

4.0

Name: _____

Integument

The terms “skin” and integument are often used interchangeably. Although this is not technically correct it is accepted common usage. The term “skin” more closely represents the cutaneous membrane, which makes up the majority of the integumentary system. The “skin” is even referred to as the largest organ in the body due in large part to its significant size and weight (approximately nine pounds). The integumentary system as a whole is composed of the cutaneous membrane and many embedded accessory organs such as sweat glands, hair follicles and sensory endings. For this reason the integumentary system is appropriately described as an organ system. The integumentary system forms a sheet that covers the outer surface of the body and is loosely connected to the deeper structures it covers (usually muscle). A loose connective tissue layer, the subcutaneous layer (or hypodermis), loosely connects the integument to these underlying structures.

Note: the subcutaneous layer is one of the principal locations for fat deposition and storage. It is not a true part of the integumentary system but, due to its close association with the integument, it is often identified and described along with the integument.

I. Membranes - there are four major types of membranes in the body, all of which are composed of an epithelial layer and a connective tissue layer. Because two different tissues make up these membranes they are correctly described as organs.

- A. Mucous Membranes - line cavities that are open to the exterior of the body (i.e. mucous membrane of the digestive, respiratory, reproductive, & urinary tracts). Structurally the epithelial layer of mucous membranes is highly variable but shares the characteristic of always being kept moist. The connective tissue layer of mucous membranes is loose and called the lamina propria. The name of this membrane is derived from the mucus that is secreted by accessory glands associated with most mucus membranes.
- B. Serous Membranes - line closed internal body cavities (i.e. pericardial, pleural, and peritoneal membranes). These membranes are very thin (composed of simple squamous epithelium) and firmly attached to the organ they enclose by loose connective tissue. The epithelium produces a transudate that serves as a lubricant.
- C. Cutaneous Membrane - the cutaneous membrane forms the bulk of the “skin” and covers the surface of the body. It consists of a stratified squamous epithelium (the epidermis) and a loose connective tissue layer reinforced by a layer of dense connective tissue (together they form the dermis).
- D. Synovial Membranes - these membranes enclose freely moveable joints and, like serous membranes, secrete a lubricating synovial fluid. Unlike the other membranes the epithelial layer of synovial membranes is incomplete and there is no basement membrane between the epithelial cells and the loose connective tissue layer.

II. Cutaneous Membrane - the cutaneous membrane makes up the majority of the structure of the integumentary system and like other membranes in the body is composed of a superficial epithelial layer and a supportive connective tissue layer. Many of the accessory organs of the integumentary system are derived from the cutaneous membrane while others (i.e. sensory endings) are embedded in the cutaneous membrane.

- A. Epidermis - the superficial epithelial layer is a keratinized stratified squamous epithelium. The two major cell types are keratinocytes and melanocytes (pigment cells). This layer is avascular

hence nutrients are delivered via diffusion from blood vessels in the underlying dermis. The cells in the deepest layer are alive, well nourished and actively dividing. As they are pushed up to the more superficial layers their activity and shape changes. The most superficial cells, even in thin "skin", are nutrient deprived and consequently are dead. In thick skin the epidermis can be 30-50 cells thick revealing a series of identifiable strata.

1. Stratum Corneum - the most superficial and variably thick layer of the epidermis. This layer is composed of dead non-nucleated squamous keratinocytes that are thoroughly keratinized (aka "cornified"). The thickness of this layer varies in response to friction thus regions exposed to regular friction such as the hands and feet exhibit a thicker stratum corneum. Note: cells are typically not identifiable in this layer and it is often separated from underlying layers in prepared slides.
 2. Stratum Lucidum - thin layer found only in thick skin and consists of flattened cells containing an intermediate form of keratin (called eleiden)
 3. Stratum Granulosum - thin layer of flattened cells filled with keratohyalin granules (a keratin precursor) giving them a granular appearance.
 4. Stratum Spinosum - layer of cells actively beginning the process of producing keratin. Cell extensions give them a "spiny" appearance. These are artifacts caused by shrinkage of the cell during slide preparation, the extensions occur where cells adhere to each other (at desmosomes). Langerhan's cells, a type of defense cell is also found in this layer.
 5. Stratum Germinativum - (aka Stratum Basale) the deepest layer composed of a simple cuboidal layer of mitotically dividing cells (keratinocytes). All of the upper layers of the epidermis originate from this layer. Pigment cells (melanocytes) are also found in this layer. Melanin produced from these cells is responsible for the brown coloration of tanned skin and is protective against UV radiation. Other factors that influence skin coloration include pigments such as carotene, hemoglobin in blood, and abnormal pigments such as bilirubin (yellow of Jaundice).
 6. Basement Membrane - separating and binding all epithelial tissues and connective tissues is a thin (generally not visible) region of extracellular material that acts as a "glue" linking epithelial and connective tissues together.
- B. Dermis - The dermis is the connective tissue layer of the cutaneous membrane housing the accessory organs and blood vessels. It is rich in collagen, elastin, and reticular fibers and is the layer the gives skin its resiliency ("leather" is made from dermis). The dermis can be divided into two layers.
- i. The superficial papillary layer of the dermis is composed of loose connective tissue that forms nipple like mounds called dermal papillae. The papillae increase the contact between the dermis and the epidermis and provide increased blood flow to the epidermis (papillary plexus).
 - ii. The deeper reticular layer is composed of dense irregular connective tissue and is the source of the resiliency of the dermis.

C. Subcutaneous Layer (aka Hypodermis) - loosely connects the "skin" to underlying structures. Composed of loose connective tissue with abundant fat cells (subcutaneous fat). Blood vessels supplying the skin form a network called the cutaneous plexus (aka rete cutaneum) along the border of the reticular layer within the hypodermis (injections into this layer using a "hypodermic" needle results in drug absorption into these vessels). Branches of these vessels pass up through the dermis supplying the accessory organs and papillary plexi with blood.

III. Accessory Organs (embedded in the "skin") Hair follicles, sebaceous glands, sweat glands, and nails are all considered accessory structures of the integumentary system. All are derived from the stratum germinativum of the epidermis but often penetrate deeply into the dermis (thus are described as being located in the dermis). Sensory endings and arrector muscles are also accessory organs of the integument but are not strictly derived from the epidermis.

A. Hair Follicles & Hair (all except arrector pili muscle and nerve plexus are derived from epidermis)

1. Hair Bulb - enlarged region at the base of the follicle. Division of epithelial cells in this region, nourished by blood from the hair papilla, results in the growth of hair.
2. Hair Papilla - a projection of connective tissue (w/ blood vessels) into the hair bulb
3. Follicle Sheath - walls of the follicle, composed of stratum germinativum epithelial cells
4. Hair Shaft
 - a. root - composed of still living epithelial cells (matrix) surrounding the hair papilla
 - b. cortex - hard outer layer of keratinized cells
 - c. medulla - inner core of hair shaft
5. Arrector Pili Muscle - smooth muscle responsible for piloerection (horripulation)
6. Root Hair Plexus - coiled sensory nerve ending
7. Sebaceous Gland - oil producing gland associated with the hair follicle

B. Nails (derived from epidermis)

- a. nail body, free edge, root
- b. nail bed, nail matrix, lunula
- c. eponychium (cuticle)

C. Glands of the Integumentary System (derived from epidermis)

1. Sebaceous Glands - oil glands (holocrine)
2. Sudoriferous / Sweat glands
 - a. apocrine - water and fatty acids (abundant in axillary and anogenital regions)
 - b. merocrine / eccrine - primarily water (numerous and widely distributed)

D. Classification of Glands (histology review)

1. Secretion vs. Excretion
 - a. Secretion - materials released from cells are typically useable (i.e. serve a purpose)
 - b. Excretion - materials released from cells are eliminated (always to the outside)

2. Classification of Glands by Type: Exocrine vs. Endocrine

Endocrine – “ductless” glands that secrete their products (hormones) into the interstitial spaces, then to the blood

Exocrine - glands that secrete their products into a duct

- Structure of Ducts - single cell (in wall of tube, i.e. mucus cells in intestine)
- tubular (may be simple or compound)
 - alveolar aka acinar (may be simple or compound)

3. Classification of Glands by Cellular Mode of Secretion:

Holocrine - entire cell filled with secretory products is shed (i.e. sebaceous glands)

Apocrine - secretion filled vesicles pinch off of apical end of cell (i.e. axillary sweat glands, mammary glands, ceruminous glands)

Merocrine / Eccrine - secretory product released by exocytosis (i.e. majority of sweat glands, salivary glands)

E. Sensory Endings - tactile sensation, temperature, pain...

a. Meissner's Corpuscles - light touch; located in dermal papillae

b. Pacinian Corpuscle - deep touch, pressure, vibration, located deep in the dermis and hypodermis

c. Free Nerve Endings - pain, temperature (?), touch; typically located in the epidermis (free nerve endings are typically anatomically indistinct, with the exception of the root hair plexus that may be distinguished by the fact that it is coiled around the hair follicle; sensitive to light touch)

d. Merkel's Disks - light touch; located in the deep layers of the epidermis

e. Ruffini's Corpuscle - deep touch, pressure; located in the dermis

Questions / Review**Lab 4.0**

I. Obtain a slide of thick skin (alternately use a scalp, monkey skin, or negro skin slide - looking at them all is best)

A. Under Low Power identify the following

Epidermis _____

Dermis _____

Dermal Papillae _____

Papillary Layer of the Dermis _____

Reticular Layer of the Dermis _____

Hypodermis _____

B. Under High Power identify the layers and cells of the epidermis and dermis:

Stratum Corneum _____

Stratum Lucidum (visible in thick skin only) _____

Stratum Granulosum _____

Stratum Spinosum _____

Stratum Germinativum _____

Identify the melanocytes and keratinocytes in this layer (negro skin best) _____

Papillary Layer of the Dermis _____

Reticular Layer of the Dermis _____

II Obtain a "scalp" slide and identify the following:

Hair Follicle _____

Hair Bulb _____

Hair Papilla _____

Sebaceous Gland _____

Can you also find some sweat glands? _____

Questions:

In addition to identifying all of the anatomical landmarks underlined in your handout you should be able to answer the following types of questions. These questions are designed to help you focus your studies, how you use them and answer them will determine how much you get from them.

1. What specific type of tissue is the epidermis composed of? What cell type is the most common, what other cell types are present (where are they found)?

2. Where are melanocytes found? What is their significance?
3. Identify and describe the layers of the dermis.
4. What specific type(s) of tissue is the dermis composed of?
5. Where are sebaceous glands found? What do they secrete?
6. Where are sudoriferous glands found? What do they secrete?
7. Compare and contrast endocrine and exocrine glands.
8. Compare and contrast the different modes of secretion (aka holocrine, apocrine, merocrine)
9. Describe the characteristics of the different strata in the epidermis.