

CHAPTER-6

The Skin

Core Resources

Tortora and Grabowski- Principles of Anatomy and Physiology
Chapter 5

Introduction

In this section we shall be looking at the structure and function of the skin. We shall look first at the cellular structure and organisation of skin tissue, before examining the accessory components that along with the skin form the integumentary system. Finally we shall learn about the functions of the skin.

Learning outcomes

The student should be able to:

- Describe the structural layers and components of the skin
- List the functions of the skin.



Skin

The skin is the largest organ of the body, covering an area of approximately 2 square meters, and making up about 16% of our body weight. The thickness of the skin can vary between 0.5mm on the eyelids, to 4mm on the heels. Generally, however, it is between 1-2 mm thick.

The skin functions mainly in protection of the body's physical and biochemical integrity, and is involved in sensory perception.

The **Integumentary System** is the name given to the skin and its accessory structures.

The Structure of Skin

The skin is divided into two main layers:

1. The **epidermis** – made up of epithelial tissue (superficial).
2. The **dermis** - made up of connective tissue (deep).

Deep to the dermis is the subcutaneous layer, which is made up of areolar and adipose tissue.

1. The Epidermis:

This layer is made up of *keratinised stratified squamous epithelium*. This layer of epithelium can be divided into four types of cells.

- **Keratinocytes** - 90% of the epithelium. These cells produce the tough, fibrous protein keratin, which protects the skin from heat, microbes and chemical damage. These cells also produce a waterproof sealant, keeping the interior of our body's safe from water damage.
- **Melanocytes** – 8% of the epithelium. Produce the dark pigment melanin, and transport the melanin to the keratinocytes where it helps to protect the skin from ultra-violet damage.
- **Langerhans cells** – develop from red bone marrow and migrate to the epidermis to participate in the immune responses against invading microbes.
- **Merkel cells** – function in touch sensation.

The epidermis is divided into several layers of cells:- these four or five layers depend of the pressure and friction applied to that part of skin.

- **The Stratum Basale** – The deepest, most metabolically active layer of the epidermis is made up of a single row of cuboidal or columnar keratinocytes with large nuclei. It is involved in cell division and the consequent production of new keratinocytes.
- **The Stratum Spinosum** – is the thickest layer of the epidermis, made up of about 10 layers of polyhedral (many sided) keratinocytes. Towards the superficial layers, these cells may become more flattened in appearance. These cells are joined together as a mesh, by filaments, which provide strength and flexibility to the skin.
- **The Stratum Granulosum** – About 5 layers of flattened keratinocytes, which begin to die when they reach this layer. This layer marks the transition between the deeper metabolically active stratae, and the dead protective cells of the more superficial layers.
- **The Stratum Lucidum** – consists of between 3 and 5 layers of clear (*'lucid'*), dead flattened keratinocytes. This layer is only found however on the thick skin of the soles of the feet and the palms and fingertips of the hands.
- **The Stratum Corneum** – this stratum is made up of many layers of dead keratinocytes, which are continually shed and replaced by cells from the deeper layers.

1. The Dermis:

The dermal layer is made up of collagen and elastic fibres. The dermis has two regions, the papillary layer and the deeper reticular region. The structures found within the dermis include:

- **Blood vessels**
- **Lymph vessels**
- **Sensory nerve endings**
- **Sweat glands**
- **Hairs**
- **Arrector pilorum muscle**
- **Sebaceous glands**

Accessory structures

The accessory structures of the skin, which make up the rest of the integumentary system, include hair, glands and nails

Hair

Hair consists of a shaft, root cuticle and hair follicle. The development of new hairs is from cell division of the matrix in the bulb. Associated with hair are sebaceous glands, arrectores pilorum muscles and root plexuses. The functions of hair are protection, reducing heat loss and light touch sensation.

Glands

Three types of gland are associated with skin: sebaceous, sudoriferous and ceruminous.

Sebaceous glands are associated with hair follicles and produce sebum, which moistens hair, waterproofs and moistens the skin and helps inhibit bacterial growth. Acne is a result of inflamed sebaceous glands.

Sudoriferous glands are sweat glands. There are two types of sudoriferous glands: **Ecrine** and **apocrine**.

- **Ecrine** gland ducts terminate at pores at the surface of the epidermis. Their primary function is to help regulate body temperature through evaporation, but they also help to eliminate waste products such as urea.
- **Apocrine** gland ducts open into hair follicles, and they are found only in the skin of the axilla, pubis and areolae

Ceruminous glands produce a waxy substance called cerumen. They are found in the external auditory meatus

Nails

Nails are keratinised epidermal cells. They are produced by cell division of the matrix cells. They provide protection to the end of the digits, as well as helping the hands to manipulate and grasp objects.

Functions of the skin

The skin acts as a barrier against microbial invasion and chemical damage to the delicate deeper tissues and cells. It protects against mild trauma, sunlight damage and excessive dehydration, as well as acting as a waterproofing agent. The skin plays a role in thermoregulation via the skin liberating sweat at its surface by adjusting the blood flow in the dermis. The skin also has cutaneous sensation and plays a minor role in the excretion and the synthesis of vitamin D.

Activity 1.2



Activity 1.1

Thermoregulation is an important function of the skin, in order to maintain homeostasis and therefore life. Read over the section in Tortora and Grabowski (pp).

Next make notes on the role of various structures in thermoregulation. The first one is done for you

Response to cold (detected by Hypothalamus)

Muscles- *contract and relax rapidly (shivering), creating five times as much heat as resting muscles*

Hair-

Arterioles-

Adrenal glands-

Response to heat (physiological)

Arterioles-

Sweat glands-

Time required: (30 -60 minutes)

Feedback

As you will have found the various structures work together in order to maintain a constant body temperature within a narrow range.

Self-assessment questions



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1. Identify the different layers of the skin and write a brief description of the structure and function.
2. Identify different cells found within the skin and describe their function.
3. Label the following plates:
 - a. Plate-9