENYERAPAN AIR PADA GINJAL (GAGAL GINJAL),
- KELEMBABAN UDARA
- AKTIVITAS TUBUH YANG MENINGKAT SEHINGGA PROSES METABOLISME BERLANGSUNG LEBIH CEPAT UNTUK MENGHASILKAN ENERGI
- FAKTOR EMOSIONAL
- MENYEMPITNYA PEMBULUH DARAH AKIBAT RANGSANGAN PADA SARAF SIMPATIK.



# STRUKTUR KULIT







# Epidermis

The **epidermis is the outer and thinner region of the skin.** It is made up of *stratified squamous epithelium divided into several layers*; the deepest layer is the stratum basale, and the most superficial layer is the stratum corneum.

## *Stratum Basale*

The basal cells of the **stratum basale lie just superior to the dermis and are constantly dividing and producing new cells** that are pushed to the surface of the epidermis in two to four weeks. As the cells move away from the dermis, they get progressively farther away from the blood vessels in the dermis. Because these cells are not being supplied with nutrients and oxygen (the epidermis itself lacks blood vessels) → they eventually die and are sloughed off.



## **Langerhans cells**

are macrophages found deep in the epidermis.

Macrophages are related to monocytes, white blood cells produced in red bone marrow. These cells phagocytize microbes and then travel to lymphatic organs, where they stimulate the immune system to react.

## **Melanocytes**

are another type of specialized cell located in the deeper epidermis.

Melanocytes produce **melanin, the pigment** primarily responsible for skin color. Since the number of melanocytes is about the same in all individuals, variation in skin color is due to the amount of melanin produced and its distribution. When skin is exposed to the sun, melanocytes produce more melanin to protect the skin from the damaging effects of the **ultraviolet (UV)** radiation in sunlight. The melanin is passed to other epidermal cells, and the result is tanning, or in some people, the formation of patches of melanin called freckles. A hereditary trait characterized by the lack of ability to produce melanin is known as **albinism**. Individuals with this disorder lack pigment not only in the skin, but also in the hair and eyes. Another pigment, called **carotene**, is present in epidermal cells and in the dermis and gives the skin of certain Asians its yellowish hue. The pinkish color of fair-skinned people is due to the pigment **hemoglobin** in the red blood cells in the capillaries of the dermis.

## *Stratum Corneum*

As cells are pushed toward the surface of the skin, they become flat and hard, forming the tough, uppermost layer of the epidermis, the **stratum corneum**. **Hardening is caused by keratinization**, the cellular production of a fibrous, waterproof protein called **keratin**. **Over much of the body, keratinization** is minimal, but the palms of the hands and the soles of the feet normally have a particularly thick outer layer of dead, keratinized cells.

The waterproof nature of keratin protects the body from water loss and water gain. The stratum corneum allows us to live in a desert or a tropical rain forest without damaging our inner cells. The stratum corneum also serves as a mechanical barrier against microbe invasion. This protective function of skin is assisted by the secretions of *sebaceous glands*



# Dermis

The dermis contains collagenous and elastic fibers. The *collagenous fibers are flexible but offer great resistance to overstretching*; they prevent the skin from being torn. The *elastic fibers stretch to allow movement of underlying muscles and joints*, but they maintain normal skin tension.

The dermis also contains blood vessels that nourish the skin. Blood rushes into these vessels when a person blushes; blood is reduced in them when a person turns cyanotic, or “blue.” Sometimes, blood flow to a particular area is restricted in bedridden patients, and consequently they develop **decubitus ulcers (bedsores)** These can be prevented by changing the patient’s position frequently and by massaging the skin to stimulate blood flow.

There are also numerous sensory nerve fibers in the dermis that take nerve impulses to and from the accessory structures of the skin



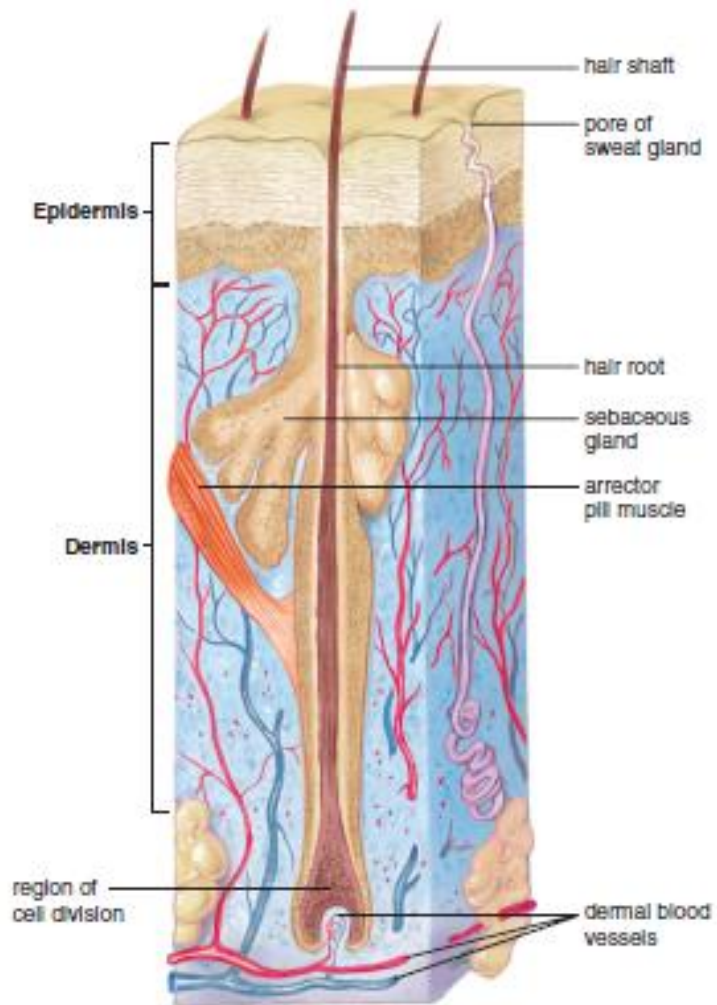
# Hypodermis

Hypodermis, or subcutaneous tissue, lies below the dermis. From the names for this layer, we get the terms subcutaneous injection, performed with a hypodermic needle.

The hypodermis is composed of loose connective tissue, including adipose (fat) tissue. Fat is an energy storage form that can be called upon when necessary to supply the body with molecules for cellular respiration. Adipose tissue also helps insulate the body. A well-developed hypodermis gives the body a *rounded appearance* and provides protective padding against external assaults. Excessive development of adipose tissue in the hypodermis layer results in obesity.



## Accessory Structures of the Skin



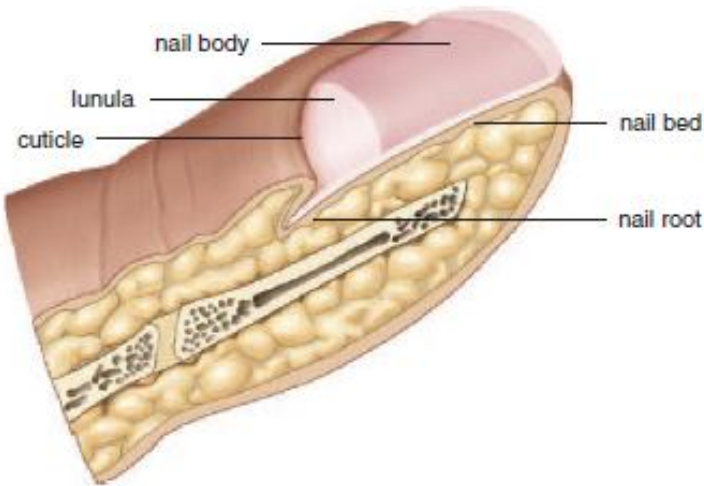
a. Hair follicle



b. Hair shaft



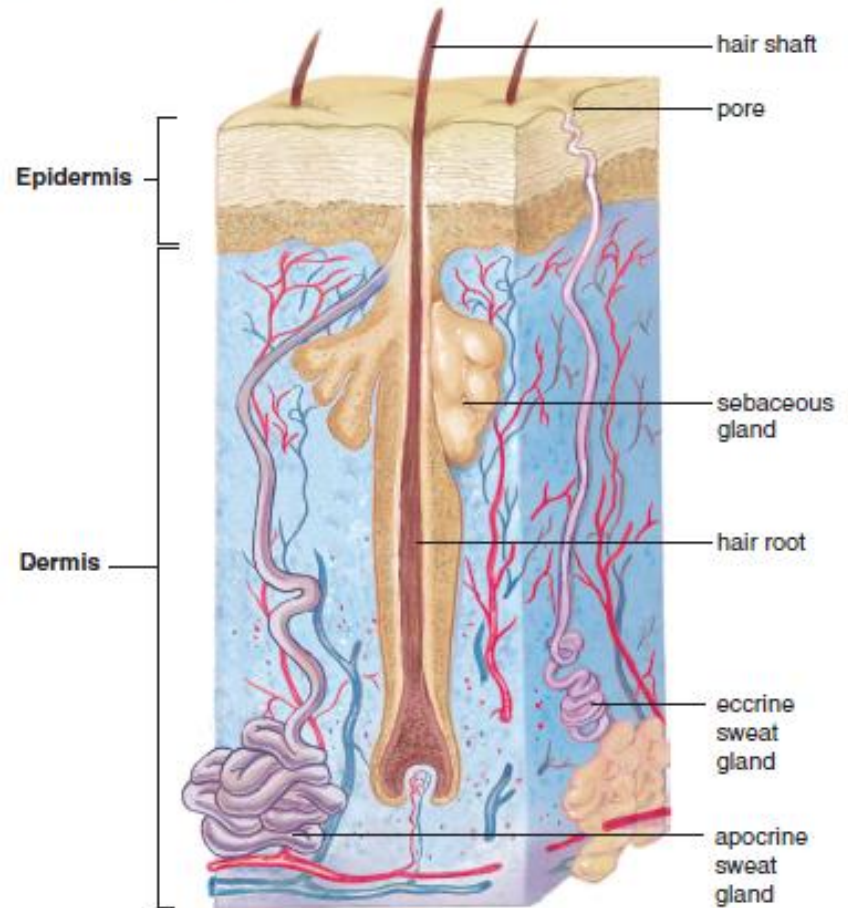
**Figure 5.4** Sagittal section of a nail. Cells produced by the nail root become keratinized, forming the nail body.



Nails grow from special epithelial cells at the base of the nail in the region called the *nail root* (Fig. 5.4). These cells become **keratinized** as they grow out over the nail bed. The visible portion of the nail is called the *nail body*. The *cuticle* is a fold of skin that hides the nail root. Ordinarily, nails grow only about 1 millimeter per week.

The pink color of nails is due to the vascularized dermal tissue beneath the nail. The whitish color of the half-moonshaped base, or **lunula**, results from the **thicker germinal layer** in this area.

**Figure 5.5** Types of skin glands. Apocrine glands and eccrine glands are types of sweat glands.



## *Sweat Glands*

**Sweat glands, or sudoriferous glands, are present in all regions** of the skin. There can be as many as 90 glands per square centimeter on the leg, 400 glands per square centimeter on the palms and soles, and an even greater number on the fingertips. A sweat gland is tubular. The tubule is coiled, particularly at its origin within the dermis. These glands become active when a person is under stress.

Two types of sweat glands are shown in Figure 5.5. ***Apocrine glands*** open into hair follicles in the anal region, groin, and armpits. These glands begin to secrete at puberty, and a component of their secretion may act as a sex attractant.

***Eccrine glands*** open onto the surface of the skin. They become active when a person is hot, helping to lower body temperature as sweat evaporates. The sweat (perspiration) produced by these glands is mostly water, but it also contains salts and some urea, a waste substance. Therefore, sweat is a form of excretion. Ears contain modified sweat glands, called ceruminous glands, which produce cerumen, or earwax.






## *Sebaceous Glands*

Most **sebaceous glands are associated with a hair follicle**. These glands secrete an oily substance called **sebum** that flows into the follicle and then out onto the skin surface. This secretion lubricates the hair and skin, and helps waterproof them. Particularly on the face and back, the sebaceous glands may fail to discharge sebum, and the secretions collect, forming whiteheads or blackheads. If pus-inducing bacteria are also present, a boil or pimple may result.

**Acne vulgaris, the most common form of acne, is an inflammation** of the sebaceous glands that most often occurs during adolescence. Hormonal changes during puberty cause the sebaceous glands to become more active at this time.

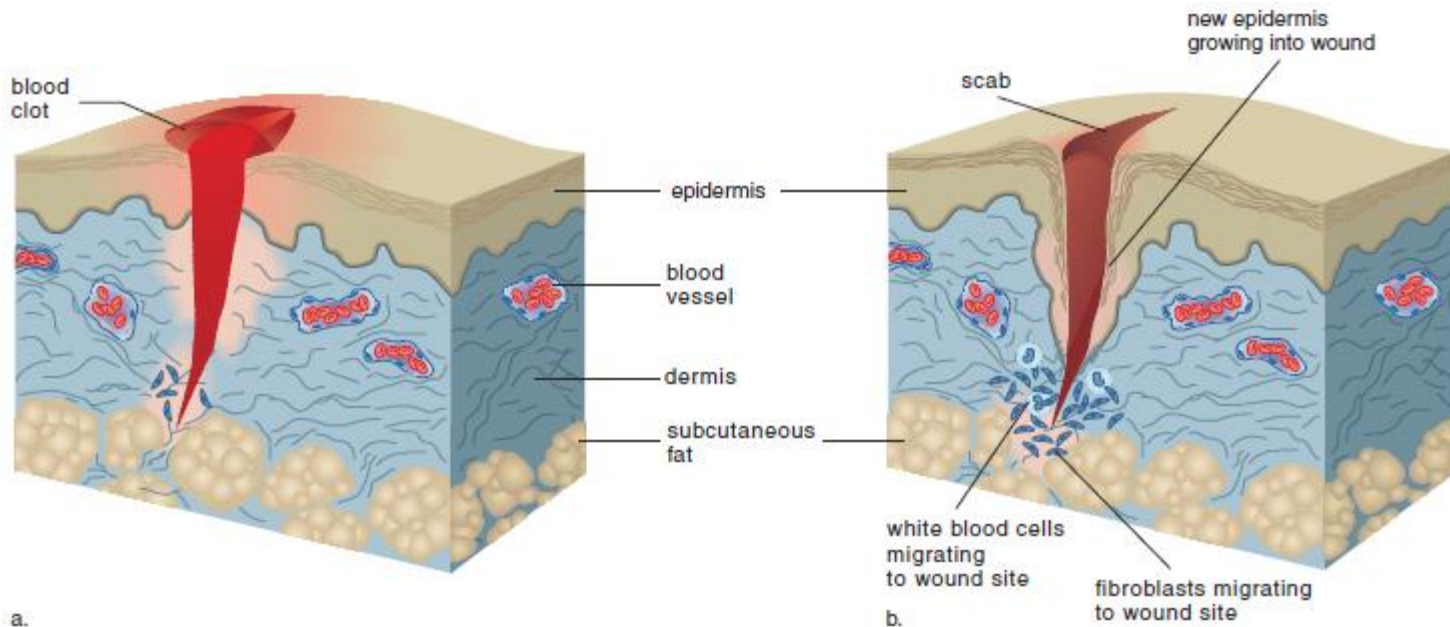
## *Mammary Glands*

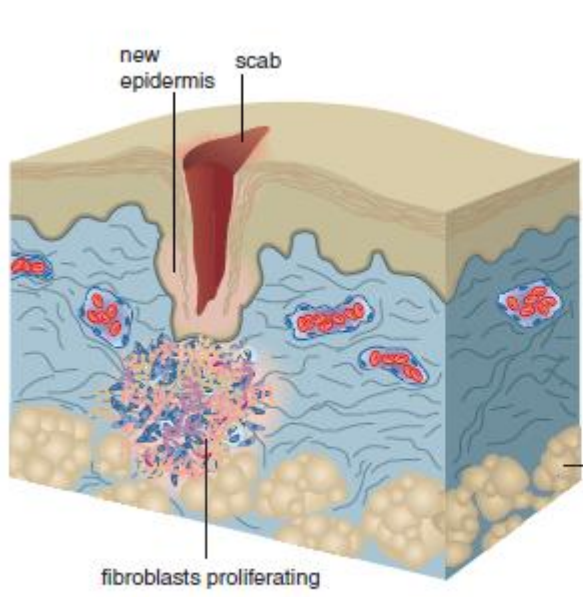
The **mammary glands are located within the breasts**. A female breast contains 15 to 25 lobes, which are divided into lobules. Each lobule contains many alveoli. When milk is secreted, the milk enters a duct that leads to the nipple. Cells within the alveoli produce milk only after childbirth in response to complex hormonal changes occurring at that time.



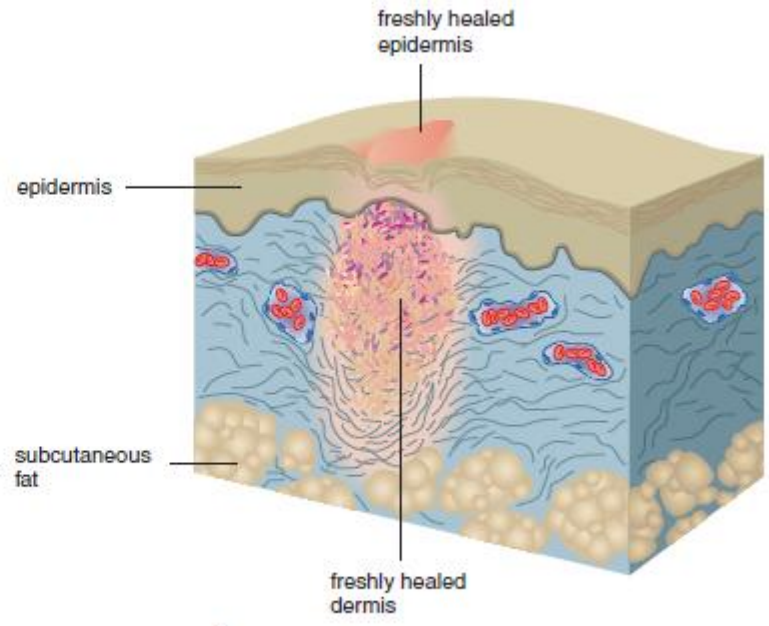
# MEDICAL FOCUS: WOUND HEALING

The process of wound healing. **a.** A deep wound ruptures blood vessels, and blood flows out and fills the wound. **b.** After a blood clot forms, a protective scab develops. Fibroblasts and white blood cells migrate to the wound site. **c.** New epidermis forms, and fibroblasts promote tissue regeneration. **d.** Freshly healed skin.





c.



d.



# MEDICAL FOCUS: SKIN CANCER



a. Basal cell carcinoma



b. Squamous cell carcinoma



c. Melanoma

