

The Integumentary System

The integument, composed of skin and its appendages, sweat glands, sebaceous glands, hair and nails, is the largest organ, constituting 16% of the body weight.

Skin

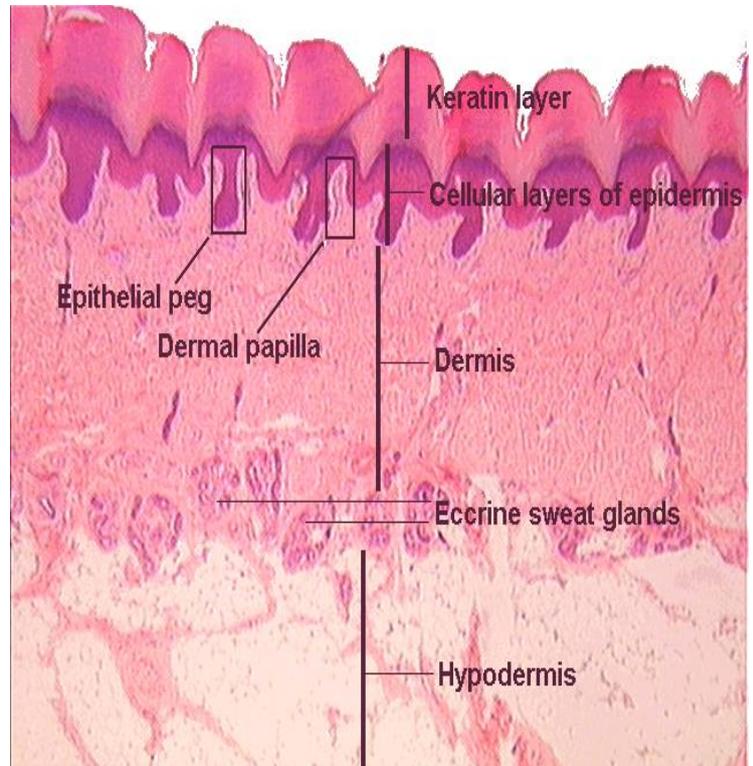
It is composed of the epidermis, an epithelial layer of ectodermal origin, and the dermis, a layer of connective tissue of mesodermal origin. The junction of dermis and epidermis is irregular, and projections of the dermis called **papillae** interdigitate with evaginations of the epidermis known as **epidermal ridges**. Beneath the dermis lies the hypodermis, or subcutaneous tissue, a loose connective tissue that may contain a pad of adipose cells. The hypodermis, which is not considered part of the skin, binds skin loosely to the subjacent tissues.

Skin is classified as thick or thin according to the thickness of the epidermis and are distinguished by the presence or absence of certain epidermal layers and the presence or absence of hair.

Thick skin covers the palms and soles. The epidermis of thick is characterized by the presence of all five layers of cells. Thick skin lacks hair follicles, muscles, and sebaceous glands but does possess sweat glands.

Thin skin covers most of the remainder of the body. The epidermis has a thin stratum corneum and lacks a definite stratum lucidum and stratum granulosum, although individual cells of these layers are present in their proper locations.

Besides providing a cover for the underlying soft tissues, skin performs many



additional functions, including

(1) protection against injury and bacterial invasion; (2) regulation of body temperature (3) reception of continual sensations from the environment (e.g., touch, temperature, and pain); (4) excretion from sweat glands; and (5) absorption of ultraviolet (UV) radiation from the sun for the synthesis of vitamin D.

Skin is composed of three layers which are:

1- Epidermis

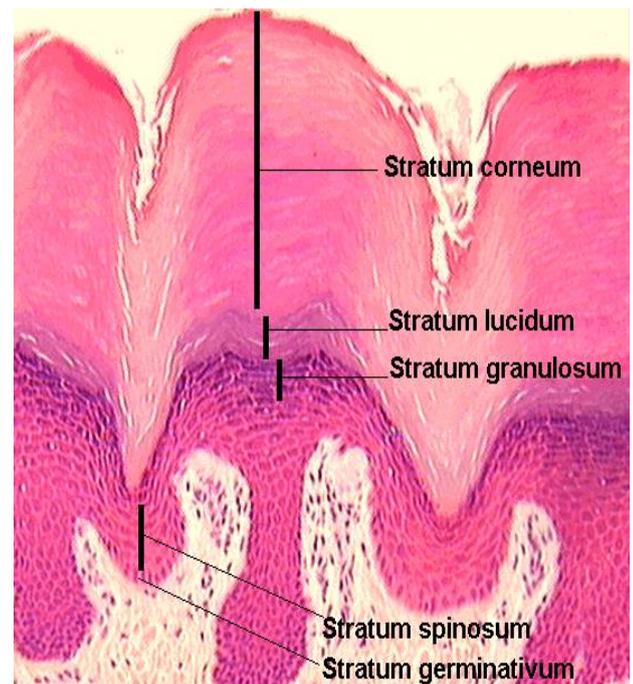
The epidermis is covered by stratified squamous keratinized epithelium and contain four populations of cells: keratinocytes, melanocytes, Langerhans cells, and Merkel's cells.

A-Keratinocytes (epithelial cells)

Form the largest population of cells, are renewed through mitotic activity in the basal layers of the epidermis; as the new cells are forming, the cells above continue to be pushed toward the surface, as they near the surface, the cells die and are sloughed off, a process that takes 20 to 30 days.

Five morphologically distinct zones of the epidermis can be identified. From the inner to the outer layer, these are:

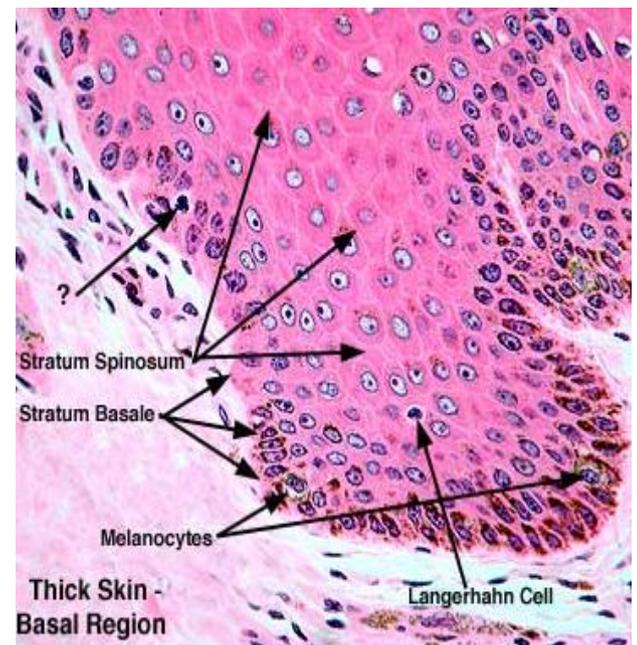
- (1) **Stratum basale (germinativum)**: consists of a single layer of basophilic columnar or cuboidal cells resting on the basement membrane at the dermal- epidermal junction. The stratum basale, containing stem cells, is characterized by intense mitotic activity and is responsible, in conjunction with the initial portion of the next layer, for constant renewal of epidermal cells.
- (2) **Stratum spinosum**: consists of cuboidal, or slightly flattened, cells with a central nucleus and a cytoplasm whose processes are filled with bundles of keratin filaments called tonofilaments play an important role in maintaining cohesion among cells and resisting the effects of abrasion. All mitoses are confined to what is termed malpighian layer, which consists of both the stratum basale and the stratum spinosum. Only the malpighian layer contains epidermal stem cells.
- (3) **Stratum granulosum**: consists of 3-5 layers of flattened polygonal cells whose cytoplasm is filled with coarse basophilic granules called keratohyalin granules. The function of this extruded material is similar to that of intercellular cement in that it acts as a barrier to penetration by foreign materials and provides a very important sealing effect in the skin.



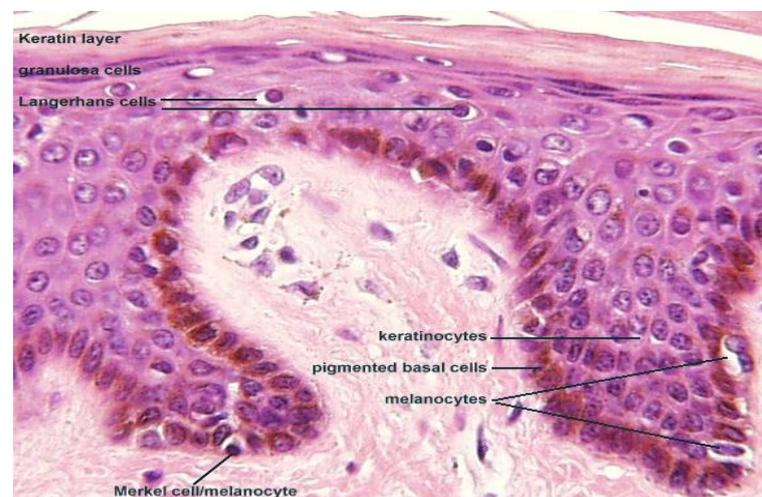
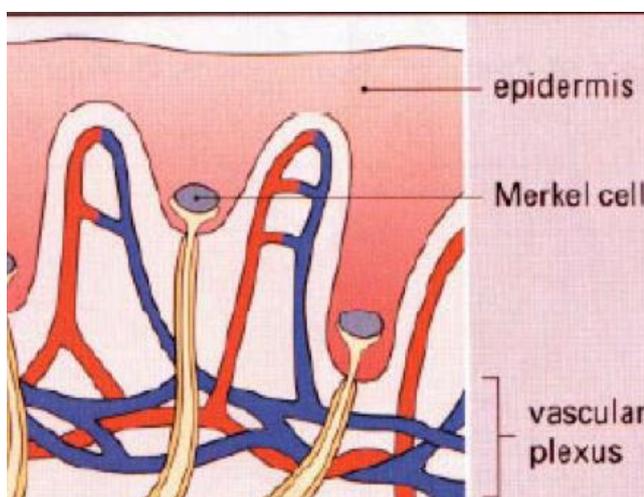
- (4) **Stratum lucidum:** More apparent in thick skin, the stratum lucidum is a translucent, thin layer of extremely flattened eosinophilic epidermal cells. The organelles and nuclei are no longer evident.
- (5) **Stratum corneum:** consists of 15-20 layers of flattened non-nucleated keratinized cells with a thickened plasma lemma and filled with keratin filaments embedded in an amorphous matrix. Those cells farther away from the skin surface display desmosomes, whereas cells near the surface of the skin called squamous or horny cells, lose their desmosomes and become desquamated (sloughed off).

B-Nonkeratinocytes

- (1) **Melanocytes:** are round to columnar Cells located among the cells of the stratum basale; their long, undulating processes extend from the superficial surfaces of the cells and penetrate the intercellular spaces of the stratum spinosum and are responsible for the production and secretion of melanin. The difference in skin pigmentation is related more to location of the melanin than to the total number of melanocytes in the skin. Single exposure to ultraviolet radiation increases the size and functional activity of the melanocytes, their population remains the same. After continued exposure to ultraviolet radiation, however, there is also an increase in the melanocytes population.



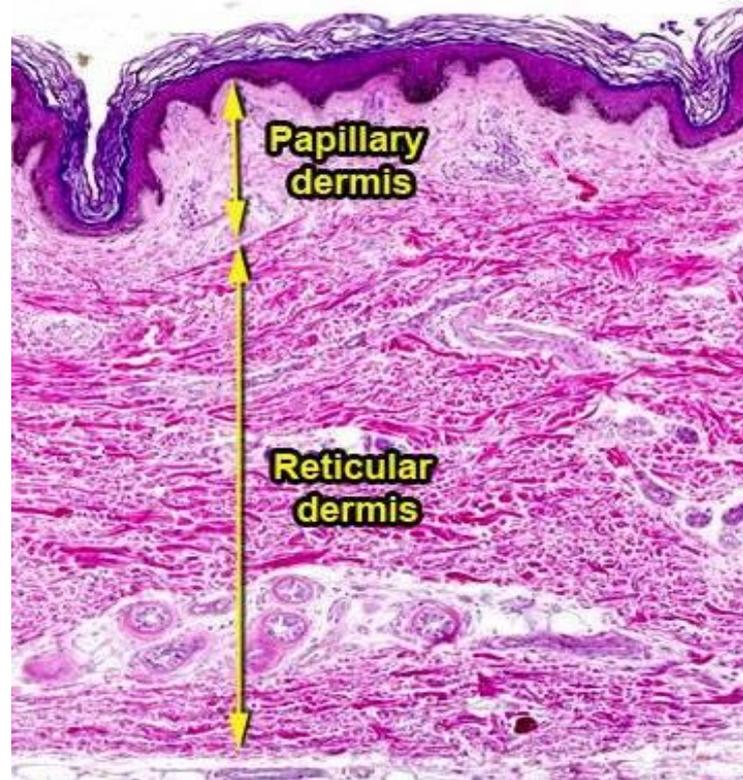
- (2) **Langerhans Cells:** star-shaped cells found mainly in the stratum spinosum of the epidermis, they have a significant role in immunologic skin reactions
- (3) **Merkel's Cells:** generally present in the thick skin of palms and soles (scattered among cells of the stratum basale), somewhat resemble the epidermal epithelial cells but have small dense granules in their cytoplasm. These cells may serve as sensory mechanoreceptors.



2- Dermis (Corium)

The dermis is the connective tissue that supports the epidermis and binds it to the subcutaneous tissue (hypodermis). The thickness of the dermis varies according to the region of the body and reaches its maximum on the back. The surface of the dermis is very irregular and has many projections (dermal papillae) that interdigitate with projections (epidermal pegs or ridges) of the epidermis. The dermis has a rich network of blood which play a very important role in temperature regulation, and lymph vessels in addition to rich supply of nerves in the dermis.

Normally, the dermis is thicker in men than in women and on the dorsal than on the ventral surfaces of the body. **The dermis contains 2 layers** with rather indistinct boundaries-the outermost papillary layer, and the deeper reticular layer.



- (1) **The papillary layer:** is thin and composed of loose connective tissue; fibroblasts and other connective tissue cells, such as mast cells, macrophages, and plasma cells are present. Extravasated leukocytes are also seen.
- (2) **The reticular layer:** is thicker, composed of irregular dense connective tissue (mainly type I collagen), and therefore has more fibers and fewer cells than does the papillary layer.

Reference:

1- diFIORE'S Atlas of histology with Functional Correlations, eleventh edition,2008.

2- diFIORE'S Atlas of histology with Functional Correlations, twelfth edition,2013.

3- Jonquiere's basic histology text and atlas 13th edition (2013) by Anthony L. Mescher ; Di Fiore's Atlas of Histology 12th ed. (2013) Victor P. Eroschenko