Skin
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Skin Lecture Objectives

- Describe the functions of skin.
- Describe the structure, location and function of the cell types found in epidermis: keratinocytes, melanocytes, Langerhans cells, and Merkel cells.
- Describe the five layers of the epidermis.
- Describe the structure and contents of the papillary dermis, reticular dermis, and hypodermis.
- Describe the structure and function of sebaceous glands, eccrine sweat glands, and apocrine sweat glands.
Skin Lecture Outline

• Introduction
• Epidermis
• Dermis
Skin Lecture Outline

- Introduction
Functions of Skin

• Serves as a barrier protecting against physical and chemical injury and infection.
• Prevents water entry and loss.
• Helps regulate body temperature.
• Receptor organ for sensory stimuli.
• Involved in synthesis of vitamin D₃ from precursors in skin.
• Excretion of substances produced by glands.
Embryologic Origins of Skin

• Epidermis (the surface layer of skin) arises from ectoderm.
• Dermis (the connective tissue component of skin) arises from somites of the paraxial mesoderm.
Skin is composed of:

- **Epidermis**: a surface of keratinized stratified squamous epithelium
- **Dermis**: connective tissue
- **Skin appendages**: Merocrine (eccrine) sweat glands, apocrine sweat glands, sebaceous glands, hair follicles, nails.
Layers of the skin

- **Epidermis**
  - Papillary layer
  - Reticular layer

- **Dermis**
  - Arrector pili muscle
  - Sebaceous (oil) gland
  - Sweat gland duct
  - Merocrine sweat gland
  - Vein
  - Artery

- **Subcutaneous layer**
  - Hair follicle
  - Sensory receptors
  - Areolar connective tissue
  - Sensory nerve fiber
  - Adipose connective tissue

- **Hair shaft**
- **Sweat pore**
- **Epidermal ridge**
- **Dermal papilla**
- **Arrector pili muscle**
- **Sebaceous (oil) gland**
- **Sweat gland duct**
- **Merocrine sweat gland**
- **Vein**
- **Artery**
- **Adipose connective tissue**
Appendages of the skin

Epidermis
- Papillary layer
- Reticular layer

Dermis

- Hair shaft
- Meissner corpuscle
- Sebaceous gland
- Arrector pili muscle
- Hair follicle
- Pacinian corpuscle
More Appendages of the Skin

- Sweat pore
- Epidermal ridge
- Dermal papilla
- Arrector pili muscle
- Sebaceous (oil) gland
- Sweat gland duct
- Merocrine sweat gland
Subcutaneous tissue

- Also called hypodermis
- NOT considered part of the skin!
- Consists of loose connective tissue and adipose tissue
- Function: loosely binds the skin to underlying structures
Skin Lecture Outline

• Introduction

• Epidermis
  • Layers of the epidermis
  • Cells of the epidermis
Skin Lecture Outline

• Introduction

• Epidermis
  • Layers of the epidermis
The Five Layers of Epidermis

- Corneum
- Lucidum
- Granulosum
- Spinosum
- Basale
Five layers of epidermis:
- corneum
- lucidum
- granulosum
- spinosum
- basale
Stratum Basale (Basalis)

- Bottom layer; just above basal lamina.
- Cuboidal to columnar keratinocytes one layer thick.
- Cells attached to each other by spot desmosomes and to basal lamina by hemidesmosomes.
- Mitoses renew epidermis every 15-30 days.
- Contains melanocytes and Merkel cells.
Stratum basale
Stratum Spinosum

- Between stratum granulosum and basale.
- Spot desmosomes connect cells.
- Cells shrink during processing but remain attached at desmosomes, and look “spiny” or prickly.
- Areas of skin subject to more mechanical pressure have more spot desmosomes.
Stratum spinosum
Keratinocytes in stratum spinosum are attached by spot desmosomes.

Cells retract during fixation and appear to be connected by spines.
Spot desmosomes
Cytokeratin filaments
Spot desmosomes
Stratum spinosumum cells
Stratum Granulosum

- Just above stratum spinosum.
- Cells contain two types of granules.
  - Keratohyaline granules: large, basophilic; bind cytokeratin molecules together to make keratin.
  - Lamellar granules: small; contain lipid that is released into intercellular spaces (acts as a cement to prevent penetration of water and other materials).
Stratum granulosum
Stratum Lucidum

- Under stratum corneum.
- Keratinocytes have lost nuclei and organelles and appear as homogeneous, translucent cells.
- Cells contain keratin.
- Present only in very thick skin.
Stratum lucidum
Stratum Corneum

- Most superficial layer.
- Consists of flat, dead cells – basically keratin scales - that are continuously shed.
- Keratin is composed of cytokeratin filaments (long intertwined protein chains) and keratohyalin (a substance that helps hold cytokeratin filaments together).
Stratum corneum
Thick vs. Thin Skin

Refers to thickness of epidermis and keratin layer

**Thick skin** is present on palms and soles

- Epidermis has five cell layers + thick keratin layer.
- Hair follicles and sebaceous glands are NOT present.

**Thin skin** is found everywhere else.

- Epidermis has no stratum lucidum, and the stratum granulosum and corneum are much thinner.
- May contain hair follicles and sebaceous glands.
Thick skin

Thin skin

corneum
lucidum
granulosum
spinosum
basale
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• Introduction

• Epidermis
  • Layers of the epidermis
  • Cells of the epidermis
Four Types of Cells in Epidermis

- **Keratinocytes** are stratified squamous epithelial cells. Most common cell in epidermis. Function is to produce intermediate filaments called cytokeratins. Amount of cytokeratins increases as the cells move upward.

- **Melanocytes** produce melanin.

- **Langerhans cells** process antigen.

- **Merkel cells** are involved in tactile sensation.
More melanin is present in keratinocytes than in melanocytes.
The number of melanocytes per unit area varies from one part of the body to another but is independent of race.

Differences in skin color are due to differing numbers of melanin granules in melanocytes!
Melanin granules accumulate above keratinocyte nuclei to protect genetic material from UV damage. Smart!
Langerhans Cells and Merkel Cells

Langerhans cells
- A type of macrophage.
- Arise in bone marrow, migrate to stratum spinosum.
- Eat stuff (like bugs), present antigen to T cells.

Merkel cells
- Present in stratum basale.
- Function as touch receptors.
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• Introduction
• Epidermis
• Dermis
  • Basic structure
  • Specialized receptors and structures
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• Introduction
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  • Basic structure
Dermal papillae

Papillary dermis

Loose connective tissue with lots of capillary loops and thin elastic fibers

Reticular dermis
Dermal papillae

Papillary dermis

Reticular dermis

Dense connective tissue with thick collagen bundles and elastic fibers, larger blood vessels and glands.
Skin Lecture Outline

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• Epidermis

• Dermis
  • Basic structure
  • Specialized receptors and structures
Meissner’s and Pacinian Corpuscles

Meissner’s corpuscle

- Sensitive to light touch
- Consists of an unmyelinated axon meandering back and forth between flattened Schwann cells.

Pacinian corpuscle

- Sensitive to vibration and pressure.
- Consists of unmyelinated nerve terminal surrounded by layers of fibroblasts.
Meissner’s corpuscle: sensitive to light touch
Pacinian corpuscle: sensitive to vibration, pressure
The Pilosebaceous Apparatus

- Hairs: hair follicle and shaft
- Sebaceous glands and ducts: empty into hair follicle
- Arrector pili muscles: cause erection of hair shaft
- Hairs and sebaceous glands derive from ectoderm
Pilosebaceous apparatus and sweat gland
Pilosebaceous apparatus

- Hair follicle
- Sebaceous gland
- Arrector pili muscle

Pilosebaceous apparatus
Main parts of the hair follicle

The dermal papilla contains numerous capillaries. It maintains the viability of the hair follicle.

The hair bulb is basically just the base of the hair follicle.

The hair shaft arises from the base of the follicle.

The hair follicle is a tubular invagination of the epidermis extending deep into the dermis.
Layers of the hair follicle

The cuticle and cortex make up the hard keratin part of the hair shaft. Some hairs have a medulla as well.

The external root sheath is continuous with the epidermis.

The glassy membrane is a thickened basal lamina that separates the hair follicle from the surrounding connective tissue.

The internal root sheath contains cells with clear cytoplasm.
Skin glands

- Three types: sebaceous glands, eccrine (merocrine) sweat glands, and apocrine sweat glands.
- Arise from ectoderm.
- Secretory portion of glands resides in the dermis.
- Three different types of secretion: holocrine, merocrine, and apocrine.
Types of secretion
Types of glands
Sebaceous glands

• Present everywhere except palms and soles.
• Secretory portion: peripheral, flattened undifferentiated cells. Central cells are large with foamy cytoplasm containing lipids.
• Cells burst, releasing sebum (holocrine secretion).
• Duct empties into hair follicle.
• Become functional at puberty.
Sebaceous gland
Sebaceous glands emptying into hair follicle
Eccrine (Merocrine) Sweat Glands

- Secretory portion has three cell types:
  - Clear cells (contain glycogen, produce a watery substance)
  - Darker cells (produce a proteinaceous substance)
  - Myoepithelial cells (surround gland)

- Duct is lined by simple cuboidal epithelium and opens onto skin surface.
Eccrine sweat glands and ducts
Eccrine sweat glands and ducts
Myoepithelial cells
Secretory cells
Eccrine sweat glands and ducts
Apocrine Sweat Glands

- Located only in axilla, areola of breast, and anal canal.
- Have larger ducts and secretory units than eccrine sweat glands.
- Ducts open into hair follicles.
- Apocrine secretion is viscous and contains proteins, carbohydrates and lipids.
Apocrine sweat glands
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