Integument Function:

1) **Protection:**
   a) Physical (e.g., cuts, abrasions, tears)
      - Tough: Keratinized cells
      - Stretchy: Elastic / collagen fibers
      - Bouncy: Adipose tissue (shock absorption)
   b) Chemical
      - Impermeable (non-porous)
   c) Biological (e.g., bacteria)
      - Arid / low nutrient surface
      - Acid / antibody secretions
   d) Environmental (e.g., UV radiation)
      - Melanin (pigment)

2) **Thermoregulation:**
   - Adipose tissue (insulation)
   - Vascular perfusion
   - Sweat glands

3) **Sensation:**
   - Pain (nociceptors)
   - Touch (light vs. heavy pressure)

4) **Excretion & Secretion**
   - Salts, water, waste (sweat glands)
   - Milk (mammary glands)
Anatomy of Integument:
1) **Cutaneous Membrane** (Skin)

![Diagram of skin layers](image)

**Epidermis**

**Dermis**

**Hypodermis** (Subcutaneous layer)

Attach skin to muscle / bone

Anatomy of Epidermis:

- Epithelial tissue (stratified squamous)
- Avascular (i.e., no blood vessels)
- Function = Protection
  - Thin vs. thick skin

Cell Types Present:

1) **Keratinocytes** (most common)

2) **Melanocytes**
   - Melanin (skin pigment)

3) **Langerhans cells**
   - Macrophages (defense)

4) **Merkel cells** (touch receptors)

**Callus:**
Epidermis thickening due to repeated friction

Chapter 5: Integumentary System

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Page 2
Chapter 5: Integumentary System

Anatomy of Epidermis:

Layers (Strata):

1) **Stratum Basale** (Germinativum):
   - Innermost layer
   - Form epidermal ridges
     - Fingerprints (unique)
   - Actively dividing cells (basal cells)
   - Melanocytes
   - Merkel cells

2) **Stratum Spinosum**:
   - Cells connect (desmosomes)
   - Langerhan’s cells

3) **Stratum Granulosum**:
   - Organelles disintegrate
   - $\uparrow$ protein / enzyme content
     - Keratin production
   - Glycolipids (water resistant)
     - Insensible perspiration

4) **Stratum Lucidum**:
   - Only present in thick skin

5) **Stratum Corneum**:
   - Outermost layer
   - Dead, keratinized cells
     - Constantly shed (40 lbs. / lifetime)

Keratinocyte Life Span:
~ 6 weeks
Epidermal Characteristics:

1) Relatively impermeable (keratin & glycolipids)
   - Oils / lipids can penetrate epidermis (slowly)

2) Colored:
   a) Pigments
      - Carotene (orange-yellow): Accumulates inside cells
      - Melanin (brown; yellow-brown; black): Produced by melanocytes
Melanocytes:

• All individuals have similar # of melanocytes
  • Variation = quality / quantity of melanin
• Albinism = lack of melanin
  • Faulty enzyme (Tyrosinase)

Freckle:
Local accumulation of melanin

• Protects against UV radiation
• Tan = Melanin production enhanced by UV light

Chapter 5: Integumentary System

• ↓ levels UV light beneficial:
  - Cholesterol (Modified) → Sunlight → Vitamin D → Calcium Uptake

• ↑ levels UV light detrimental:

Skin Cancers (DNA damage)

Most common
Basal Cell Carcinoma (stratum basale)

Most dangerous
Squamous Cell Carcinoma (stratum spinosum)
Melanoma (Melanocytes)
Epidermal Characteristics:

1) Relatively impermeable (keratin & glycolipids)
   - Oils / lipids can penetrate epidermis (slowly)

2) Colored:
   a) Pigments
      - Carotene (orange-yellow): Accumulates inside cells
      - Melanin (brown; yellow-brown; black): Produced by melanocytes
   b) Dermal circulation:
      - Blood vessels under skin = Pinkish tint (hemoglobin)
      - Cyanosis = Low blood oxygen level (dark red blood)

Diseases Associated with Skin Pigmentation:

1) Jaundice:
   - Accumulation of yellowish pigment (bilirubin)
     - Liver malfunction (does not secrete bile)

2) Pituitary Tumor:
   - Overproduction of melanocyte-stimulating hormone

3) Addison's Disease:
   - Overproduction of adrenocorticotropic hormone
     - Mimics melanocyte-stimulating hormone

4) Vitiligo:
   - Loss of melanocytes (autoimmune disease)
Anatomy of Integument:
1) **Cutaneous Membrane** (Skin)

   - **Epidermis**
   - **Dermis**
   - **Hypodermis**
     - **Subcutaneous layer**
     - Attach skin to muscle / bone

Anatomy of Dermis:

1) **Papillary Layer** (superficial):
   - Loose connective tissue
   - Supports / nourishes epidermis
     - Capillaries; nerves

2) **Reticular Layer** (deep):
   - Dense, irregular connective tissue
     - Collagen fibers: strength
     - Elastic fibers: stretch / recoil

- **Blister**: Dermis / epidermis separation
- **Tattoos**: Ink placed in dermis
- **Cleavage Lines**: (Surgical importance) Stretch marks
Burns: Tissue damage inflicted by heat, electricity, chemicals, radiation

Severity = Depth of Damage

1st Degree
Epidermis

2nd Degree
Epidermis & dermis

3rd Degree
Epidermis, dermis & hypodermis

Burn (tissue damage)

\[ \uparrow \text{Perfusion} \]

Water / electrolyte loss

\[ \downarrow \text{blood pressure} \]

Circulatory Shock

Chapter 5: Integumentary System

Anatomy of Integument:

1) Cutaneous Membrane (Skin)
2) Skin Appendages:
Skin Appendages:

1) **Sweat Glands** (merocrine – 3 million / person):
   - **A)** Produce sweat (water, salts, waste - acidic)
     - Eccrine sweat glands:
       - Widely distributed (palms / soles / forehead)
       - Cool body (perspiration - 1 gal / hour)
     - Apocrine sweat glands:
       - Axillary & genital regions (hair follicle)
       - Odor = bacterial breakdown
   - **B)** Produce cerumen (i.e., earwax)
     - Ceruminous glands:
       - Ear canal: produce sticky, bitter substance
       - Protection against insects / foreign matter
   - **C)** Produce milk (nutrition for offspring)
     - Mammary glands:
       - Breast (females / males)
       - Nutrition for developing offspring

2) **Sebaceous Glands** (holocrine):
   - Secrete oily substance (sebum)
     - Hair follicles (structure = simple branched alveolar)
     - Lubricates hair shaft; antibacterial (acidic)
     - Pimple = Blocked, infected gland

3) **Hairs** (pili - ~ 2.5 million / body):
   - Fused, keratinized cells
   - Composed of shaft & root
     - Hair appearance = shaft shape
     - Color = variation in melanin
   - Produced by hair follicles
     - Growth: 2 – 5 years (0.3 mm / day)
     - **Vellus Hairs:** “Peach fuzz”
     - **Terminal Hairs:** Course hair
       - Roots set deep in dermis / hypodermis
Skin Appendages:

3) **Hairs** (pili - ~ 2.5 million / body):
   - Function:
     1) Scalp: protection & insulation
     2) Body: hair plexi
        - Sensation (e.g., insect detection)
        - Insulation (arrector pili = muscles)
     3) Ears / Nose / Eye:
        - Protection (trap particles)
        - Hair growth affected by age, stress and diet (e.g., alopecia)

4) **Nails**:
   - Keratinized, dead cells (body of nail)
   - **Nail root** = site of growth