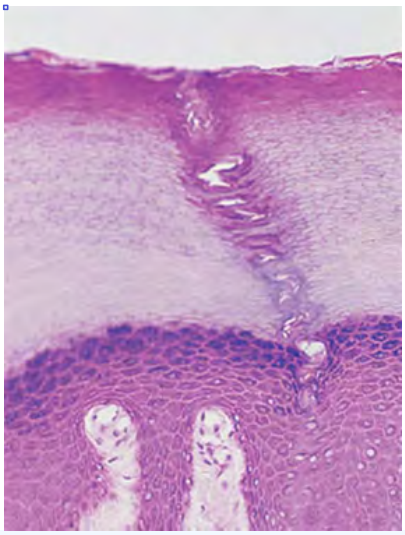
1

BIO 211:

ANATOMY & PHYSIOLOGY I



CHAPTER 06

SKIN
INTEGUMENTARY

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Some illustrations are courtesy of McGraw-Hill.

Naugatuck Valley Community College

2

GENERAL FUNCTIONS

- Composed of several tissues
- Maintains homeostasis
- Protective covering
- Retards water loss
- Regulates body temperature
- Houses sensory receptors
- Contains immune system cells
- Synthesizes chemicals
- Excretes small amounts of waste

3

SKIN Structure

The skin is the body's largest organ and consists mostly of two layers:
EPIDERMIS
DERMIS.

Skin *varies* in thickness mostly due to variations in the stratum corneum (uppermost layer).

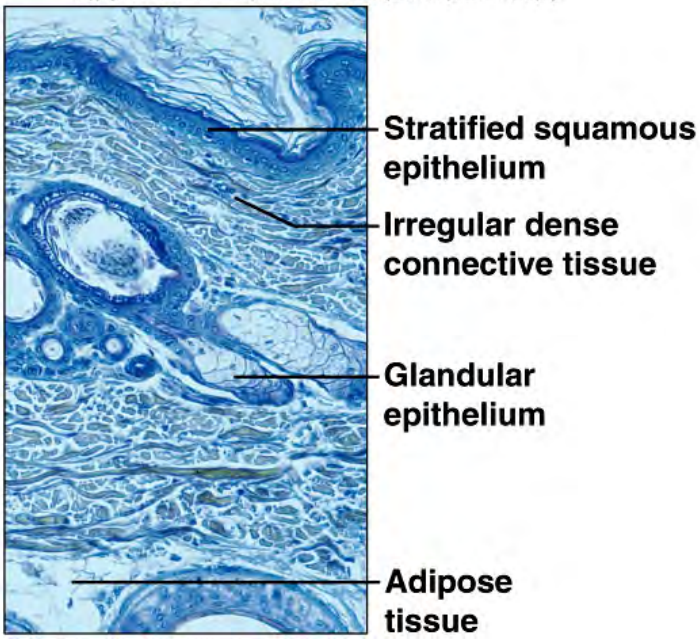
EPIDERMIS: **stratified squamous epithelium.**
is "**cornified**" with the **protein keratin.**

Since it is a **type of epithelium,** it is:
avascular:
NO blood vessels
activities via diffusion

4

Layers of Skin

- **Epidermis**
- **Dermis**
- **Subcutaneous layer**



SKIN Structure

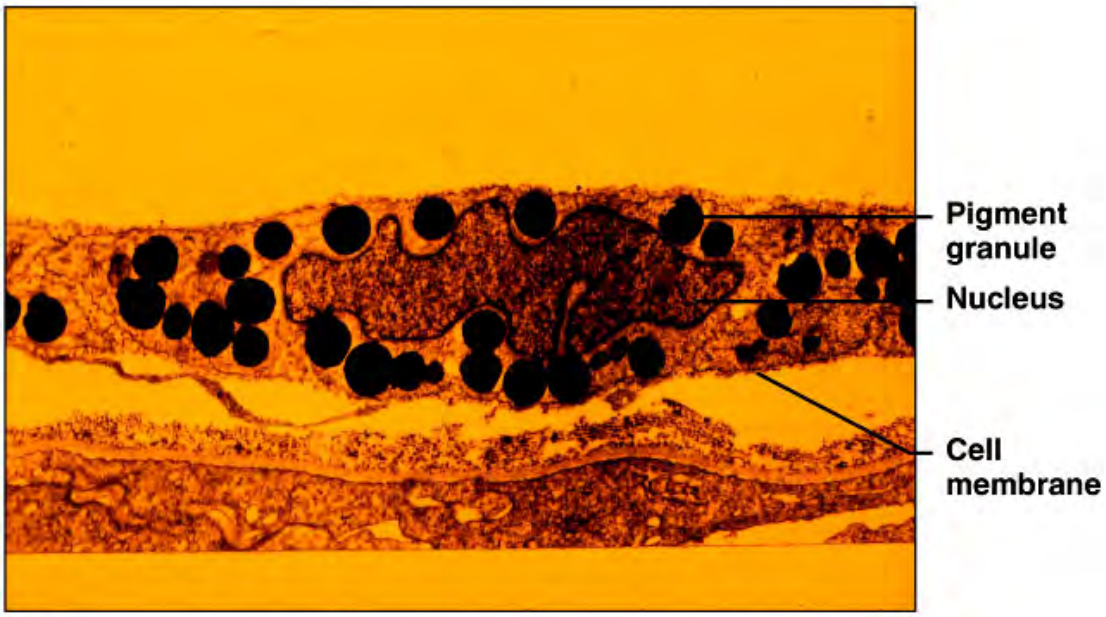
5

EPIDERMIS:

1. **Stratum Basale (sometimes called "germinativum")**
   - a. **The stratum basale, a single layer of low columnar cells, rests on the *basement membrane.***
   - b. **Keratinocytes give rise to most new epidermal cells that are pushed outward *during cell division.***
   - c. **Melanocytes lie in this layer and produce the *pigment* melanin.**
     Melanin is passed from melanocytes to keratinocytes through *phagocytosis*.
   - d. **Merkel cells: in conjunction with a dermal nerve ending, form a *tactile (touch) receptor* known as a *Merkel disc.***

SKIN Structure

6



SKIN Structure

7

EPIDERMIS:

2. Stratum Spinosum

a. made up of several layers of flattened keratinocytes in which organelles are degenerating. These cells are attached to each other by desmosomes, giving them a spiny appearance as they shrink.

b. Macrophages (called Langerhans cells) are present in this layer and the stratum granulosum.

3. Stratum Granulosum

a. This layer consists of two to five layers of cells with granules of keratohyalin.

SKIN Structure

8

EPIDERMIS:

4. Stratum Lucidum

This thin, translucent zone (much matrix) is seen only in thick skin, such as the soles of the feet.

5. Stratum Corneum

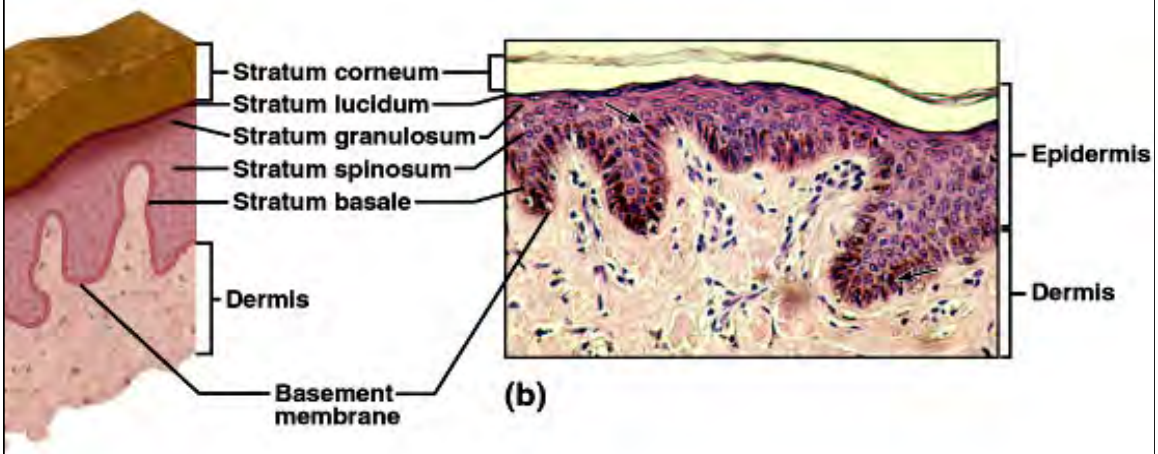
The stratum corneum is made up of 25-30 layers *of dead, keratinized cells.*
-a waterproof, protective outer layer.

DERMIS:

Since connective tissue (CT) will be covered in a separate, dedicated ***Lab***, some areas are of the DERMIS plates are greyed out. But first, some epidermal images……..

SKIN Structure

9



SKIN Structure

10

DERMIS:

1. **The dermis is primarily composed of fibroconnective tissue, with blood vessels, nerve endings, sweat glands, hair follicles, and nail roots.**

2. **The papillary layer of the dermis is a zone of areolar tissue (loose CT) closest to the epidermis, projecting upward as dermal papillae.**
   ***Blood vessels* extend close to the epidermis within the papillae.**
   The large number of white blood cells within this layer helps prevent infection.

3. **Reticular layer contains dense irregular connective tissue.**
   Stretching of the skin causes tears in this area, called linea albicantes, or stretch marks.

11

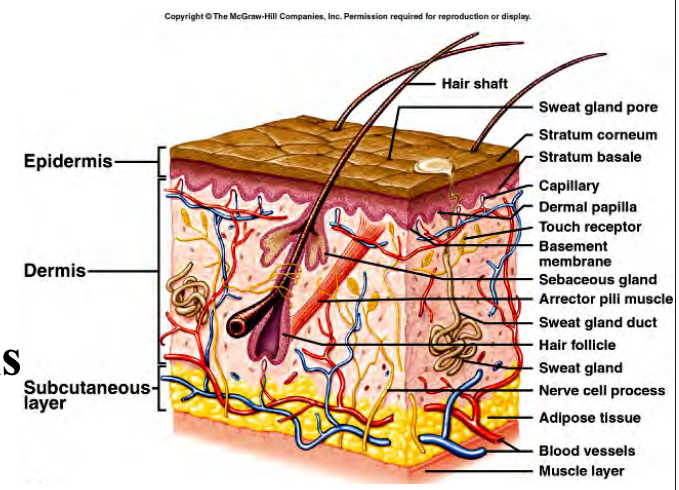
Dermis

- on average 1.0-2.0 mm thick
- dermal papillae
- binds epidermis to underlying tissues
- muscle cells
- irregular dense connective tissue
- nerve cell processes
- blood vessels
- hair follicles
- glands

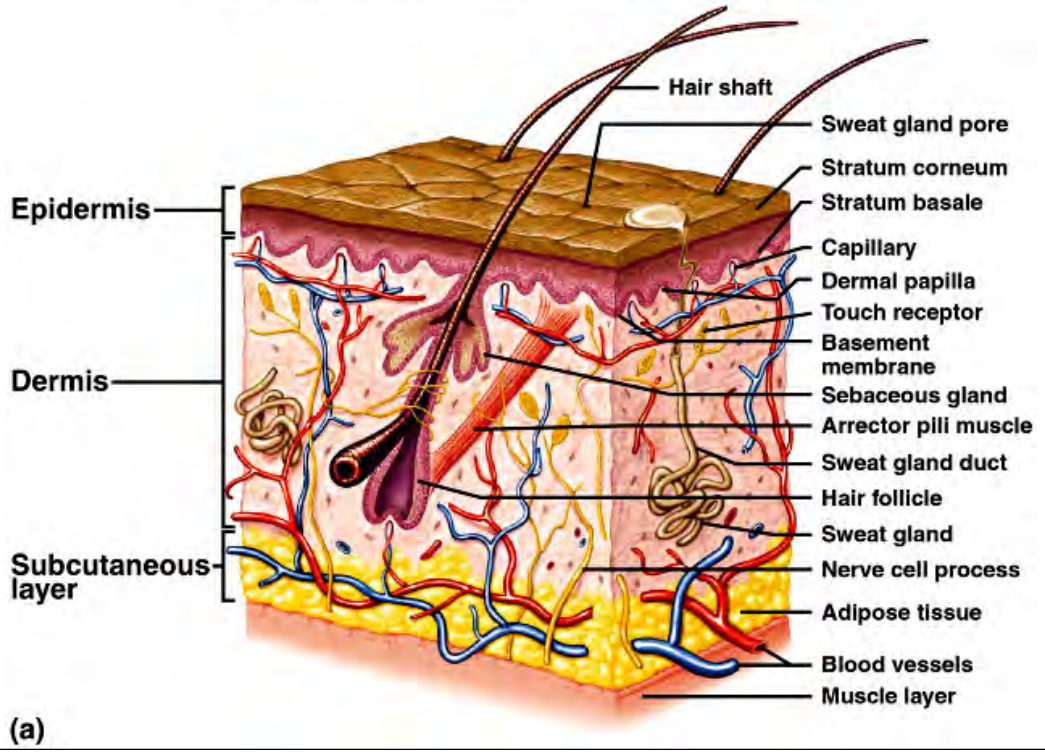
12

Subcutaneous Layer

- hypodermis
- loose connective
- adipose tissue
- insulates
- major blood vessels



13



14

Skin Color

Genetic Factors

- varying melanin amounts
- size of melanin granules
- albinos lack melanin

Environmental Factors

- sunlight
- UV light from sunlamps
- X rays

Physiological Factors

- dermal BV dilation
- dermal BV constriction
- carotene (orange)
- jaundice (hepatitis)

Hematoma (bruise) gives a purplish caste.

Erythema: abnormal skin redness. Shock may cause **pallor.**

Cyanosis: **blue (low Oxygen)**

Skin Markings

- **hemiangiomas** (birthmarks),
- **moles (nevus), freckles**

SUMMARY of SKIN FUNCTIONS

15

A. The Skin as a Barrier

1. **Keratin** and epidermal **desmosomes** make skin a tough barrier to penetration and injury.
   The **dry habitat** of the skin, and the **acid mantle** of sweat are *unfavorable to microbial growth*.
2. The skin is impervious to water (keratin) and a barrier to some ultraviolet radiation.

B. Vitamin D Synthesis

UV radiation can penetrate into the dermis where it reaches the steroid **dehydrocholesterol** found in blood.
The steroid is converted to **cholecalciferol** that the liver and kidneys turn into an **active** form of **vitamin D.**
Vitamin D activity is related to the control of calcium and phosphorous levels in the body.

SUMMARY of SKIN FUNCTIONS

16

C. Cutaneous Absorption

1. **The blood receives 1-2% of its oxygen through the skin.**
2. **Many toxic compounds, as well as fat-soluble vitamins, can be absorbed through the skin.**

D. Sensory Roles

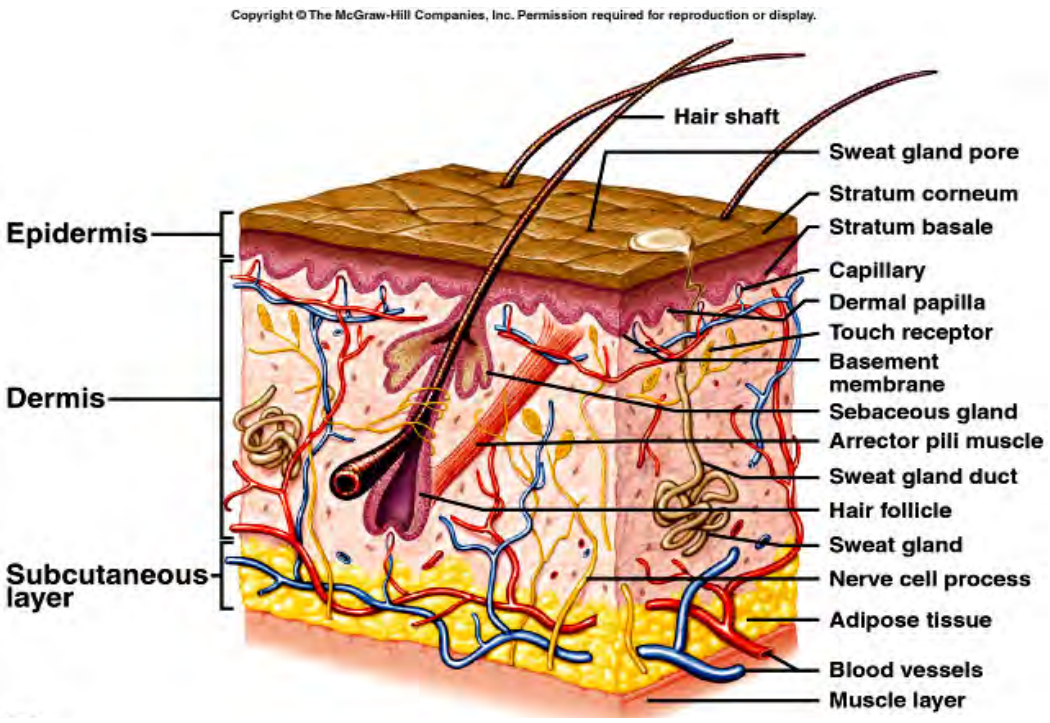
A variety of types of sensory nerve endings are present in skin. (to be discussed at a later date)

E. Thermoregulation

1. **The skin functions as an adjustable radiator to regulate body temperature.**
2. **When cold, dermal blood vessels constrict, thus retaining heat in the body core.**
3. **When hot, dermal blood vessels dilate, radiating heat to the surroundings.**

   Also, perspiration allows **evaporative cooling.**
   Insensible perspiration: not very noticeable (approx. 500 ml/day)

17



18

HAIR (*aka* Pili) and NAILS

Both are *accessory organs* to the Skin

Both are made of hard keratin (compared to the soft keratin of skin).

Types and Distribution of Hair:

1. Almost all areas of the skin have hair, **except** lips, nipples palms and soles, and portions of the fingers and genitals.
2. **Lanugo,** a fine, downy, **unpigmented** hair covers the fetus before birth.
3. Fine, unpigmented hair is otherwise called **vellus**, and covers most of the body.
4. **Terminal hair** is coarser, longer, and pigmented. It can be found on the head and face (men), and in axillary and pelvic regions after puberty.
   Short guard hairs in nose, ear canal = "**vibrissae**"

19

HAIR (*aka* Pili) and NAILS

Both are *accessory organs* to the Skin

Structure of the Hair and Follicle

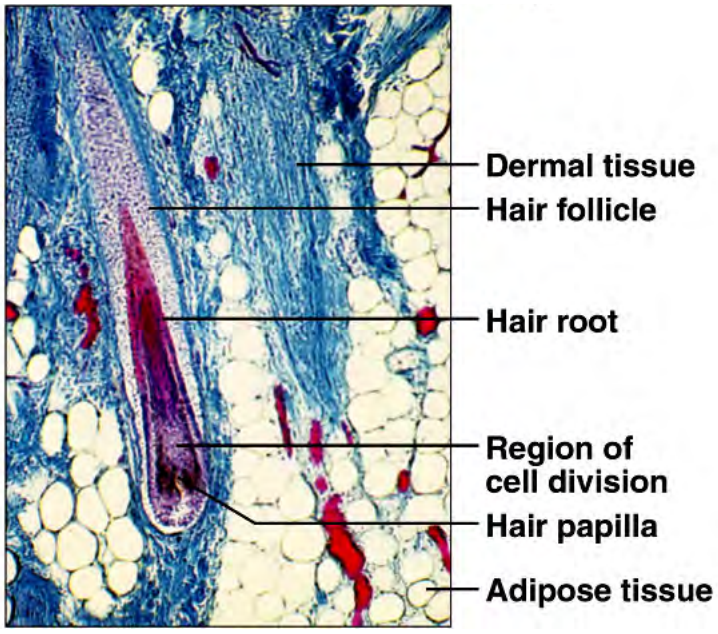
1. The hair itself is divided into the swollen base, where the hair originates, the **root** (the remainder of the hair within its **follicle**), and the **shaft**, the portion above the skin.
2. The color of hair is due to the **relative abundance of keratin**. Red hair also contains **trichosiderin.**
3. The hair **follicle** dips into the **dermis** and has **two layers.**
4. The **epithelial root sheath** is an extension of the **epidermis.**
5. The connective tissue root sheath, derived from the dermis, surrounds the epidermal sheath.
6. Also associated with the follicle are hair receptors, and an **arrector pili** muscle: smooth muscle (involuntary), hair erect.

20

HAIR (*aka* Pili) and NAILS

Both are *accessory organs* to the Skin

Structure of the Hair and Follicle



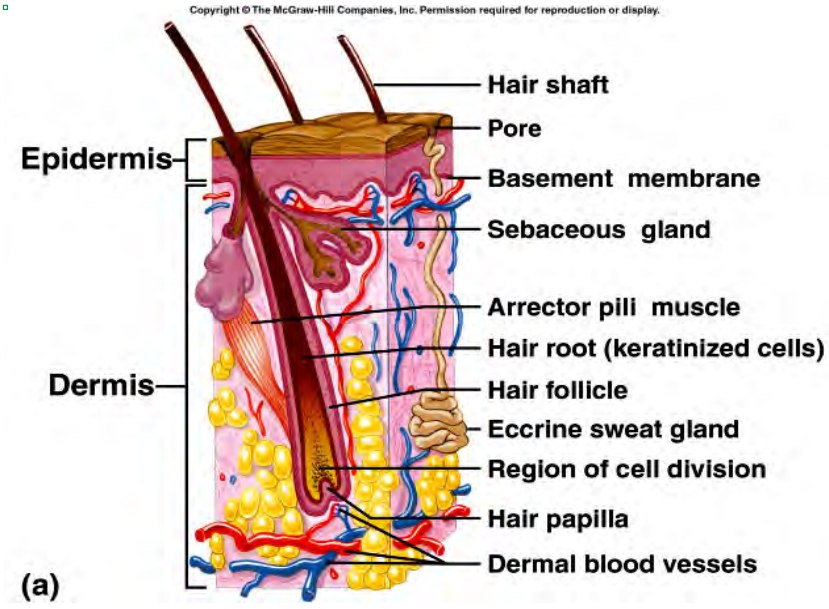
21

HAIR (*aka* Pili) and NAILS

Both are *accessory organs* to the Skin

Structure of the Hair and Follicle

- epidermal cells
- tube-like depression
- extends into dermis
- hair root
- hair shaft
- hair papilla
- dead epidermal cells
- melanin
- arrector pili muscle



22

HAIR (*aka* Pili) and NAILS

Both are *accessory organs* to the Skin

The Growth of Hair

Growth of hair is due to **mitosis** in cells in the **stratum basale** of the epidermal root sheath**.**

Thinning of the hair **(alopecia)** is usually age-related, but may be influenced by disease, nutrition, emotional trauma, radiation, or chemotherapy.

Pattern baldness is more common in males. Excessive, unwanted hair: ***hypertrichosis***.

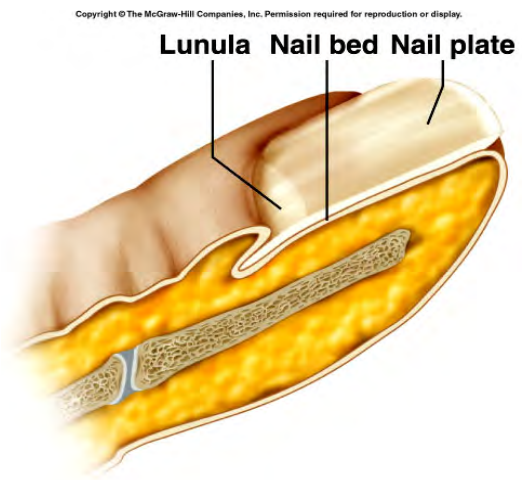
23

HAIR (*aka* Pili) and NAILS

Both are *accessory organs* to the Skin

NAILS

- **protective coverings**
- **nail plate (the nail itself)**
- **nail bed**
- **lunula**



Nails are clear derivatives of the *stratum corneum.*

24

CUTANEOUS GLANDS

SWEAT GLANDS

Sudoriferous (sweat) glands: the most numerous cutaneous (skin) glands.
Sweat: mostly water; also, salts, ammonia, urea, sugar, uric acid, lactic acid, ascorbic and amino acids.

Two basic types:

a. **Merocrine sweat glands:** produce watery perspiration to cool the body; ducts to skin surface.
Functional before and after puberty.
Sweat not very viscous.

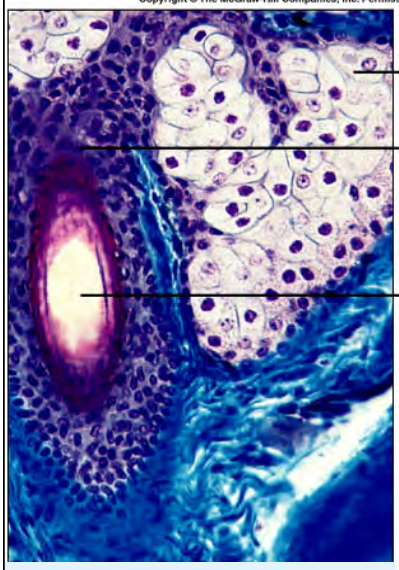
b. **Apocrine sweat glands** occur in the groin, axilla, and breast areola; also, faces of males;
ducts lead into hair follicles. Usually, not functional until puberty. Sweat most viscous. **Develop odors.**
Respond to stress and sexual stimulation.

25

CUTANEOUS GLANDS

SEBACEOUS GLANDS

Holocrine Gland:
Secretes ***entire*** contents

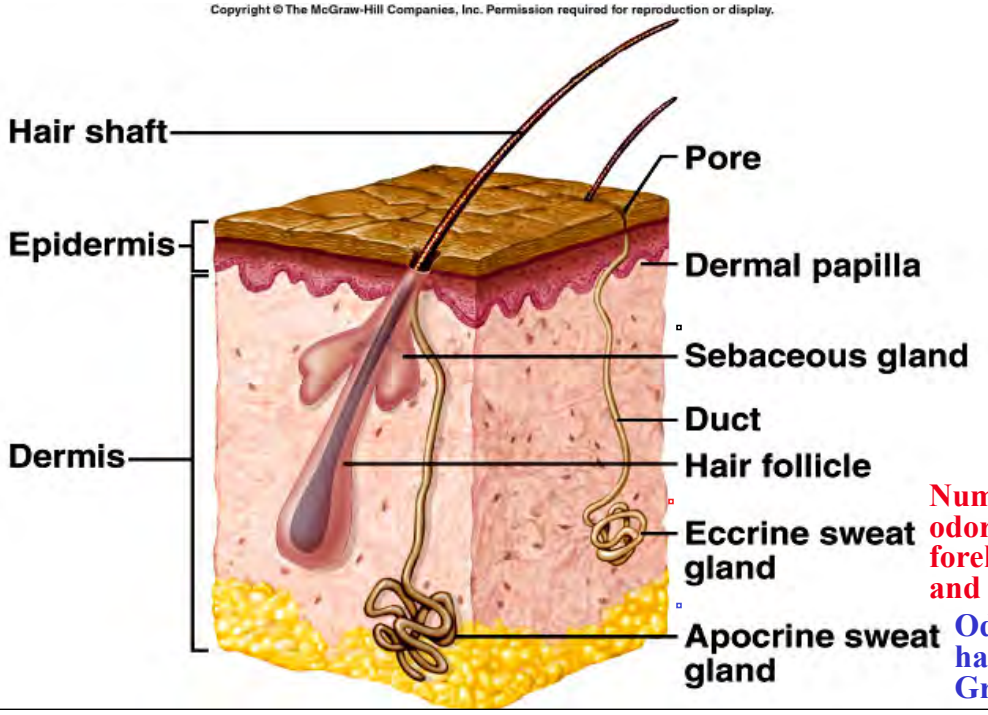


absent on palms and soles

Sebaceous glands produce an oily **sebum** (cholesterol, fats proteins and salts) to moisturize the skin and hair.
If associated with hair, then contents released via **ducts into the hair follicle.**
If not associated with hair, ducts open onto the **surface of the skin**. Examples- **lips, eyelids, glans penis, labia minora.**

26

CUTANEOUS GLANDS



Numerous and odorless forehead, neck and back.

Odors: hair, armpit, Groin etc.

27

CUTANEOUS GLANDS

CERUMINOUS GLANDS

Ceruminous glands:
found only in the external ear canal where they produce cerumen (earwax). They are a type of modified sweat gland.

BREAST and MAMMARY GLANDS

Breasts and Mammary glands:
Mammary glands are *modified* apocrine sweat glands.

Both men and women have breasts; it is only during pregnancy and lactation that women develop mammary gland tissue within the breasts capable of producing and secreting milk.

28

Integumentary Aging and Disease

AGING

1. **At puberty, the skin of women thickens somewhat. Therefore, it contains more blood vessels than that of men, thus women blush and bleed more easily.**
2. **After age 40, skin degenerative changes (senescence) become more noteworthy.**

SKIN CANCER

1. **With increasing age and UV exposure, the development of skin cancer becomes more likely.**
2. **Skin cancer is the most common of all cancers, with *basal cell carcinoma* (arising from the stratum basale) the most frequent skin cancer.**
   It appears as a raised bump with a central depression, and seldom metastasizes.

Integumentary Aging and Disease

29

SKIN CANCER

3. Squamous cell carcinoma arises from the stratum spinosum usually on the scalp, ears, lips, or hands.
   This cancer is readily curable, but can metastasize and turn deadly if left untreated.

4. The deadliest, but least common, form of skin cancer is malignant melanoma.

   It usually arises from melanocytes in a preexisting mole.

   It is most likely in those who suffered severe sunburns as children, especially redheads.

Integumentary Aging and Disease

30

SKIN CANCER

Squamous Cell Carcinoma

Basal Cell Carcinoma

Malignant Melanoma

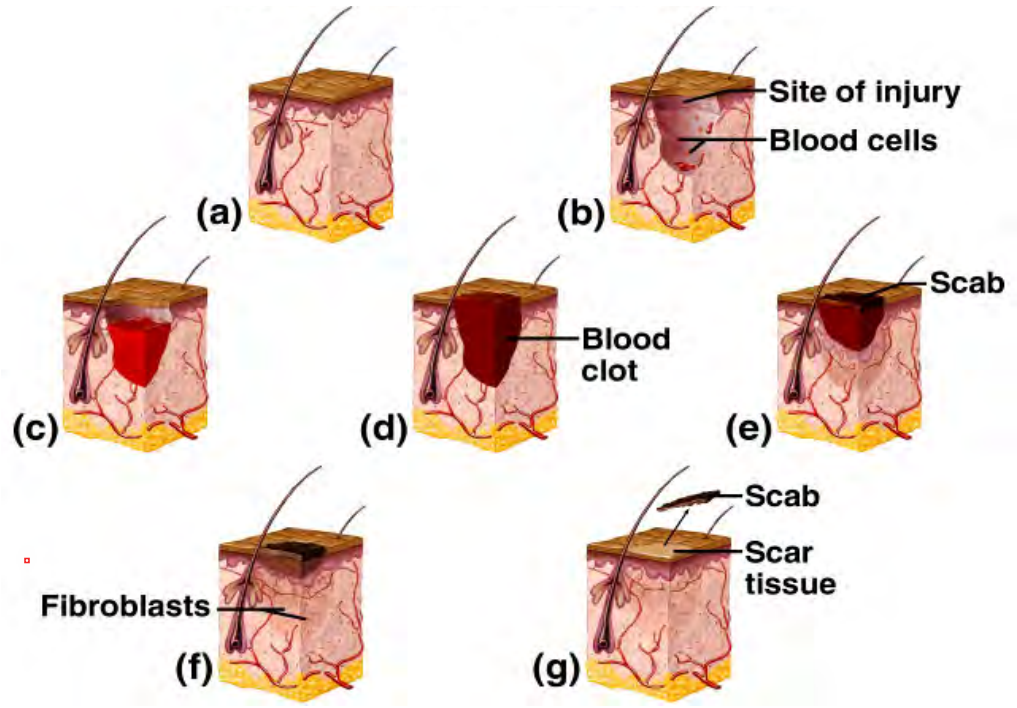
31

Life Span Changes

- Scaly skin
- Age spots
- Dermis becomes reduced
- Loss of fat
- Wrinkles
- Sagging
- Sebaceous glands secrete less oil.
- Melanin production slows
- Hair thins
- Number of hair follicles decrease
- Impaired nail growth
- Sensory receptors decline
- Inability to control body temperature
- Less vitamin D production

32

Healing of Cuts



33

SKIN BURNS

1. **Burns are the leading cause of accidental death.**
2. **Burns are classified according to the depth of tissue involvement.**

First-degree burns
involve only the epidermis.

Second-degree burns
involve the upper dermis.

Third-degree burns
destroy the skin and sometimes deeper tissue; "full -thickness burns"

- **Hyperthermia – abnormally high body temperature**
- **Hypothermia – abnormally low body temperature**

3. **With severe burns, fluid and electrolyte replacement, and infection control (and use of debridement; "cutting away") are essential.**

34

Skin Grafts and Artificial Skin

Third degree burns destroy the dermis, requiring skin grafts.
An autograft is taken from the same person.

Grafts from other individuals include:

isograft:
from an **identical twin.**

homograft (allograft):
from an ***unrelated person.***

heterograft or xenograft:
from a ***different animal.***

LAST SLIDE