Laboratory Manual in Animal Histology (Biology 134)

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EXERCISE 6: THE SKIN

Introduction

The skin forms the external surface of the body. It is regarded as the largest and heaviest organ in the body accounting for about 16% of the total body weight. It performs various functions in the body such as protection, sensation, thermoregulation and synthesis and storage of Vitamin D.

Objectives

At the end of the exercise, the students should be able to:
1. identify the layers and strata of the skin;
2. identify the glands and specialized structures associated with the skin; and,
3. characterize the different cells types found in the different strata of the skin.

I. The Two Types of Skin

A. Thick Skin- cross section of the palm skin.

Under the LPO, take note of the following layers of the skin.

1. Epidermis- this region is made up of keratinized stratified squamous epithelium. A prominent feature of the epidermis of this skin type is pattern of surface ridges formed by the epidermis which is usually used as a basis for identification. This region of the skin is represented by different morphological layers.

a. Stratum Corneum- also known as cornified layer. It is the most superficial layer of the epidermis. It is made up of approximately 30 layers of flattened and dead keratinocytes cells. ***Do the cells possess nuclei?***

b. Stratum Lucidum- this layer is seen only in thick skin. It usually appears as homogenous layer which usually stains violet under and H& E stain. This layer is seen in between stratum granulosum and stratum corneum.

c. Stratum Granulosum- also known as the granular layer due to characteristic intracellular granules of the cells which greatly contribute to the keratinization process. Cells in this stratum appear very dark.

d. Stratum Spinosum- also known as the spiny layer. Note that the cells appear prickly or spiny due to intercellular bridges. ***What is the significance of such feature?*** The cells found in this layer usually undergo massive growth and keratin synthesis.

e. Stratum basale- also known as stratum Malpighii. It is a layer characterized by cells undergoing active mitotic division. ***What is the morphology of the cells in this layer?***

2. Dermis- this layer supports the epidermis. It is made of dense fibro-elastic tissue. It usually merges with the loose supporting tissue of the hypodermis made up of purely adipose tissue which acts for shock absorption.

B. Thin Skin- transverse section of the human scalp

Compared to the thick skin, the stratum corneum of this skin is relatively thinner aside from the fact that the ridges are less prominent since this skin type is least subjected to shearing forces. Under the LPO and HPO, take note of the following layers comprising this skin type:

1. **Epidermis**- the appearance of this layer is characteristically the same with that of the thick skin. The only difference lies on the number and relative thickness of layers comprising it. From superficial to deep region, the following layers can be observed:

a. Stratum corneum- cells in this layer are dead and dying. They are usually flattened and are devoid of nucleus and other organelles and are filled with keratin.

b. Stratum granulosum- this layer is made up of 3-5 layers of flattened keratinocytes. The cells possess numerous, dense basophilic granules crowding the cytoplasm. It is also in this layer where the cells undergo process of transforming into the tough outer cells of the epidermis. Their nuclei and organelles disintegrate, plasma membranes thicken, and cells begin to accumulate keratohyaline granules and lamellated granules.

c. Stratum spinosum- the cells of this region appears to be spiny due to the presence of intercellular junctions. Aside from the spiny cells of this region, Langerhans cells are also visible. These cells are small and are characterized by round nucleus and moderately condensed chromatin. **What is the primary function of this cell?**

d. Stratum basale- this layer is characterized by single layer of cube-like cells lying on a basement membrane. Keratinocytes of this layer are highly mitotic and are primarily responsible for the replacement of cells in the stratum corneum. Aside from keratinocytes, Merkel and melanocytes cells can also be seen in this region. ***What are the function of the Merkel's cells and melanocytes?***

2. Dermis- thickest region of the skin. It is composed of strong, flexible connective tissue that is richly supplied with blood vessels and sensory nerve endings; also contains glands and hair follicles. It is subdivided into two layers namely:

a. Papillary layer- it is the superficial layer of the dermis. This layer is relatively loose and highly vascular layer with interlacing collagen fibers. It is usually made up of loose areolar connective tissue. Also seen in this layer

are small, oval-shaped, encapsulated sensory receptors called *Meissner's corpuscles* which are predominantly seen along dermal papillae immediately beneath the epidermis.

b. Reticular layer- is the deepest layer of the dermis and is named due to the interlacing arrangement of collagen fibers. This layer is characterized by the presence of irregular collagen fibers. Associated with the fibroblasts, are mast cells and tissue macrophages involved in defense and immune surveillance.

II. Skin Appendages

1. Hair- longitudinal and cross section of the scalp

Hairs are elongated keratinized structures derived from the epidermal epithelium. It usually arises from the *hair follicles* which are downgrowth of surface epithelium covered by collagenous fibers. Growth takes place within the terminal dilatation called the *hair bulb*. Hair bulb is essential for hair growth since it contains in its basal region the dermal papillae. ***What are dermal papillae?***

Aside from the sebaceous gland, a bundle of smooth muscle called arrector pili muscle is also associated with the hair. Its contraction causes the hair to erect producing the so-called "goose-bumps".

Similar to the stratum germinativum of the skin, cells comprising the hair follicle also undergo constant division and differentiation. The following regions can be seen:

a. Medulla- the innermost layer of the follicle which undergoes slightkeratinization. Cells appear to be pale with an H and E stain.
b. Cortex- layer of cells surrounding the medulla which forms the bulk of the hair. It appears as pale yellow with an H & E stain.
c. Cuticle- the third layer of the follicle which undergoes massive keratinization.
d. Internal root sheath- the fourth layer which surrounds the initial part of the hair shaft, the exposed part of the hair. The cells of this layer usually disintegrate above the level of the sebaceous gland. It is usually composed of a thin, pale epithelial stratum (Henle's layer) and a thin granular stratum (Huxley's layer) which become indistinguishable as they merge with the hair bulb.
e. External root sheath- the outermost layer of the follicle which is separated from the connective tissue surrounding the follicle by a specialized membrane called *glassy membrane*. It is composed of several layers which are continuous with the layers of the epidermis.

2. Sweat gland- longitudinal section of the scalp

The sweat gland is simple, highly coiled tubular gland that extends deep into the dermis. It secretes watery fluid via merocrine secretion and is an important component in maintaining body temperature. This gland has two components:

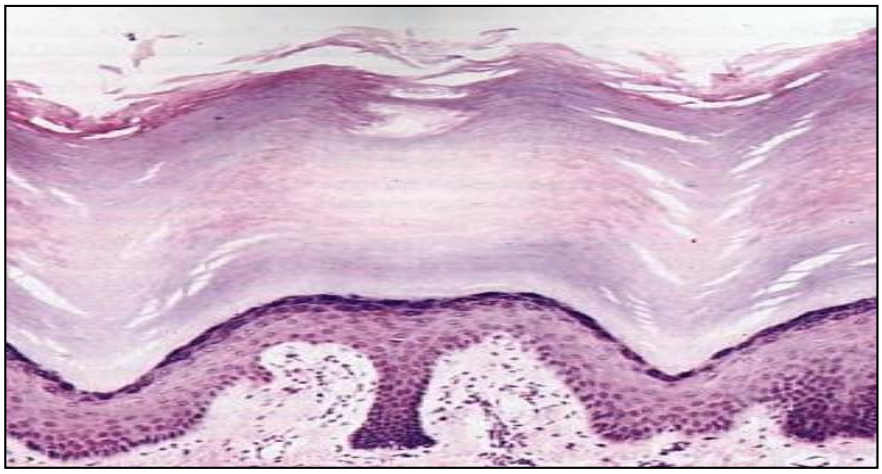
a. Secretory portion- these are small, oval bodies in the lower dermis. Cells comprising this portion are usually large and tall which stains light pink under H & E stain. It is usually surrounded by spindle-shaped *myoepithelial cells*.

b**. Excretory duct**- has smaller diameter compared to the secretory portion. It is usually lined by deeply staining 2- layered thick cuboidal cells.

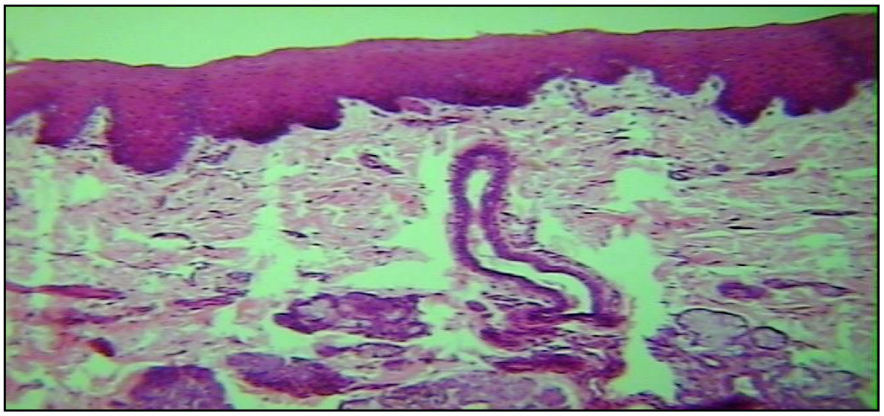
3. Sebaceous gland- longitudinal section of the scalp

This gland is usually associated with the hair follicle. They are responsible for secreting *sebum* which acts as waterproofing and moisturizing agent for the hair and skin. They are composed of large, lightly staining cells surrounded by the stratified columnar or cuboidal epithelium which is continuous with the external root sheath of the hair follicle. Myoepithelial cells are also seen to enclose the secretory portion of the gland.

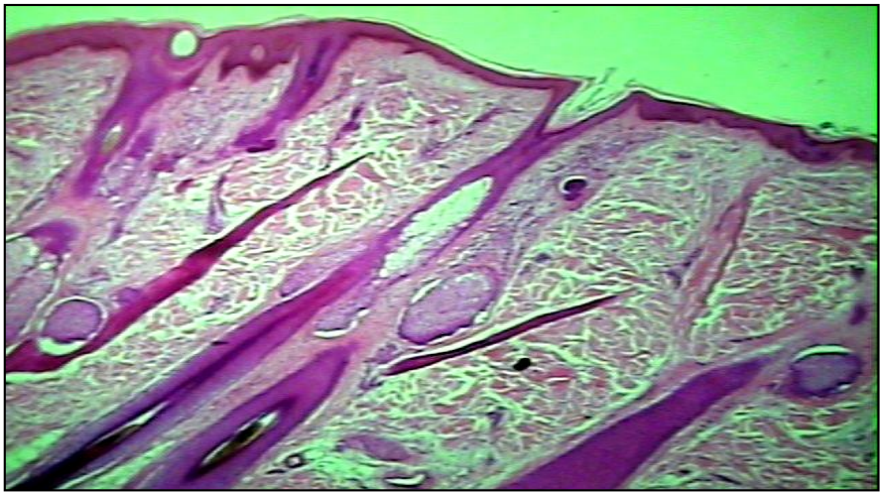
Illustrations



Human thick skin



Human thin skin



Human scalp

Guide Questions:

1. What do the following structures represent under EM? Give their importance.
   - **a.** "Spiny" projections in the stratum spinosum
     _____
     _____
     _____
   - **b.** Granules in the cells of stratum granulosum
     _____
     _____
     _____

2. Describe the process of melanin synthesis.
   _____
   _____
   _____
   _____

3. Draw and label the following specialized cells and structures:
   a. Melanocytes
   b. Langerhans cells
   c. Merkel's cells
   d. Meissner's corpuscles
   e. Pacinian corpuscles