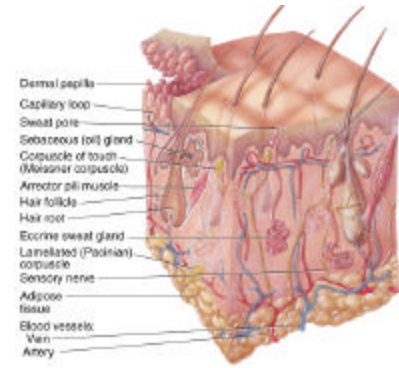


## The Integumentary System

- Skin and its accessory structures
  - structure
  - function
  - growth and repair
  - development
  - aging
  - disorders



### General Anatomy

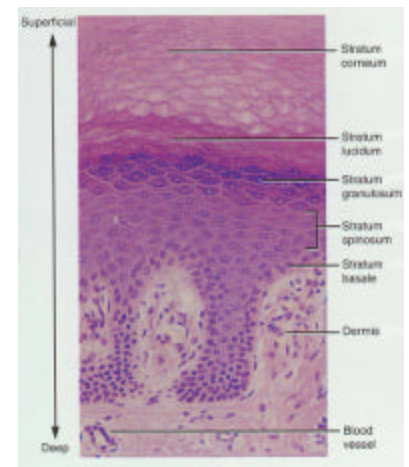
- A large organ composed of all 4 tissue types

### Overview

- 2 Major layers of skin
  - epidermis is epithelial tissue only
  - dermis is layer of connective tissue, nerve & muscle
- Subcutaneous tissue (subQ or hypodermis) is layer of adipose & areolar tissue
  - subQ = subcutaneous injection
  - intradermal = within the skin layer

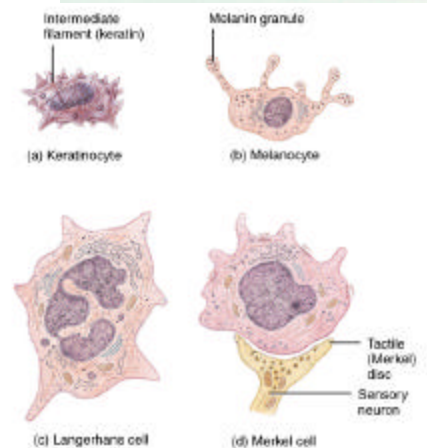
### Overview of Epidermis

- Stratified squamous epithelium
- Contains no blood vessels
- 4 types of cells
- 5 distinct strata (layers) of cells



### Cell types of the Epidermis

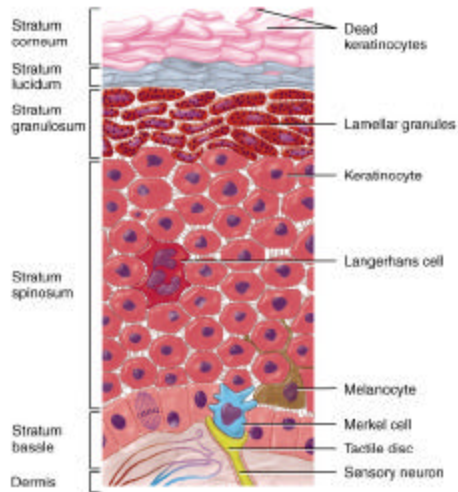
- Keratinocytes--90%
  - produce keratin
- Melanocytes-----8 %
  - produces melanin pigment
  - melanin transferred to other cells with long cell processes
- Langerhan cells
  - from bone marrow
  - provide immunity
- Merkel cells
  - in deepest layer
  - form touch receptor with sensory neuron



### Layers (Strata) of the Epidermis

- Stratum corneum: consisting in most areas of layers of flattened cells composed mostly of keratin

- Stratum granulosum: spindle-shaped cells containing keratohain granules
- Stratum spinosum: the appearance of the layer is due to desmasomes connecting adjacent cells
- Stratum basale: deep growing layer of cuboidal or columnar cells, follows the contour of the underlying papillary layer of the dermis to which it is closely applied



### Keratinization & Epidermal Growth

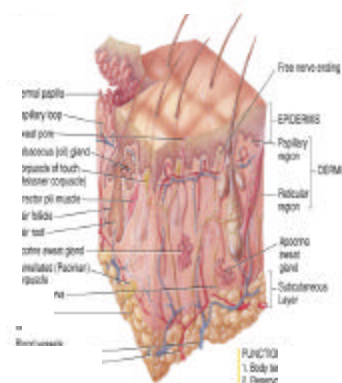
- Stem cells divide to produce keratinocytes
- As keratinocytes are pushed up towards the surface, they fill with keratin
- 4 week journey unless outer layers removed in abrasion
- Hormone EGF (epidermal growth factor) can speed up process

### Skin Grafts

- New skin can not regenerate if stratum basale and its stem cells are destroyed
- Skin graft is covering of wound with piece of healthy skin
  - autograft from self
  - isograft from twin
  - autologous skin
    - transplantation of patients skin grown in culture

### Dermis

- Also known as the corium
- Arteries, veins, capillaries and lymphatics of the skin are concentrated here
- Also contains hair follicles, glands, nerves
- Major regions of dermis
  - papillary region
  - reticular region



### Papillary Region

- Top 20% of dermis
- Composed of loose CT & elastic fibers
- Finger like projections called dermal papillae
- Functions
  - anchors epidermis to dermis
  - contains capillaries that feed epidermis
  - contains Meissner's corpuscles (touch) & free nerve endings (pain and temperature)

### Reticular Region

- Dense irregular connective tissue
- Contains interlacing collagen and elastic fibers
- Packed with oil glands, sweat gland ducts, fat & hair follicles
- Provides strength, extensibility & elasticity to skin
  - stretch marks are dermal tears from extreme stretching
- Epidermal ridges form in fetus as epidermis conforms to dermal papillae
  - fingerprints are left by sweat glands open on ridges
  - increase grip of hand

### Skin Color Pigments

- Melanin produced in epidermis by melanosomes which are housed in melanocytes
  - same number of melanocytes in everyone, but differing amounts of pigment produced
  - results vary from yellow to tan to black color
  - melanocytes convert tyrosine to melanin
    - UV in sunlight increases melanin production
- Clinical observations
  - freckles or liver spots = melanocytes in a patch
  - albinism = inherited lack of tyrosinase; no pigment
  - vitiligo = autoimmune loss of melanocytes in areas of the skin produces white patches
- Carotene in dermis
  - yellow-orange pigment (precursor of vitamin A)
  - found in stratum corneum & dermis
- Hemoglobin
  - red, oxygen-carrying pigment in blood cells
  - if other pigments are not present, epidermis is translucent so pinkness will be evident

### Hypodermis

- Separates the dermis from the underlying structures such as bone and deep fascia

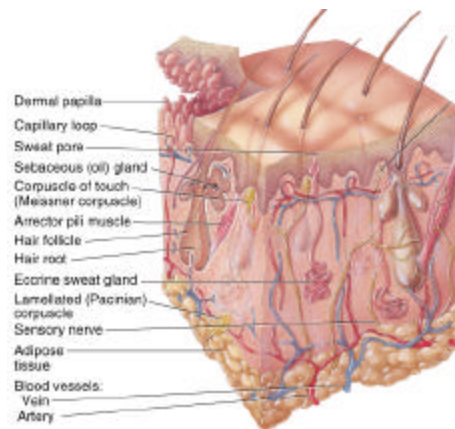
- Important because it permits movement of the skin without tearing

#### Accessory Structures of Skin

- Epidermal derivatives
- Cells sink inward during development to form:
  - Hair
  - Arrectores pilorum muscles
  - oil glands
  - sweat glands
  - nails/hooves
  - horns, dewclaws, chestnuts, ergots

#### Structure of Hair

- Shaft -- visible
  - medulla, cortex & cuticle
  - CS round in straight hair
  - CS oval in wavy hair
- Root -- below the surface
- Follicle surrounds root
  - external root sheath
  - internal root sheath
  - base of follicle is bulb
    - blood vessels
    - germinal cell layer



#### Hair Color

- Result of melanin produced in melanocytes in hair bulb
- Dark hair contains true melanin
- Blond and red hair contain melanin with iron and sulfur added
- Graying hair is result of decline in melanin production
- White hair has air bubbles in the medullary shaft

#### Functions of Hair

- Prevents heat loss
- Decreases sunburn
- Eyelashes help protect eyes
- Touch receptors (hair root plexus) senses light touch

#### Glands of the Skin

- Specialized exocrine glands found in dermis
- Sebaceous (oil) glands

- Sudiferous (sweat) glands
- Ceruminous (wax) glands
- Mammary (milk) glands

#### Sebaceous (oil) glands

- Secretory portion in the dermis
- Most open onto hair shafts
- Sheep produce lanolin
- Sebum
  - combination of cholesterol, proteins, fats & salts
  - keeps hair and skin from soft & pliable
  - inhibits growth of bacteria & fungi(ringworm)

#### Sudoriferous (sweat) glands

- most areas of skin
- secretory portion in dermis with duct to surface
- regulate body temperature with perspiration in horse; not functional in most other animals

#### Hoof

- the insensitive cornified layer of epidermis covering the distal end of the digit

#### Horns

- formed over the horn process, a bony core that projects from the frontal bone of the skull

#### Dewclaws, chestnuts, ergots

- other areas of modified epidermis
- dewclaw: a miniature digit, and its covering resembles a hoof or claw of the same animal
- chestnut: horn-like growths on the medial sides of horses' legs
- ergots: small projections of cornified epithelium in the center of the caudal part of the fetlock of the horse

#### General Functions of the Skin

- Regulation of body temperature
- Protection as physical barrier
- Sensory receptors
- Excretion and absorption
- Synthesis of vitamin