Lab 11 – Skin (Integument)
IUSM – 2016

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         b. Apocrine
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V. Summary

SEM of hair shafts emerging from skin.
Learning Objectives

1. Understand the functions and physiological importance of the skin.
2. Know the layers of the epidermis and their cellular characteristics.
3. Recognize melanocytes and understand their function and mechanism of action.
4. Understand the structure, function, and formation of specialized features of the integument: hair, nails, sweat and sebaceous glands.
5. Know the cellular and extracellular composition of the dermis.
6. Know the sensory specializations of the skin.
7. Understand the basic mechanism of epidermal/dermal repair and regeneration.
Keywords

Apocrine sweat gland  
Arrector pili muscle  
Dermal papillae  
Dermis  
Epidermis  
External root sheath  
Follicle cortex  
Follicle cuticle  
Follicle medulla  
Hair follicle  
Internal root sheath  
Keratinocyte  
Meissner’s corpuscle  
Melanocyte  
Merocrine sweat gland  
Myoepithelial cell  
Nail  
Pacinian corpuscle  
Papillary layer  
Reticular layer  
Sebaceous gland  
Stratum basale  
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Stratum granulosum  
Stratum lucidum  
Stratum spinosum
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looking at the slides of the eyelid and the lip, determine which of the surfaces is covered in skin and which is covered in conjunctiva or oral mucosa, respectively

Slide 119 (NW): Lip, Sagittal Section

look at different slides of skin to appreciate the differences in appearance of thick vs. thin skin and in H&E vs. trichrome stains
Skin is classified as either thick or thin based upon the thickness of the epidermis: thin (hairy) skin covers the majority of the body and thick (glabrous) skin is generally restricted to the palm of the hand and sole of the foot; however, this classification ignores the thickness of the dermis (and therefore the actual “thickness” of the skin) – thus, the skin on the upper back is classified as “thin” based upon its epidermis, but is actually some of the thickest skin in the body based upon the combined thickness of the epidermis and dermis.
Slide 83 (464): Skin of Sole, H&E

epidermis
epithelial compartment of the skin, consisting of keratinized stratified squamous epithelium

dermis
connective tissue compartment of the skin, underlying the epithelium; it provides support and nourishment of the epidermis and contains vasculature, skin appendages, and sensory receptors

hypodermis
also known as subcutaneous tissue or superficial fascia; the layer is not technically considered a layer of the skin, rather it is a deep connective tissue layer, with varying amount of adipose, that serves to anchor the skin (dermis) to underlying structures (e.g., muscle)

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**stratum corneum**: the most superficial layer of the epidermis; consists of dead, flattened, anucleate keratinocytes that form “water barrier”; it is generally 20-30 cell layers thick but varies depending upon location and is much more prominent in thick skin than in thin skin; skin on the genitals has the fewest layers (~5) while skin on the heel has the most (~100)

**stratum lucidum**: present in thick skin only

**stratum granulosum**: 3-5 layers of cells; cells are undergoing keratinization which takes 2-6 hours

**stratum spinosum**: thickest “cellular layer” of the epidermis; on higher magnification, keratinocytes have a “spiny” or “prickly” appearance; Langerhans cells are also present

**stratum basale**: single-cell layer of mitotically-active keratinocytes, melanocytes, and Merkel cells

*Mnemonic for the layers of the epidermis, from most superficial to deepest: come, let’s get sun-burned (terrible advice but a helpful mnemonic)*
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Slide 5: Thick Skin, Trichrome

notice the very fine spines (at arrow tips) from the desmosomes connecting the keratinocytes together, giving them a “prickly” or “spiny” appearance

the **stratum spinosum** is the thickest cellular layer of the epidermis; it consists principally of keratinocytes with a few interspersed **Langerhans cells** (antigen-presenting cells) which are generally not readily identifiable on routine slide preparations

Slide 36: Thin Skin, H&E
Slide 36: Thin Skin, H&E

**Melanocytes (M)** are found in the **stratum basale** (and in hair follicles), with approximately one melanocyte for every 5-6 **keratinocytes**; they have pale-staining, rounded cell bodies and cytoplasmic extensions up into the stratum spinosum; they are responsible for the production of brownish-colored **melanin pigment** (blue arrow); also, possible **Langerhans cells (L)** may be seen – they have a dark-staining nucleus and light-staining cytoplasm with numerous cytoplasmic extensions (difficult to visualize in routine preparations); they are antigen-presenting cells found primarily in the **stratum spinosum**.
Slide 73 (NW): Thin Skin, Pigmented

the “flakiness” of the *stratum corneum* is an artifact of slide preparation

lots of granules of *melanin pigment*

the difference in skin color between individuals is due to differences in the activity level of melanocytes, not differences in the relative number of melanocytes which are roughly 5% of the total cells of the epidermis
the dermis is composed of the more superficial papillary layer directly underlying the epidermis and the deeper reticular layer; the papillary layer is composed of loose CT and forms upward-projecting dermal papillae that interdigitate with downward-projecting rete ridges of the epidermis to “anchor” the epidermis to the dermis and resist frictional forces; the reticular layer contains dense irregular CT surrounding skin appendages (e.g., hair follicles and sweat glands); note that there is no sharp demarcation between the two specific layers so defining the transition area between them is arbitrary
**Slide 72 (NW): Thick Skin**

**epidermis**

**dermis**

**hypodermis**

*(subcutaneous tissue or superficial fascia)* contains a varying amount of adipose tissue but overall accounts for nearly 50% of the body’s total fat storage; the extensive vascular supply within the layer allows for rapid uptake of drugs, making this a common site for medication (e.g., insulin) injections.
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Slide 60 (NW): Fingertip

look in the dermal papillae (papillary layer of dermis) to find Meissner’s corpuscles

look in the deep dermis and hypodermis to find Pacinian corpuscles
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Slide 60 (NW): Fingertip

Pacinian (lamellated) corpuscles are large, pressure and vibration receptors found within the dermis and hypodermis; seen in cross-section, they have a “cut onion” appearance of concentric layers (lamellae) of Schwann cells and collagen fibrils surrounding a central axon.

Eccrine sweat gland
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Slide 5: Thick Skin, Trichrome

Pacinian corpuscles can also be found associated with joints, periosteum, and internal organs.

Slide 61 (NW): Pacinian Corpuscle

a large Pacinian corpuscle seen in longitudinal section.

Slide 12: Urinary Bladder, Cat

look here, deep in the hypodermis, to find additional examples of Pacinian corpuscles.
Meissner’s (tactile) corpuscles are receptors for light touch found in dermal papillae (not seen in every papilla); they are oval shaped with stacked Schwann cells surrounding a central nerve fiber; elongated nuclei of fibroblasts wrapping transversely around and providing a connective tissue capsule may be visible.
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Slide 51: Thin Skin, H&E

A pilosebaceous unit (Lt. “hair and tallow”) consists of three major structures: a hair follicle (and hair), associated sebaceous glands, and an arrector pili muscle; the hair follicle and sebaceous glands are both derived from downgrowths of the epithelium of the epidermis, while the arrector pili m. is smooth muscle.
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a **hair follicle** generally consists of five specialized layers of epithelial cells: the hair (hair shaft) itself consists of three layers (inner **medulla** layer surrounded by the **cortex** layer and the outermost **cuticle** layer on the surface of the hair); next, the **internal root sheath** (IRS) layer surrounds the hair at the base but does not extend above the level of attachment of the sebaceous gland to the follicle; finally the outermost **external root sheath** (ERS) layer is a direct continuation of the epidermis of the skin; the ERS is separated from the CT of the dermal sheath surrounding the epithelial hair follicle by a thick basement membrane (the **glassy membrane**).
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Slide 17: Thin Skin, Trichrome

look here to see examples of **hair follicles** in cross-section
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Similar to thick skin which has five layers of epidermal epithelium, a hair follicle consists of five specialized layers of epithelium (medulla, cortex, cuticle, IRS, ERS).
**Slide 51: Thin Skin, H&E**

**sebaceous glands** are glandular epithelial outgrowths generally associated with the external root sheath of hair follicles; the **sebocytes** of the glands undergo holocrine section, releasing **sebum** and cellular debris into the hair follicle; sebocytes contain large amount of lipid and abundant smooth endoplasmic reticulum (sER), giving them a characteristic pale-staining appearance.
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**Slide 138: Eyelid, H&E**

- **Sebaceous gland** surrounding a hair follicle in the skin
- **Meibomian (tarsal) glands** are specialized sebaceous glands associated with the conjunctiva of the eyelid
- **Conjunctiva**
Meibomian glands are specialized sebaceous glands that empty directly onto the epithelial surface of the eyelid, instead of into a hair follicle; they produce an oily product onto the tear film of the eye which serves to slow tear evaporation.
arrector pili muscles (Lt. “raiser of hair”) are small bundles of smooth muscle attached to the connective tissue sheath of the hair follicle and inserting into the CT of the dermal papillary layer; contraction of the muscle, via innervation of the sympathetic nervous system, leads to erection of the hair shaft and can be seen as “goose bumps” as the contracted muscle distorts the shape of the dermis.
**Slide 36: Thin Skin, H&E**

- **unbranched, dark-staining duct portion** of eccrine sweat gland
- **highly-coiled, pale-staining secretory portion** of eccrine sweat gland

**eccrine (merocrine) sweat glands** are found in most areas of thick and thin skin of the body (except lips and parts of genitalia); they are simple, coiled tubular glands with their secretory portions generally located deep in the dermis or into the hypodermis and their duct portions emptying onto the surface of the skin.
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*look in the dermis and hypodermis of the skin from the axilla (armpit) to see examples of apocrine sweat glands*

*note that eccrine sweat glands are also present*

**Apocrine sweat glands** are primarily found in the axillary and perineal regions; *despite the name (a historical misnomer), like eccrine glands they undergo merocrine – not apocrine – secretion; they appear similar to eccrine glands except the lumens of their secretory portions are much wider; the duct portion is histologically similar to those of eccrine glands but instead of emptying on the surface of the skin, they empty into adjacent hair follicles*
Slide 25: Auditory Meatus, H&E

keratinized stratified squamous epithelium

hair follicle and surrounding sebaceous glands

ceruminous glands are specialized apocrine sweat glands that facilitate production of cerumen (earwax)

the ear canal (external auditory meatus) is the only “blind pouch” of skin in the body and lacks eccrine sweat glands
there are three specialized regions of the epidermis associated with the **nail**: the **eponychium** (cuticle) is the extension of the stratum corneum of the nail fold over the **nail root**, where new nail plate growth occurs; the **nail bed** includes the epidermis which binds the nail plate, and the **hyponychium** is the epidermal fold beneath the free edge of the distal nail plate which serves to secure the plate at the tip of the finger.
like the soft keratin found in the stratum corneum of all other areas of skin, nails (or nail plates) contain plates of hard keratin, similar to that found in the hair cortex, containing a high sulfur content; nail formation occurs in a manner similar to hair formation with keratinocytes proliferating and differentiating in the matrix of the nail root, at the proximal aspect of the nail; this growth causes the nail to "slide" forward across the nail bed
1. Skin is composed of all four basic tissue types (epithelium, CT, muscle, and nervous) and is involved in a variety of body processes including protection, homeostasis, and sensation; it covers the entire body surface area and is the largest organ of the body.

2. All skin consists of two layers: a superficial epithelial epidermis and an underlying supportive connective tissue dermis.

   - **Epidermis** is avascular stratified squamous epithelium divided into four or five specific layers (thin vs. thick skin); it consists primarily of keratin-producing keratinocytes with interspersed melanocytes, Langerhans cells, and Merkel cells.

   - **Dermis** is connective tissue (loose CT and deeper dense irregular CT) that accounts for the majority of the mass of the skin; it has a well-defined border with the overlaying epidermis but lacks a defined deep border with the underlying hypodermis; within the dermis are found most of the skin appendages, vasculature, and sensory structures.

3. Skin appendages are structures derived from downward growths of the epithelium of the epidermis; they are responsible for the production of specialized products that serve important roles in fulfilling the overall functions of skin:

   - **Hair follicles** produce hair for protection and thermoregulation.

   - **Sebaceous glands** produce sebum for protection of skin and hair and may also serve a role in innate immunity.

   - **Sweat glands** produce sweat for thermoregulation and sexual attraction.
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**Compare and Contrast Structures of the Integumentary System**

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