

LABORATORY 21 - INTEGUMENT

OBJECTIVES: LIGHT MICROSCOPY: Recognize thick and thin skin. In epidermis distinguish cell layers and understand changes that occur in each layer. Distinguish between different regions of dermis. Recognize accessory organs and their distribution and distinguishing characteristics.

ELECTRON MICROSCOPY: Recognize ultrastructural characteristics of the four cell types found in the epidermis and the ultrastructural changes that occur during differentiation of keratinocytes. Recognize ultrastructural characteristics of eccrine and apocrine sweat glands and sebaceous glands.

ASSIGNMENT FOR TODAY'S LABORATORY

GLASS SLIDES

[SL 25](#) Thick skin

[SL 26](#) Thick skin (Bencosme's trichrome)

[SL 9](#) Thin skin

[SL 89](#) Scalp

[SL 33](#) Axilla

[SL 42](#) Embryonic skin

[SL 178](#) Thick skin finger tip (sensory receptors)

ELECTRON MICROGRAPHS

EM 20

POSTED ELECTRON MICROGRAPHS

S-56 Epidermis

11 Desmosomes

[Lab 21 Posted EMs](#); [Lab 21 Posted EMs with yellow labels](#)

HISTOLOGY IMAGE REVIEW - available on computers in HSL

Chapter 11, Integumentary System

Frames: 716-764

SUPPLEMENTARY ELECTRON MICROGRAPHS

Rhodin, J. A.G., [An Atlas of Histology](#)

Copies of this text are on reserve in the HSL.

Integument pp. 274 - 286

- I. Although skin always consists of epidermis and dermis, there is substantial variation in different regions of the body. The examples referred to here reflect these variations. As you look at the slides listed below keep in mind the following parts of skin and associated regions, identify them and compare these structures to their appearance in the different locations.
- A. The EPIDERMIS consists of several layers, some of which may not be present: basal layer, spinous layer, granular layer, ("clear" layer), cornified layer, i.e. stratum basale, spinosum, granulosum, (lucidum) and corneum.
 - B. The DERMIS has two layers: papillary and reticular.
 - C. HYPODERMIS is evident below the dermis and contains an abundance of adipose cells.
 - D. Accessory organs of the skin include:
 - 1. Two types of sweat glands both of which have secretory portions, ducts, and myoepithelial cells.
 - a. ECCRINE sweat glands are simple coiled tubular glands located over the whole body.
 - b. APOCRINE sweat glands are branched, coiled, tubular glands restricted in their distribution to the axillary and the genital regions.
 - 2. HAIR FOLLICLES are found in many locations, but have considerable variation in size. ARRECTOR PILI muscles are smooth muscles associated with hair follicles.
 - 3. SEBACEOUS glands are usually associated with hair follicles. They are simple branched glands and lack myoepithelial cells.
 - E. In addition, briefly observe the distribution of blood vessels (W. 9.14, 9.15). The keratinocytes of the epidermis and its appendages (hair follicles, sweat glands, sebaceous glands) differentiate from ectoderm, whereas the dermal cells (fibroblasts, smooth muscle cells and macrophages) differentiate from mesoderm.
- II. Study the following regions of skin and skin related structures and cells.

- A. THICK SKIN (palm and sole) SL 25, 26 (W. 9.2) Skin that has a thick layer of epidermis is identified as thick skin. Thick skin (scan, low 1, low 2, med) is found on the soles and palms. The stratum granulosum is several cells thick and the stratum corneum consists of a wide band of cells in which cellular structure is not evident in LM. In thick skin the epidermis includes four to five layers, since the stratum lucidum may be evident (stratum lucidum not present in these images high, oil).

Epidermal pegs (rete pegs) or ridges (Rete Pegs) are projections from the epidermis into the dermis that aid in anchoring the epidermis to the dermis. They interdigitate with dermal papilla in the upper region of the dermis, called the papillary layer, which consists of relatively loose irregular c.t. Capillaries and other vessels are numerous in the papillary layer and nerve endings may be observed in the regions of that form the dermal papillae. The reticular layer is thicker than the papillary layer and is formed of dense irregular connective tissue.

Identify the types of glands (med, high 1, high 2, oil) that are present (W. 9.10). What structures, found in other regions of skin, are absent?

- B. THIN SKIN SL 9 (scan) (Similar to W. 9.1). Auricle of ear. Contrast this skin to the thick skin. This skin has more pigment (W. 9.5-9.6). Are hair follicles (long, cross) present (W. 9.8)? What types of glands (red circles) are found that are absent from thick skin (W. 9.9, 9.10)?
- C. SCALP SL 89 (W. 9.16, 9.8 to 9.9). In this slide the structure of hair follicles (low, med) may be observed. What structures are associated with the hair? Is there any muscle (low, high, (enclosed by blue line)) apparent in the dermis? Compare the ratio of epidermis to dermis on this slide versus slide 25.
- D. AXILLA SL 33 (scan) (W. 9.9 to 9.11). Is this skin thick or thin? This slide shows apocrine sweat glands (med, high (red arrows)) (W. 9.11). What is their mode of secretion? Are eccrine sweat glands (W. 9.10) present? Are sebaceous glands (W. 9.9) present? On this slide good examples of hair follicles (J. 18-14, 15) may be evident.
- E. EMBRYONIC SKIN SL 42 (low) In early embryonic stages before keratinization occurs, the most superficial layers of the skin are called the periderm, in which the cells are all nucleated and have enormous stores of glycogen. What is the appearance of the periderm on this slide? The periderm persists until keratinization occurs, (slightly prior to midgestation) then it is sloughed into the amniotic cavity.
- F. SENSORY RECEPTORS SL 178. Skin of fingertip - Locate a Meissner's (enclosed by blue line) corpuscle in one of the papillae of the papillary layer of the dermis (W. 7.31). Often they are not very numerous in the sections and somewhat difficult to distinguish from a capillary plexus. SL 26 or 25 - Locate a Pacinian (low, med) corpuscle in the region of the hypodermal dermal junction (W. 7.32). Read about these and other receptors.
- G. From your texts review LANGERHANS cells and MERKEL cells, (J. p. 379; W. 9.5-9.6), also the structure of the nail (J. pp. 356-357; W. 9.18). How do these cell types differ?
- H. Electron microscope
1. Study EM 20. (J. 18-5 to 7). Note characteristics of various layers of epidermis and distribution of cell types at this level of organization.
 2. From lecture notes review process of pigmentation (J. pp. 372-375).
- I. You may wish to fill in the charts on the next two pages.

SKIN

Examine the six slides listed below. Fill in the chart. Answer the questions from your analysis and the textbook's description.

<u>Slide No.</u>	<u>General Function of Component</u>	<u>9</u> Auricle of Ear, Thin	<u>26 and 25</u> Sole of Foot/ Palm, Thick	<u>89</u> Scalp	<u>33</u> Axilla	<u>42</u> Embryonic Digit
<u>Component Epidermis</u>						
<u>Type of Epithelium</u>						
Layers Present (which of 5)						
Melanocytes and Pigmentation						
Basement Membrane (distinct/indistinct)						
<u>Epidermal Derivatives</u> Sebaceous Glands (Presence & Location)						
Eccrine Sweat Gland						
Apocrine Sweat Gland						
Hair						

SKIN

Examine the six slides listed below and illustration of a finger nail from the test. Fill in the chart. Answer the questions from your analysis and the textbook's description.

<u>Slide No.</u>	<u>9</u> Auricle of Ear, Thin	<u>26 and 25</u> Sole of Foot/ Palm, Thick	<u>89</u> Scalp	<u>33</u> Axilla	<u>42</u> Embryonic Digit
Component Dermis	General Function of Component				
Ratio of Dermis to Epidermis					
<u>Papillary Layer</u> A. Degree of penetration into epidermis - long - short – absent					
B. Presence of nerve Endings					
Basement Membrane (distinct/indistinct)					
<u>Reticular Layer</u> A. Relative thickness of this layer					
B. Presence of nerve Endings					
Size and relative numbers of blood vessels					
<u>Hypodermis</u> Amount of fat - large amount, moderate, scant?					

OBJECTIVES FOR LABORATORY 21: INTEGUMENT

1. Using the light microscope or digital slides, identify:

Layers of skin

Epidermis

- Stratum basale
- Stratum spinosum
- Stratum granulosum
- Stratum lucidum (thick skin only...not well defined on our slides)
- Stratum corneum

Dermis

- Papillary layer
 - Dermal papilla and epidermal pegs
- Reticular layer

Hypodermis

Accessory structures

Hair

- Follicle
- Shaft
- External and internal root sheaths
- Dermal papilla
- Arrector pili muscle

Glands

- Sebaceous glands
- Sweat glands
 - Eccrine
 - Apocrine
 - Ducts (eccrine or apocrine not distinguishable)
 - Secretory cells and myoepithelial cells
 - Fibroblasts (in surrounding connective tissue)

Specialized sensory receptors

- Meissner's corpuscles
- Pacinian corpuscles

Based on skin thickness and distribution of accessory structures, be able to distinguish:

Typical skin (e.g. forearm, leg, abdomen, back)

Scalp

Palms of hands / soles of foot

Axilla / groin

2. On electron micrographs, identify:

Layers of skin (see above, if provided enough context)

Cells

Keratinocytes

- Desmosomes
- Hemidesmosomes
- Basal lamina / basement membrane
- Tonofibrils / tonofilaments
- Melanosomes
- Keratohyalin granules

Merkel cells

- Secretory cells of glands
- Myoepithelial cells of glands

REVIEW OF INTEGUMENT

1. How are desmosomes seen at the electron microscopic level related to the "prickles" of the spinous layer? Are desmosomes restricted to this layer? If not, where else are they found in the skin?
2. Compare the location of the least and most differentiated cells in epidermis, hair follicle, sebaceous gland and from class notes in the nail. Note that the epidermis, hair follicle, sebaceous gland and nail follow a common path in forming completely differentiated cells even though the product of each is quite distinct from any of the others.
3. Consider the diverse roles played by the skin and where possible correlate this with the anatomic structure responsible for the following:
 - a. Protection against ultraviolet light
 - b. Impermeability to water
 - c. Temperature regulation
 - d. Detection of touch
 - e. Protection against trauma
 - f. Function as an excretory organ

FYI – an interesting case

Illustrated below is an interesting historical account of one of the genetic diseases affecting collagen formation (Ehlers-Danlos Syndrome) and its manifestation in the skin. For reference see J. pp. 107, 111, 367, as well as Dr. Brackenbury's handout and Biochemistry notes.

This account was copied from:

Connective Tissue and Heritable Disorders Molecular, Genetic and Medical Aspects. Ed.: P.M. Royce and B. Steinmann, Wiley-Liss, WD375 C748, 1993.

1. First description and picture of an individual with EDS in Belgium" in 1668 [9], and translated into German in 1675 [10]. Below follows a translation from the German, by Michael Roth and Ursula Zeller of Zürich. The original Belgian report was also translated into Latin in 1682 [11], and an English translation of this last is given in McKusick [2].

Of A Soft-Skinned Spaniard

Out of pressing needs and unforgettable sufferings our ancestors raised us, as it were, from the cradle with the belief that there is no wilder, more merciless and cruel people to be found in the world than the Spanish. As the history books, especially the chroniclers of the Dutch wars and the American barbarities to excess prove.

In spite of this we must confess that we have not seen a softer or more lithe Spaniard than Gregorius Albes, begotten by Spanish parents and on a Canary Island born. However, in his skin alone was he such. We saw him together with the famous professors, Johann von Horne, Francisco Sylvio, Guil. Pisone, and Francisco von der Schaagen in the year 1657 in the large hospice. He was a young fellow, twenty-three years of age, healthy in body and build. In our presence he took with his left hand the skin from his right shoulder and pulled it to his mouth, like an archer pulls the string on a cross-bow. The skin, however, from the chin he pulled with both his hands into a point like a beard, to his breast, from whence he then pulled the self same skin over his head, covering his eyes in a manner such that we could no longer see them. Even more of a wonder was how his skin, when he let go of

it, fell back immediately into its proper place in such a manner as if it had never been touched. In just such a way he pulled the skin from his right knee up and down about half an arm's length. And once he let go of it, a man could not notice that it had once been pulled up.

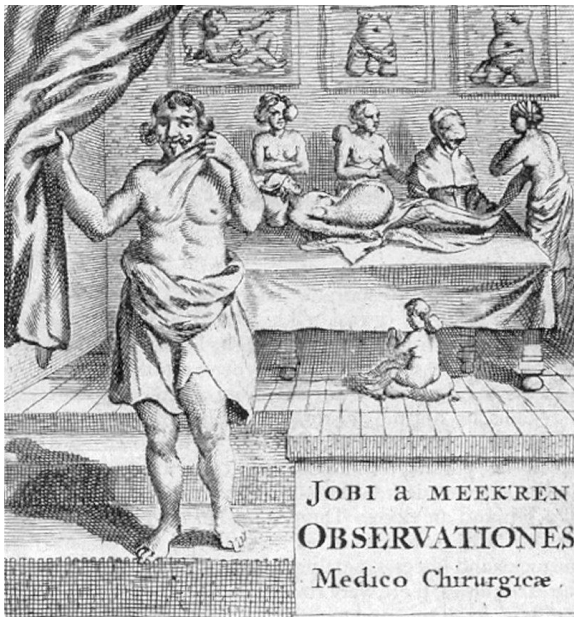
In this chapter we try to cover the EDS in as detailed a manner as possible, but without being encyclopedic, to weigh

As the same time we were astonished to discover that the skin on his left shoulder and knee in no way let itself be pulled, as it was in these places so fixed and firm, it would have been impossible.

What however the causes of the soft parts as well as the firm parts were remains to us till this very hour unknown.

(Chapter 29 in: "Rare and Fantastical Observations of the Surgical and Healing Arts, as they were first made public five years ago, shortly after the passing away of the author, after much urging and desire to please the students of the Healing Arts; now for the advantage of High German speakers truly translated and printed. Throughout adorned with copper engravings and supplied with a complete register. Set and printed by Paul Fürstens, Art and Book dealer, Late Wittib and Successors, An 1675", pp 186–188, with permission of the British Library.)

Note that the left side is not involved and that there is no mention of joint laxity. (Reproduced from [11], with permission of the British Library.)



J. M. S. T. E. L. O. D. A. M. S.
Ex officina Henrici et Viduae Theodori Boom 1682.