The Integumentary System

Functions of the skin

- Protection
  - abrasion, invasion, water loss, UV protection
- Vitamin D synthesis
  - epidermal keratinocytes when exposed to UV light
  - helps maintain health of skeleton by increasing absorption of Ca^{2+}

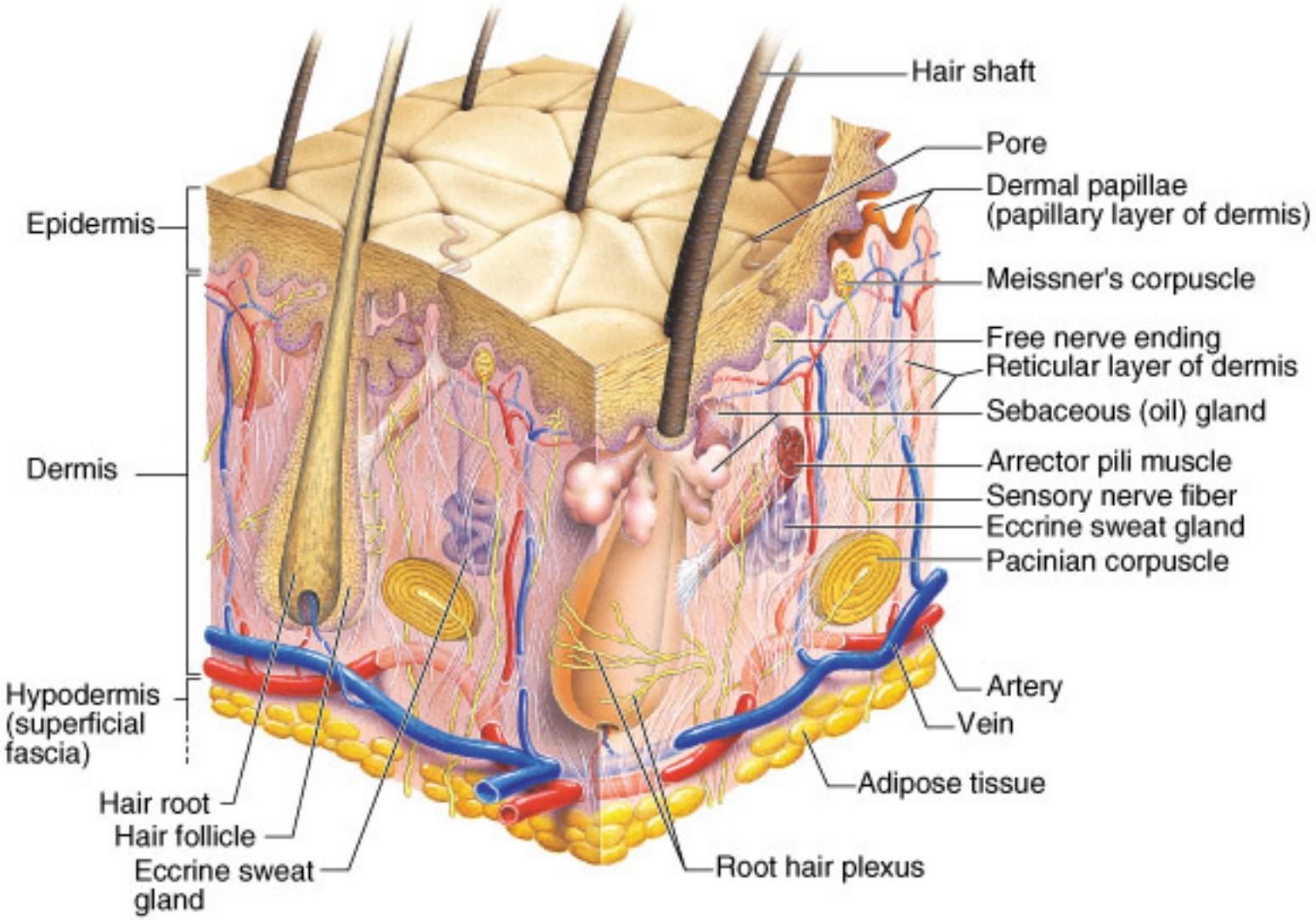
- Sensation
  - receptors for heat, cold, touch, pressure, vibration and pain
- Thermoregulation
  - thermoreceptors and sweat glands
  - hypothalamus controls cutaneous arteries and sweat glands to retain or dissipate heat
- Psychological and social functions
  - appearance and social acceptance
  - facial expression and nonverbal communication

The Integumentary System

- Composed of the skin, sweat and oil glands, hair, and nails.
- Accounts for 7% of the body's weight.
- Major role is protection from pathogens and dehydration.
- Varies in thickness from 1.5 to 4.0 mm.
- Composed of 3 distinct layers.
- Epidermis, Dermis, and Hypodermis

Overview

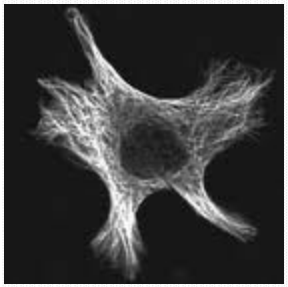
- Largest and heaviest organ of the body
- Epidermis
  - stratified squamous epithelium
  - contains 5 major layers
- Dermis
  - connective tissue layer
- Hypodermis (subcutaneous)
  - Underlying fat and connective tissue



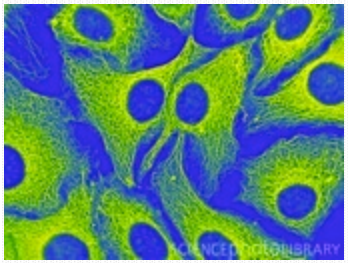
Epidermis

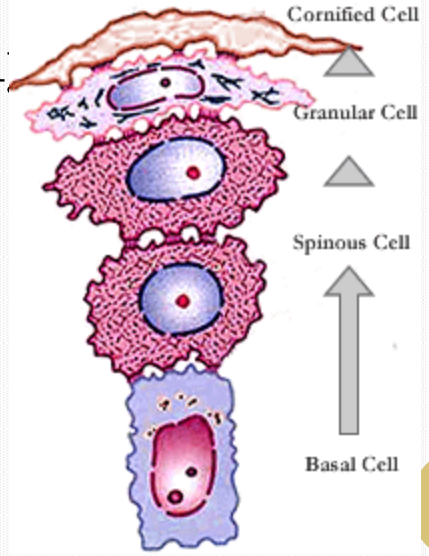
- Outermost layer. Most superficial.
- Composed mostly of keratinized stratified squamous epithelium.
- 1-2 mm
- Contains 4 distinct cell types and 4 to 5 distinct layers.
- Avascular

Cell Types of the Epidermis



- Keratinocytes—
  - produce keratin
  - tightly connected by desmosomes.
  - arise from the stratum basale.
  - undergo continuous mitosis.
  - are pushed upward and continuousl become more keratinized.
  - Those on the surface of the skin are dead.
  - Millions rub off per day.





Cell Types of the Epidermi

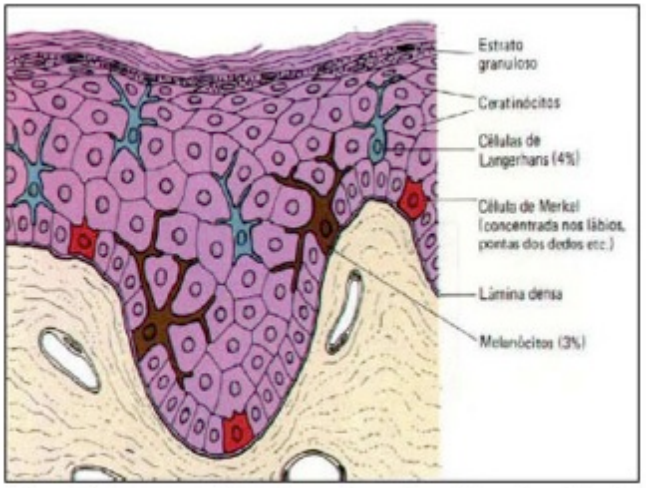
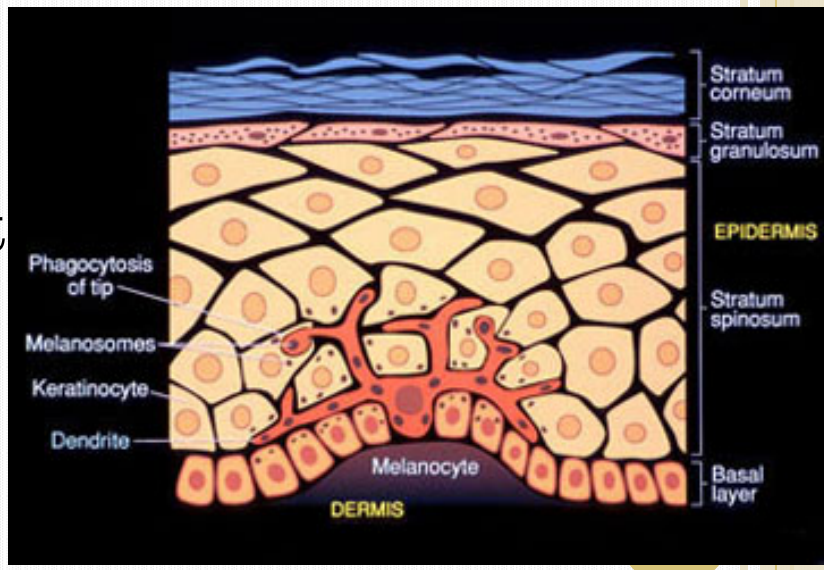


Figure 1: Arrangement of melanocytes on the epidermis and their inter-relation with keratinocytes

- Melanocytes—synthesize melanin.
- Located at the deepest layer of the epidermis.
- The melanin is transferred to the keratinocyt
- Protects against UV damage.



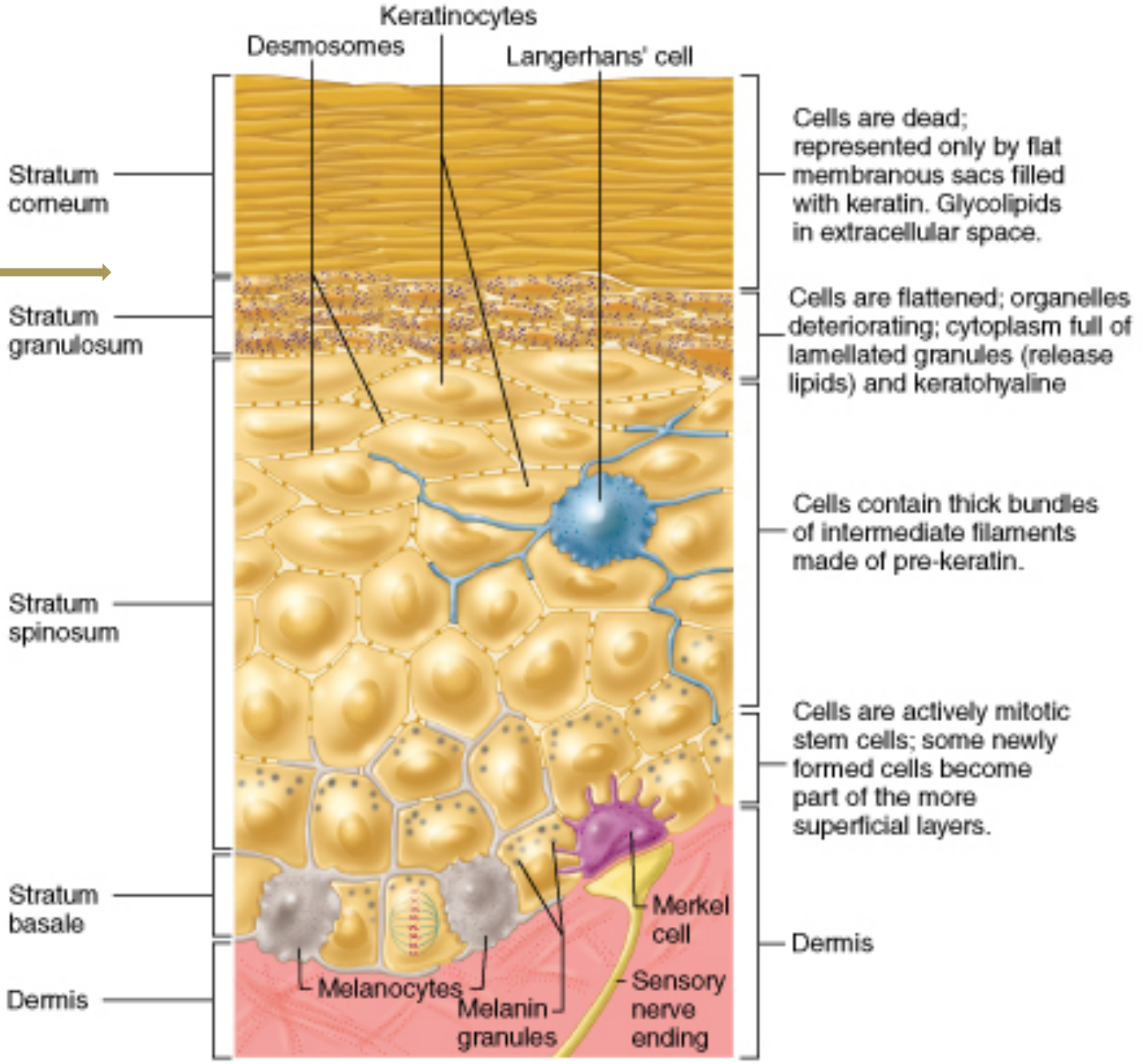
Up to 30 layers

Stratum Lucidum

Nucleus breaks down (last living layer)

Flattened keratinocytes produce keratinohyalin

Mitosis, melanocytes and keratinocytes

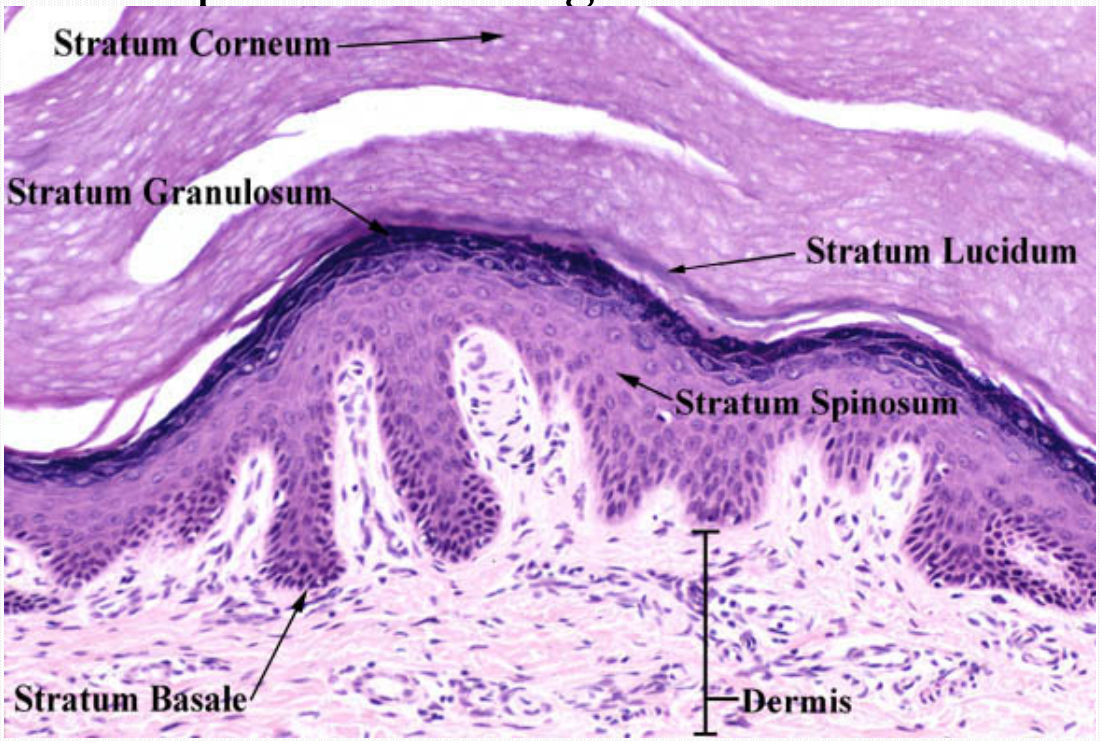


The Dermis

- Made mostly of connective tissue.
- The hide of the human body.
- Richly innervated and vascularized.
- Contains the hair follicles, sweat glands, oil glands, lymphatic vessels, and many sensory receptors.

The Dermis

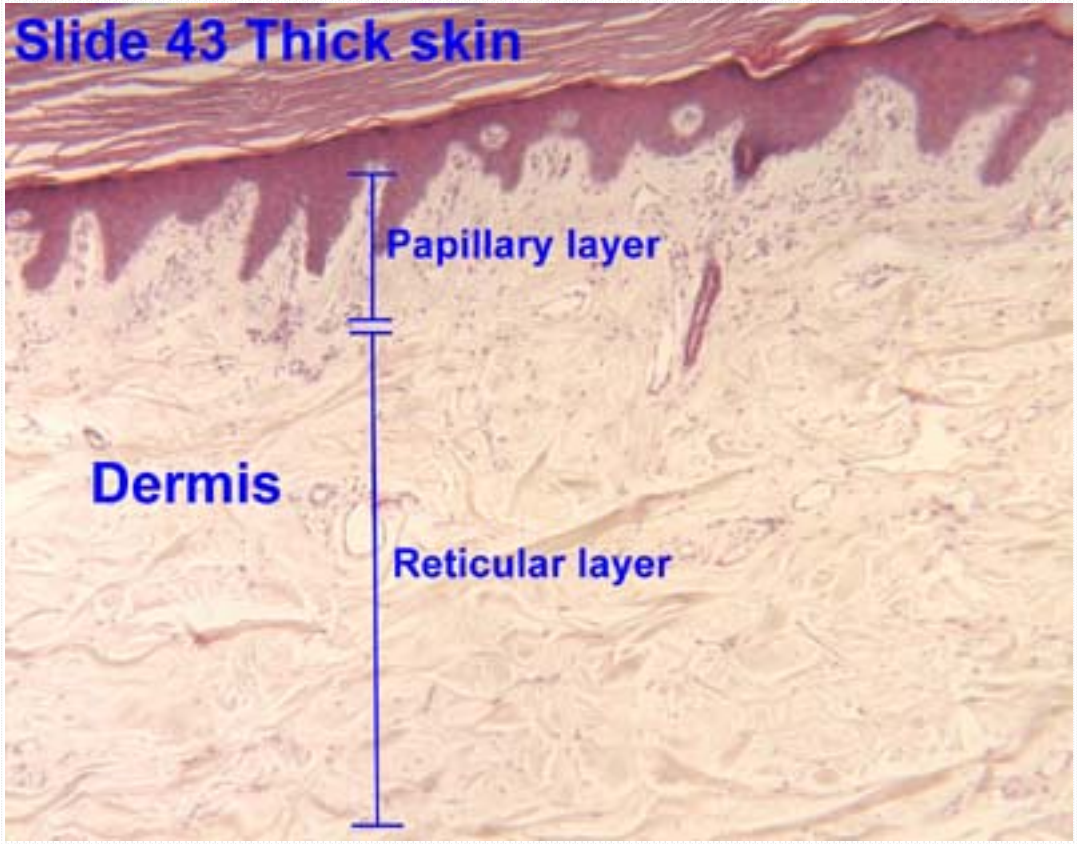
- Consists of 2 layers.
  - Papillary layer—areolar connective tissue, heavily vascularized.
  - In some areas these lie on top of the dermal ridges. Cause the epidermal ridges that cause fingerprints.



The Dermis

- Skin color—determined by melanin, carotene, and hemoglobin.
- Freckles & moles
- Melanin protects nucleus from UV (could cause mutations)

Reticular Layer (dense irregular CT)



Makes up 80% of dermis

Skin Appendages

- Sweat Glands
  - more than 2.5 million per person.
- Eccrine sweat glands coil in the dermis, a duct leads to a pore at the skin's superficial surface.
- Sweat has pH 4-6
- Apocrine sweat glands—in the axillary and anogenital areas. Empty into hair follicles. Contains fatty substances and proteins. May cause body odor. Begin to function at puberty. May contain pheromones.

Skin Appendages

- Ceruminous glands—secrete earwax.
- Mammary glands—secrete milk.
- Sebaceous Glands—oil glands. Found everywhere except the palms and soles. Secrete sebum. Usually secreted into hair follicles.

Skin Appendages

- Whiteheads
- Blackheads
- http://www.acne.org/whatisacne.html
- Acne—staphylococcus
- Hair—covers the entire body except for the palms, soles, lips, nipples, and parts of the genitalia.
- Mostly dead keratinized cells.

Nails

- Modification of the epidermis
- Composed of keratin.
- http://www.webmd.com/healthy-beauty/ss/slideshow-nails-and-health

Skin disorders

- Causes
- Basal cell carcinoma—30% of Caucasians get this type of skin cancer. Does not metastasize.
- Squamous Cell carcinoma—arises from the keratinocytes in the stratum spinosum. May metastasize.
- Melanoma—arises in the melanocytes. Rapidly metastasizes.
- ABCD rule– Asymmetry, Border irregularity, Color, Diameter

Skin disorders

- Callus-the result of friction in the epidermis
  - causes thickening of the epidermis
- Corn- inward growth of epidermal cells due to pressure (A thickening of the stratum corneum that pushes inward.)
- Blister- the result of trauma that breaks the basement membrane and separates epidermis from dermis
  - Caused by friction, heat, UV rays, chemical burns

Burns

- Denaturation of cell proteins.
- Dehydration, protein loss, and infection.
- First degree burns—only the epidermis.
- Second degree burns—epidermis and upper dermis. May include blisters.
- Third degree burns—full thickness. Not painful. Skin grafting is almost always necessary.
- Grafting techniques
- Autograft
- Dangers of facial burns and burns near joints.

Aging Effects

- Thinning of the skin
- Slowing of epidermal cell replacment.