

THE STRUCTURE AND FUNCTION OF THE SKIN

The skin is an amazing structure; it is the largest organ of the body containing many structures such as capillaries, lymphatic vessels, nerve endings, glands and more. These structures help the skin to perform its many functions which include temperature regulation, sensory and waste elimination. An average adult males skin would cover an area of between 19^[1] and 22^[3] sq feet and weigh between 10^[1] and 16%^[3] of the body weight. This structure varies in thickness from 0.5mm to 4mm, the thinnest area being the eye lids^[3] which in its self serves a purpose, thicker areas of skin tend to be found where there is more friction or where palms of hands, soles of feet and thinner areas where the skin needs to be more flexible eye lids.

The Skin is broken down into 2 main Layers the epidermis (or cuticle) (fig 1,2) and the dermis (or true skin).(fig 3)

1. The epidermis is the outer layers of the skin and is divided into two zones, the horny and the germinal zone.

The horny zone is subdivided into 3 layers:

- i. Stratum Corneum (fig 1,2) - The outer layer of the skin comprising of 25 to 30^[3] rows of dead flat scaly cells (keratinocytes). These cells contain the protein keratin and between the cells are lipids^[3] (a greasy organic compound that is insoluble in water)^[5] which help to create the water proof barrier, this aids protection. These cells are replaced by the layer below as they work their way to the surface and in turn the top layer of cells are constantly being shed.
- ii. Stratum Lucidum (fig 1) - A layer of 3 to 4 rows of dead flat transparent cells^[3]. This layer is only found in the palm and soles. Eleidin droplets ("A semi fluid, acidophilic substance related to keratin")^[5] are present and give it a transparent appearance^[2].
- iii. Stratum Granulosum (fig 1,2) - A layer of 2 to 3 rows of flattened cells (keratinocytes) which contain granules of keratohyalin, this converts the tonofilaments into keratin.^[3] Tonofilaments are proteins and are

part of the mechanism that helps to bind the cells together. [3] At this stage the cells are dying.

The germinal zone is subdivided into 2 layers. These 2 layers are often classed as 1[4]

- i. Stratum Spinosum or the prickly cell layer[2] (fig 1,2) - There are 8 to 10 rows of many sided cells[3] and have prickly bundles of fibres which tightly connect them together, hence the name.
- ii. Stratum Germinativum or Basal layer (fig 1,2). A single columnar cell layer at the base of the epidermis, about 90% of these cells are Keratinocytes. Other cells found are Merkel, Langerlen and Melanocytes. There are stem cells in this layer which divide to produce new cells[3]. The stratum germinativum rests on a basement membrane dividing the dermis and epidermis. Tonofilaments bind the cells together and also bind them to the membrane below and stratum spinosum above. [3]

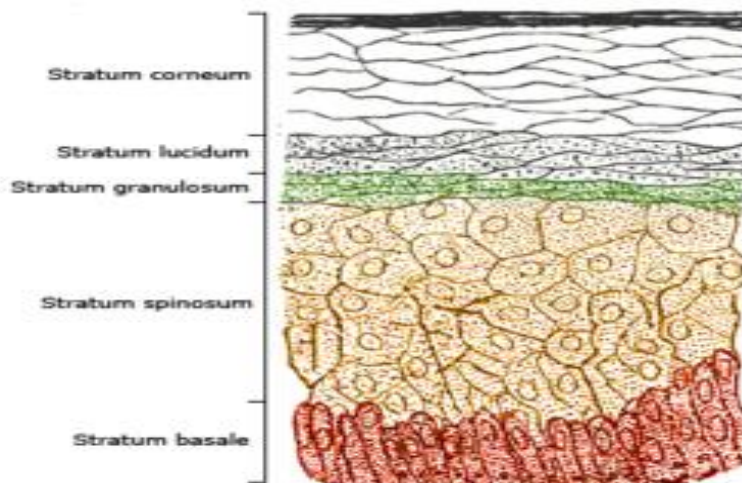


Figure 1 Epidermis [8]

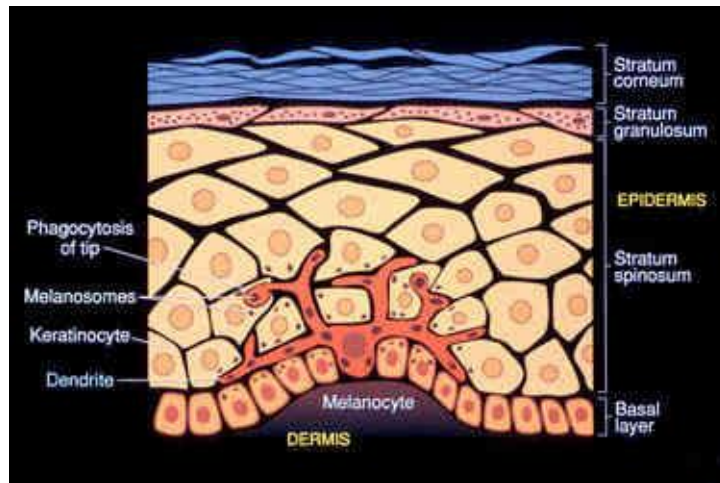


Figure 2 Epidermis [6]

2. The Dermis is the deeper of the two main layers and is divided into two regions
 - a. The Papillary region - is made up of areolar connective tissue which contain fine elastic fibres. It has dermal papillae some of which contain nerve endings or capillaries and stick up into the epidermis like fingers.[3] (fig 3)
 - b. The Reticular region - this layer is an irregular dense connective tissue made up of a net like pattern of collagen and elastic fibres[3], this provides the skin with its strength and its ability to stretch and return to its original length. This layer is attached to the subcutaneous layer. [3]

The dermis holds many structures, which are needed to complete the skins functions.

1. Capillary blood vessels, there is a vast network of capillaries throughout the dermis known as the blood reservoir it holds 8 to 10% of the body's blood[3]. Without this the skin could not complete its function of temperature regulation. The epidermis is also fed from this supply[3].(fig3)

2. Lymphatic vessels which carry interstitial fluid^[3] back to the blood, for elimination.^(fig3)
3. Sensory nerve endings (tactile receptors) to detect hot and cold (temperature regulation), pain (protection) and other sensations felt through the skin^[3] ^(fig3) Meissner's corpuscles^(fig 3) which respond to gentle pressure and Pacinian corpuscles^(fig3) which respond to deep pressure^[2].
4. Sweat glands (eccrine and apocrine larger of the two glands^[2]) which help the skin to regulate temperature and eliminating impurities.^(fig3)
5. Sebaceous glands that produce sebum which balances the acid mantle, this is part of the protection roll.^(fig3)
6. Hair to protect (eyelashes) and trap warm air to help with warming the body.^(fig3)
7. Hair follicles to grow hair in.^(fig3)
8. Arrector pili muscles which are attached to the hair follicle and when stimulated will make your hair stand up.^(fig3)

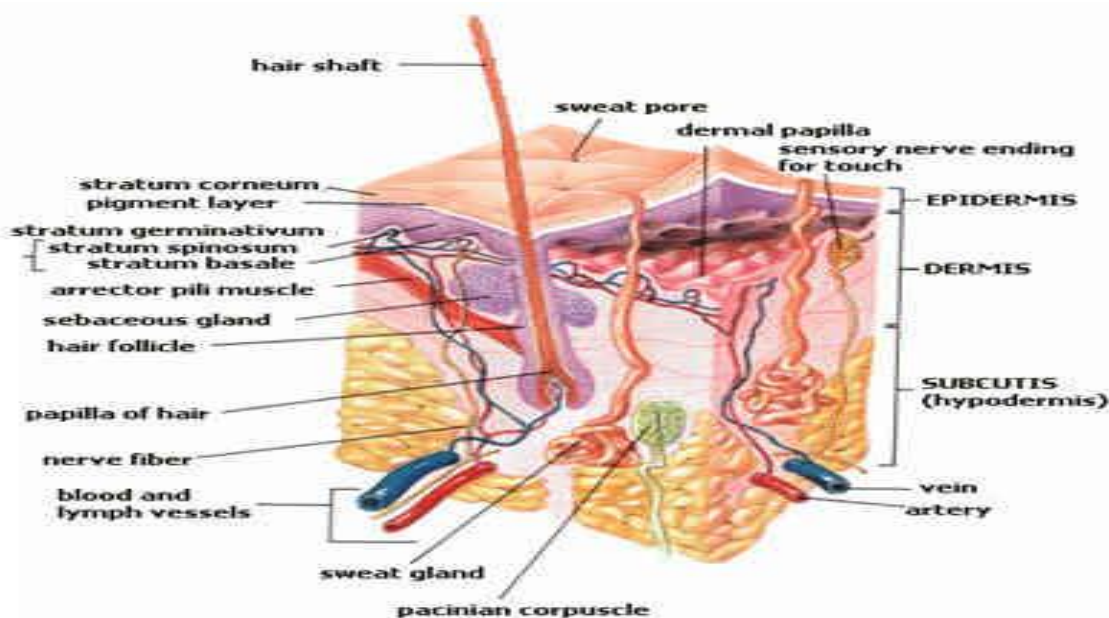


Figure 3 skin cross section [7]

The 7 main functions of the skin are:

1. Protection. The stratum corneum is a tightly interlocking layer of dead cells that guard against infections entering via the skin. It is also mostly waterproof (see function 4) preventing the loss or entry of fluids. The acidic pH balance inhibits the growth of bacteria. It protects against mechanical damage such as abrasions and friction^[4]. It tries to protect against the damaging effects of sunlight (ultraviolet light), through the regulation of melanin which is produced by the Melanocyte cells. When stimulated by sunlight the cells produce more melanin which appears as a sun tan, this is the skin's way of trying to protect itself.
2. Heat regulation. Body temperature is controlled by sensing the environmental temperature via the nerve endings and then adjusting the blood flow and sweat production accordingly^[3] to try and maintain the body's optimal working temperature which is around 37 degrees C^[2]. It does this by producing more sweat from the sweat glands which evaporates and cools and by blood vessel dilation to reduce temperature and visa versa to increase body temperature.
3. Sensation. With most sensory nerve endings terminating in the dermis, the skin is able to sense many things including, environmental temperature, pressure, vibrations, touch and pain^[4] and then reacts accordingly.^(fig3)
4. Absorption. Although the skin is almost waterproof some lipid soluble materials will penetrate. Included in this list are fat soluble vitamins, oxygen, carbon dioxide, also some drugs and unfortunately toxic materials^[3].
5. Secretion. Sebum is secreted from sebaceous glands; the sebum balances the skin's acid mantle. Sebum makes the skin oily when there is an over production. It moisturises the skin keeping it soft and supple therefore prevents cracks and openings in the skin. ^[4]

6. Elimination. Small amounts of urea, uric acid, ammonia and lactic acid are excreted out of the body in our sweat which is produced by the sweat glands. [2]
7. Vitamin D formation. The skin with the aid of UVB (ultraviolet) a part of sunlight, forms vitamin D. The UV light converts a fatty substance called Ergosterol (colourless, crystalline, water-insoluble sterol, $C_{28}H_{43}OH$, that occurs in ergot and yeast)[5] into vitamin D which then circulates around the body and is used in the formation and maintenance of bone along with calcium and phosphorous. [2,3]

A massage therapist needs to understand the skin so that they can fully appreciate the affect they are having in a positive and negative way. For example there are a lot of fine capillary's and lymphatic vessels in the skin so when you put pressure on and push (effleurage) you will help to move the fluids (blood and interstitial fluid) through the body quicker. Also when massaging you can create an erythema by warming the skin with effleurage and also warm the capillary's causing them to dilate bring more blood to the area and creating redness. Massage may also encourage the blood supply to move more quickly possibly having an effect on blood pressure. When massaging you need to be aware of how much pressure to apply especially on thinner areas of skin as you may possibly damage delicate capillaries which could cause bruising or damage to other delicate structures on the other hand massage deep enough to be effective. Also certain areas may be more sensitive as there is more nerve endings in some areas so this may feel more uncomfortable. Being aware of these things will help you provide a safe, comfortable and more effective treatment for your client ensuring you look after their well being.

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