



Lecture2: The Integumentary System

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21-09-2022

Introduction

- The **integumentary system** (integument) is composed of the **skin** (cutaneous membrane) and its **derivatives**: hair, glands, and nails.
- The skin mirrors the **general health** of other systems.
- Your skin **protects** you from the surrounding **environment**; its **receptors** tell you a lot about the outside world; and it helps regulate your body **temperature**.

Integumentary System

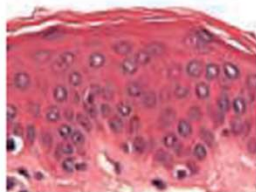
FUNCTIONS

- Protects from environmental hazards
- Synthesizes and stores lipids
- Coordinates immune response to pathogens and cancers in skin
- Senses information
- Synthesizes vitamin D₃
- Excretes
- Regulates body temperature (thermoregulation)

Cutaneous Membrane (Skin)

Epidermis

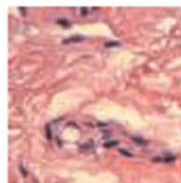
- Protects dermis from trauma, chemicals
- Controls skin permeability, and prevents water loss
- Prevents entry of pathogens
- Synthesizes vitamin D₃
- Sensory receptors detect touch, pressure, pain, and temperature



Dermis

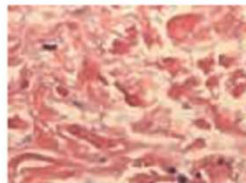
Papillary Layer

- Nourishes and supports epidermis



Reticular Layer

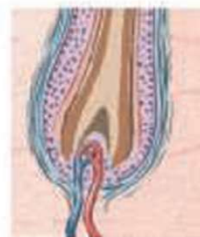
- Restricts spread of pathogens penetrating epidermis
- Stores lipids
- Attaches skin to deeper tissues
- Sensory receptors detect touch, pressure, pain, vibration, and temperature
- Blood vessels assist in thermoregulation



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



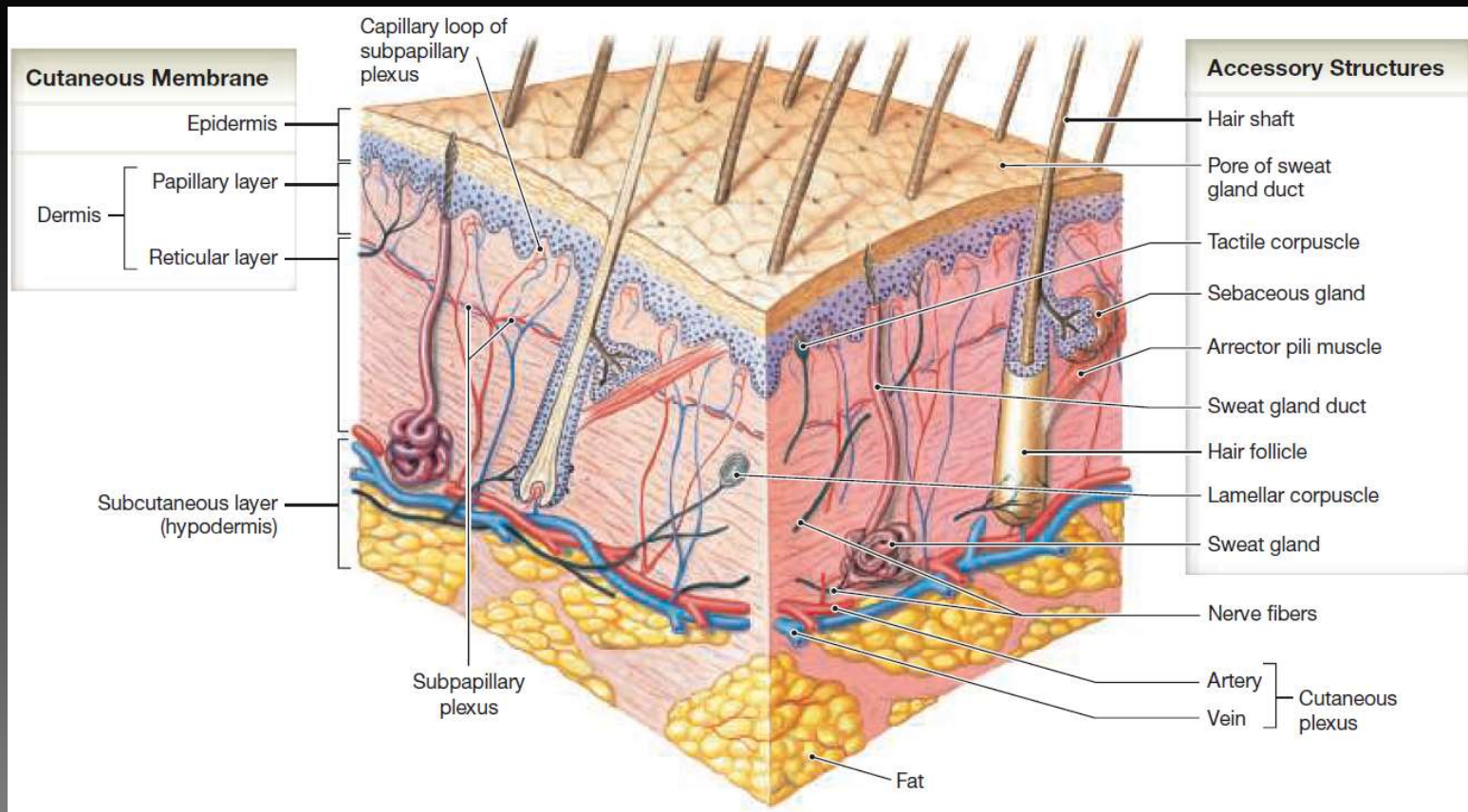
Structure and Function of the Integumentary System

- The integument has two major components: the cutaneous membrane and the accessory structures.
- The integument contains all four primary tissue types:
 - > An **epithelium** covers its surface.
 - > Underlying **connective** tissues make it strong and resilient.
 - > Smooth **muscle** tissue within the integument controls the diameters of the **blood vessels**.
 - > **Nervous** tissue controls these smooth muscles and monitors sensory receptors that provide the sensations of touch, pressure, temperature, and pain.

Structure and Function of the Integumentary System

- The **skin** is the largest organ of the body, which consists of the **epidermis** the superficial epithelium - and the underlying connective tissues of the **dermis**.
- The loose connective tissue of the **subcutaneous layer** separates the integument from the other organs, such as muscles and bones.
- The accessory structures are located in the dermis and protrude through the epidermis to the surface.

Skin structure



The Epidermis

- The epidermis, the most superficial layer of the skin a stratified squamous epithelium.
- There are four cell types in the epidermis:
 - Keratinocytes
 - Melanocytes
 - Merkel cells
 - and Langerhans cells.

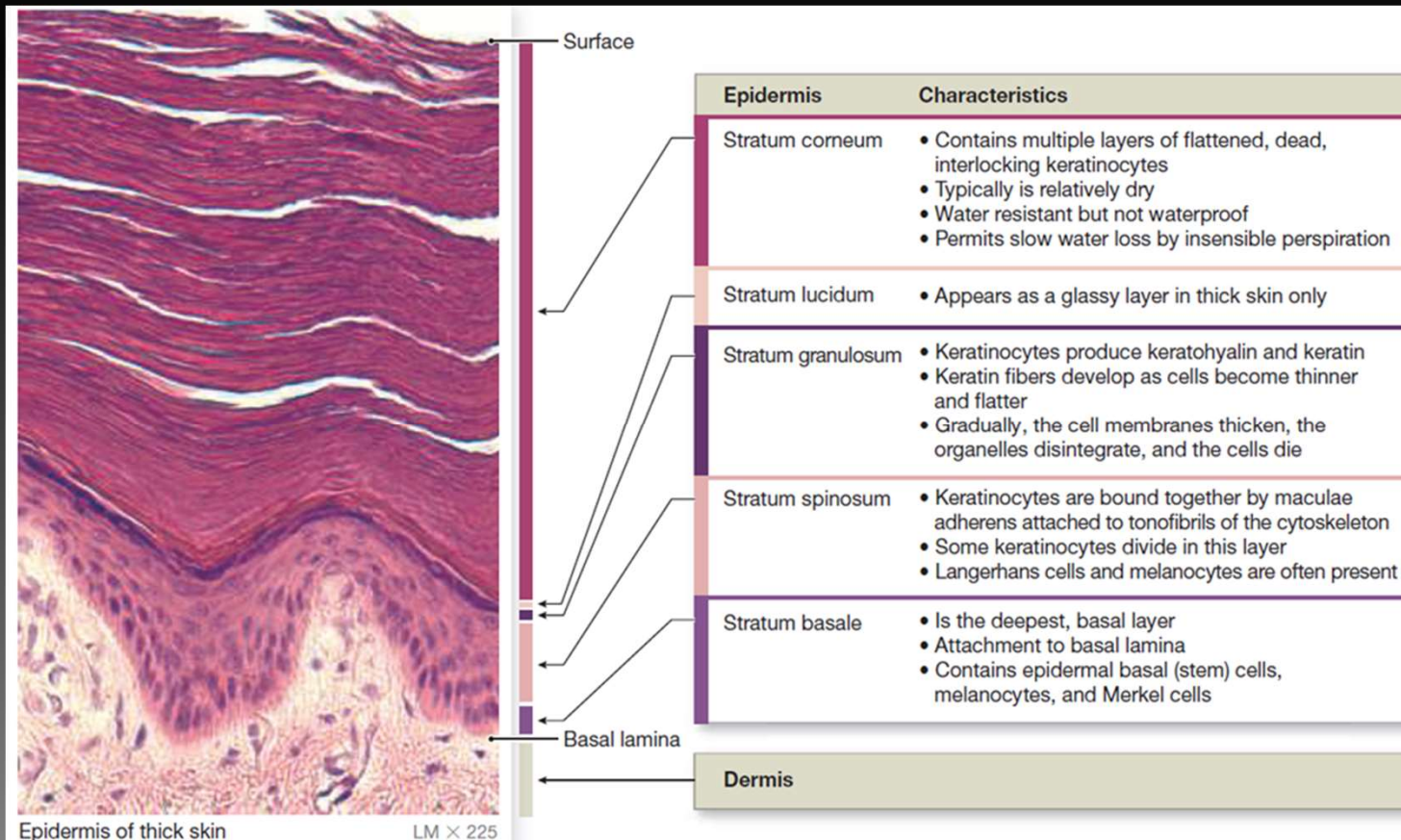
The Epidermis

- **Keratinocytes** are the most numerous cells within the epidermis.
- **Melanocytes** are the pigment-producing cells in the epidermis.
- **Merkel cells** have a role in detecting sensation, and **Langerhans cells** are wandering phagocytic cells.

Layers of the Epidermis

- The epidermis of thick skin has **five layers**. Beginning at the basal lamina and traveling superficially toward the epithelial surface, we find the:
 - stratum basale
 - stratum spinosum
 - stratum granulosum
 - stratum lucidum
 - and stratum corneum.

Layers of the Epidermis



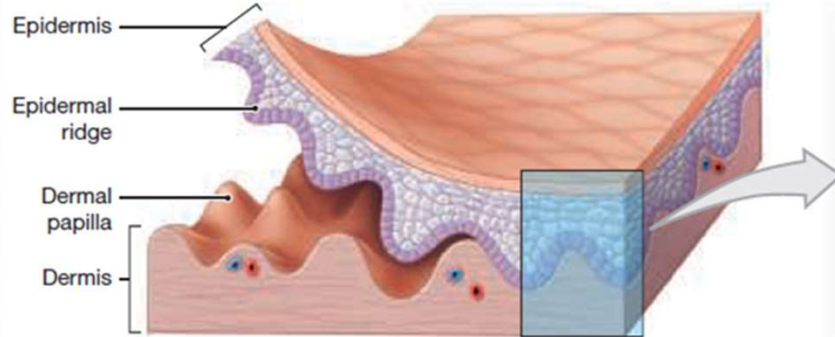
Thin and Thick Skin

- The terms thin and thick skin refer to the relative thickness of the epidermis.
- Most of the body is covered by **thin skin**, which has only four layers because the stratum lucidum is typically absent.
- In thin skin, the epidermis is a mere 0.08 mm thick, and the stratum corneum is only a few cell layers deep.

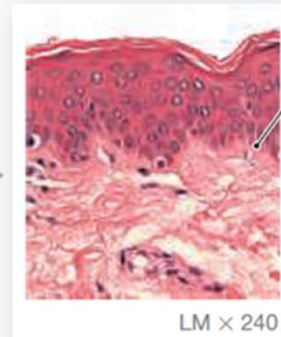
Thin and Thick Skin

- **Thick skin**, found only on the palms of the hands and soles of the feet, contains all five layers and may be covered by 30 or more layers of keratinized cells.
- As a result, the epidermis in these locations is up to six times thicker than the epidermis covering the general body surface.

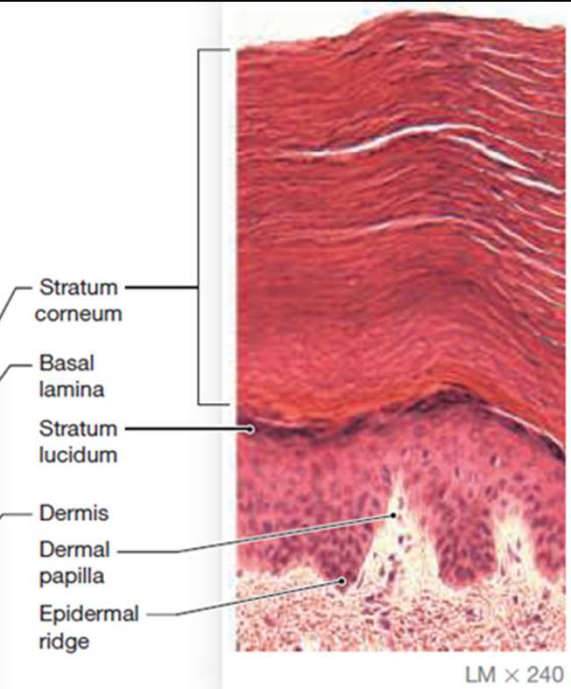
Thin and Thick Skin



a The basic organization of the epidermis. The thickness of the epidermis, especially the stratum corneum, changes depending on the location sampled.



b Thin skin covers most of the exposed body surface. (During sectioning the stratum corneum has pulled away from the rest of the epidermis.)



c Thick skin covers the surfaces of the palms and soles.

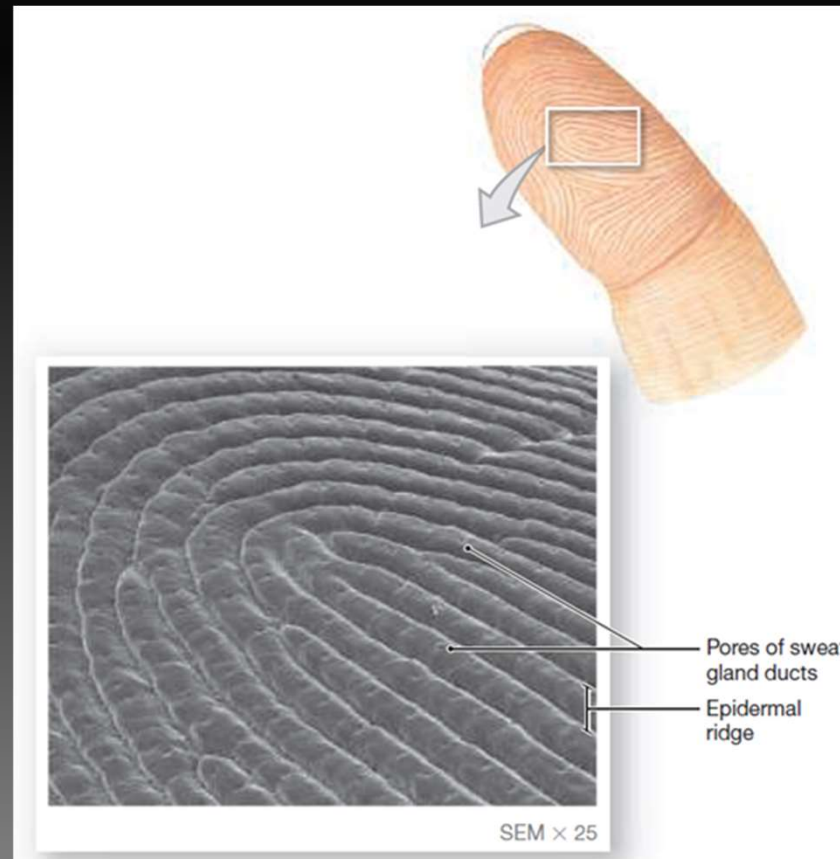
Epidermal Ridges

- The stratum basale of the epidermis forms **epidermal ridges** (also known as *friction ridges*) that extend into the dermis, increasing the area of contact between the two regions.
- Projections from the dermis toward the epidermis, called **dermal papillae**, extend between adjacent ridges.

Epidermal Ridges

- Ridges on the palms and soles increase the surface area of the skin and promote friction, ensuring a **secure grip**.
- Ridge shapes are **genetically** determined: Those of each person are unique and do not change during a lifetime.
- Ridge patterns on the fingertips can identify individuals, and **criminal investigators** have used fingerprints for this purpose for over a century.

Epidermal Ridges



The Dermis

- Deep to the epidermis is the dermis. The dermis has two major parts: a superficial **papillary layer** and a deeper **reticular layer**.

Dermal Organization

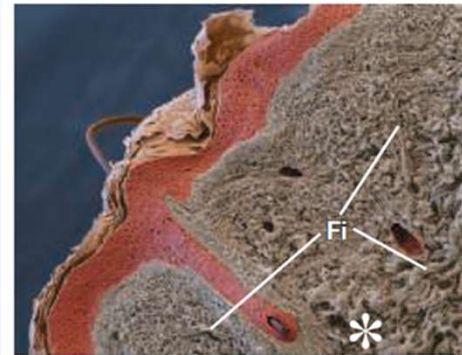
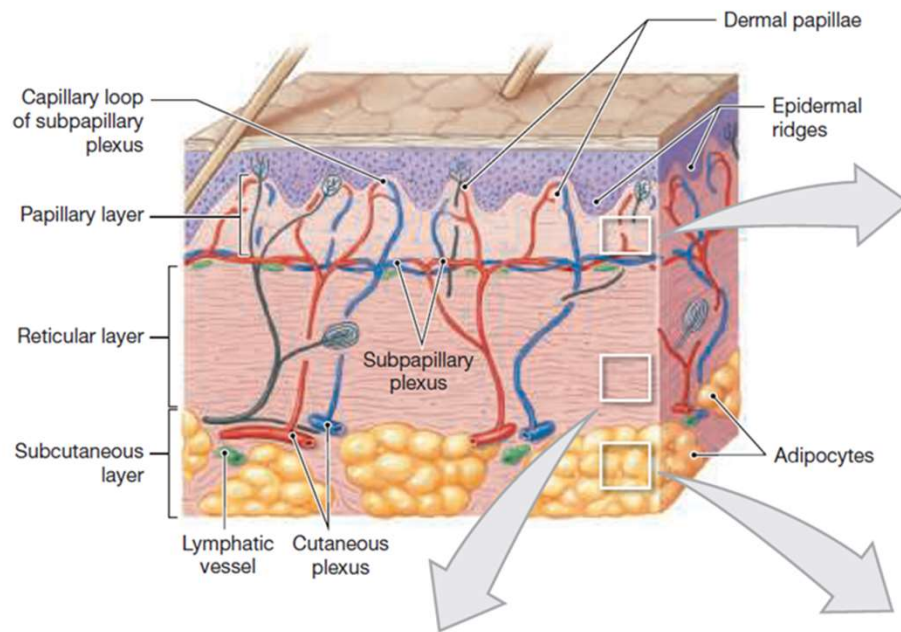
- The **papillary layer**, the superficial layer of the dermis, consists of loose connective tissue.
- This region is specialized to provide **mechanical attachment** for the more superficial epidermis. It also contains **capillaries** and **axons** of neurons.
- Capillaries supply the epidermis, and axons of sensory neurons.

Dermal Organization

- The **reticular layer** consists of fibers of dense irregular connective tissue that surrounds blood vessels, hair follicles, nerves, sweat glands, and sebaceous glands.
- Some of the **collagen fibers** in the reticular layer extend into the papillary layer, tying the two layers together.

Dermal Organization

- **Collagen fibers** of the reticular layer also extend into the deeper subcutaneous layer.
- The arrangement of these connective tissue fibers in the reticular layer is responsible for the **strength, toughness and elasticity** of the skin.



Papillary layer of dermis SEM × 20

a The papillary layer of the dermis contains loose connective tissue with numerous blood vessels (not visible), fibers (Fi), and macrophages (not visible). Open spaces, such as that marked with an asterisk, are filled with fluid ground substance.



Reticular layer of dermis SEM × 1340

b The reticular layer of the dermis contains dense irregular connective tissue.



Subcutaneous layer SEM × 268

c The subcutaneous layer contains large numbers of adipocytes in a framework of loose connective tissue fibers.

Questions!