You gotta have skin;
All you really need is skin.
Skin's the thing, that if you've got it outside,
It helps keep your insides in.

Alan Sherman (1924-1973)
Two Major Subdivisions

- **Cutaneous Membrane, i.e. skin**
  - Epidermis
  - Dermis
  - Hypodermis

- **Accessory Structures**
  - Excretory glands (?)
  - Hair
  - Nails
Function of skin

- Protection
  - Mechanical
  - Immune
- Heat regulation
- As a membrane
  - Absorption
  - Excretion
- Vitamin D metabolism
- Sensation
INTEGUMENTARY SYSTEM
- Physical protection from environmental hazards
- Thermoregulation
- Excretion
- Synthesis and storage of lipid reserves
- Synthesis of vitamin D₃
- Provides sensory information
- Coordinates immune response to pathogens and cancers in skin

CUTANEOUS MEMBRANE

EPIDERMIS
- Protects dermis from trauma, chemicals
- Controls skin permeability, prevents water loss
- Prevents entry of pathogens
- Synthesizes vitamin D₃
- Sensory receptors detect touch, pressure, pain, and temperature
- Coordinates immune responses to pathogens and skin cancers

DERMIS
- Papillary layer
  - Nourishes and supports epidermis
- Reticular layer
  - Restricts spread of pathogens penetrating epidermis
  - Stores lipid reserves
  - Attaches skin to deeper tissues
  - Sensory receptors detect touch, pressure, pain, vibration, and temperature
  - Vessels assist in thermoregulation

ACCESSORY STRUCTURES

HAIR FOLLICLES
- Produce hairs that protect skull
- Produce hairs that provide delicate touch sensations on general body surface

EXOCRINE GLANDS
- Assist in thermoregulation
- Excrete wastes
- Lubricate epidermis

NAILS
- Protect and support tips of fingers and toes
Made up of all 4 tissue types
Epidermis

- Type of Epithelium?
- Avascular
- Different layers (= strata)
  - 4 layers in thin skin
  - 5 layers in thick skin
A Concept Map (from Histo, Part 1)

Epithelial tissues

Squamous
  - Simple
  - Stratified
    - Keratinized
    - Nonkeratinized

Columnar
  - Simple
  - Pseudostratified

Cuboidal
  - Simple

Transitional

Stratified
Stratum Germinativum

- **Cell types:**
  - Stem cells (basal cells)
  - Melanocytes
  - Merkel cells (touch receptors in hairless skin only)

= stratum basale

Innermost, single layer
**Stratum Spinosum**

- Stem cell daughter cells (some can still divide)
- Establishment of Desmosomes
  - The desmosomes create the “spines” as artifact pulls the cells apart

Several cells thick
Stratum Granulosum

- Cells displaced from stratum spinosum → Keratinocytes
- Production of keratohyalin and keratin fibers
- Cells start to die. Dehydration leaves interlocked layers of keratin and keratohyalin

Small granules of keratin
**Stratum Lucidum**

- In “thick skin” only, i.e., palms of hands and soles of feet
- Cells do not stain well → clear (lucid) looking

Mostly keratin
Stratum Corneum

- Many layers of flattened, dead cells, filled with keratin
- Continually sloughed
- Water-resistant but not water proof (⇒ insensible perspiration)
- Relatively dry - advantage?
- Keratinization occurs everywhere except for anterior surface of eye

15-30 layers
(much thicker in thick skin)
Thin vs. Thick Skin

Refers to epidermis

- Average 0.08 mm
- Most of body
- Up to 1.5 mm
- Where??
Contour of skin surface follows pattern of epidermal ridges.
Skin Color

Depends on 3 pigments:

- **Hemoglobin (dermal blood supply)**
  - Reddish tones
  - Pale, due to?
  - Bluish (=?), due to?

- **Melanin**
  - Produced by melanocytes of stratum basale

- **Carotene**
  - Obtained from plant foods
Melanocytes

Function? UV protection?

Number of melanocytes same in all people, production levels differ!
Albinism

Vitiligo
Dermis

1. Papillary layer
   Areolar (loose) c.t.

2. Reticular layer
   dense irregular c.t.
Review of Connective Tissue

This is similar to Table 4.2
1. Papillary Layer

- Dermal papillae project between epidermal ridges
- Aerolar c.t.
- Capillaries
- Tactile receptors
2. Reticular Layer

- Consists of
- Dense irregular c.t.
- Accessory Structures
  - Hair
  - Glands
  - Nerves
  - Blood Supply
Hypodermis

- 2 other names
  - Subcutaneous Layer (subcutis)
  - Superficial fascia

- Indistinct boundary (c.t. fibers interwoven)
  - Loose c.t.

- Function
  - Stabilization of skin while allowing for independent movement
Clinical Brief:

- Wrinkles
- Stretch marks (lineae albicantes)
- Decubitus
- Transdermal medication
  - Advantage and disadvantage?
  - Examples?
- Hypodermic needles
Accessory Structures:

- Hair follicles and hair
- Glands
  - 1. Sebaceous Glands
  - 2. Apocrine glands
  - 3. Eccrine sweat glands
- Nails
Hair Follicles & Hair

- 5 million hairs/human body. (98% not on top of head)
- Three hair types (vellus – intermediate – terminal)
- Function?
- Hair color
- Growth cycle
Skin Glands

**EXOCRINE GLANDS**
- Assist in thermoregulation
- Excrete wastes
- Lubricate epidermis

**SEBACEOUS GLANDS** (See Figure 4.13)
- Secrete oily lipid (sebum) that coats hair shaft and epidermis
- Provide lubrication and antibacterial action

**SEBACEOUS FOLLICLES**
- Secrete into hair follicles
- Secrete onto skin surface

**TYPICAL SEBACEOUS GLANDS**

**APOCRINE SWEAT GLANDS** (See Figure 4.14)
- Limited distribution (axillae, groin, nipples)
- Produce a viscous secretion of complex composition
- Possible function in communication
- Strongly influenced by hormones

**CERUMINOUS GLANDS**
- Secrete waxy cerumen into external ear canal

**MAMMARY GLANDS**
- Apocrine glands specialized for milk production

**MEROCRINE SWEAT GLANDS** (See Figures 3.5 and 4.14)
- Widespread
- Produce thin secretions, mostly water
- Meroocrine secretion mechanism
- Controlled primarily by nervous system
- Important in thermoregulation and excretion
- Some antibacterial action

**SWEAT GLANDS**
- Produce watery solution by merocrine secretion
- Flush epidermal surface
- Perform other special functions

**INTEGUMENTARY SYSTEM**
- Physical protection from environmental factors
- Thermoregulation
- Excretion
- Synthesis and storage of lipid reserves
- Synthesis of vitamin D3
- Provides sensory information
- coordinates immune response to pathogens and cancers in skin

**CUTANEOUS MEMBRANE**
- Protects dermis from trauma, chemicals
- Controls skin permeability, prevents water loss
- Prevents entry of pathogens
- Synthesizes vitamin D3
- Sensory receptors detect touch, pressure, pain, and temperature
- Coordinates immune responses to pathogens and skin cancers

**DERMIS**
- Nourishes and supports epidermis

**PAPILLARY LAYER**
- Extends spread of sensation to somatosensory epithelium
- Stress test epidermis
- Attached skin to deeper tissues
- Sensory receptors detect touch, pressure, pain, vibration, and temperature
- Nervous system assists in thermoregulation

**RETICULAR LAYER**
- Protects dermis from trauma, chemicals
- Controls skin permeability, prevents water loss
- Prevents entry of pathogens
- Synthesizes vitamin D3
- Sensory receptors detect touch, pressure, pain, and temperature
- Coordinates immune responses to pathogens and skin cancers
1) Sebaceous Glands

- Sebum discharged mostly into hair follicles
  - (lubrication & bactericidal)
- Folliculitis; furuncle (boil); acne
2) **Apocrine Sweat Glands**

- Empty into hair follicle
- Location: armpits, groin, nipples
- Viscous, cloudy secretion → good nutrient source for bacteria (odor !!)
- Secretion may contain Pheromones
- Secretion begins at puberty and is stimulated during emotional distress (cold sweat)
Apocrine Sweat Glands
3) Merocrine (Eccrine) Sweat Glands

- Merocrine secretion
- Empty directly onto skin surface
- Location: most all over body (esp. abundant on palms & soles: ~ 500/cm²)
- Clear, watery secretion (99% H₂O; rest NaCl + some waste products)
- Sensible perspiration; Function: ?
Nails

(a) Direction of growth
- Free edge
- Lateral nail fold
- Nail bed
- Lunula
- Eponychium
- Proximal nail fold

(b) Lateral nail groove
- Nail body
- Phalanx (bone of fingertip)

(c) Nail root
- Proximal nail fold
- Eponychium
- Lunula
- Hyponychium
- Phalanx (bone of fingertip)
- Epidermis
- Dermis
For purpose of completion:

- **Other integumentary Glands:**

- Mammary glands: **Modified apocrine sweat glands**

- Ceruminous glands: **Modified sweat glands in ears**
Skin Pathology

- First degree burn
- Second degree burn
- Third degree burn

Sunburn
Skin Cancers

1. Basal Cell Carcinoma (Epithelioma)
2. Most common, not malignant
   - Squamous Cell CA
   - Stratum spinosum
   - Melanoma

Iris Melanoma

Dermal Melanoma

SCC
Skin and Aging Process

- Fewer Melanocytes:
  - Pale skin
  - Reduced tolerance for sun exposure

- Fewer Active Follicles:
  - Thinner, sparse hairs

- Dry Epidermis:
  - Reduction in sebaceous and sweat gland activity

- Thin Epidermis:
  - Slow repairs
  - Decreased vitamin D production
  - Reduced number of Langerhans cells

- Reduced Sweat Gland Activity:
  - Tendency to overheat

- Changes in Distribution of Fat and Hair:
  - Due to reductions in sex hormone levels

- Reduced Blood Supply:
  - Slow healing
  - Reduced ability to lose heat

- Thin Dermis:
  - Sagging and wrinkling due to fiber loss