The Skin

home study course
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The Skin

The Skin

Your skin is your largest organ. It covers your entire body and has a surface area of around 2 square metres. Its thickness varies from 0.5mm on your eyelids to 4mm or more on the palms of your hands and the soles of your feet. In total, it accounts for around 16 percent of your body weight.

The Main Functions of the Skin

The main functions of the skin are :-

1) Protection

- Fat cells protect the body against knocks and bangs.
- Stratum corneum against injury (abrasions)
- Acid mantle against bacteria and fungi
- The skin is waterproof so prevents the body from becoming waterlogged and the absorption of invading chemical substances.
- Protects from harmful UV rays from sunshine because melanin is formed in melanocytes in the basal cell layer.

2) Temperature Regulation

Your skin's blood vessels, sweat glands and hairs play a crucial role in regulating your body temperature. When you need to cool down

- Your blood vessels widen and allow heat to escape through your skin
- You start sweating, and as your sweat dries, it uses heat from your skin and cools you down
- Your hairs lie flat to make sure little warm air doesn't get trapped between your skin and your hairs

When you need to retain heat, the opposite happens, your blood vessels narrow, you produce less sweat and your hairs stand up on end to trap warm air around your body.

3) Absorption

The skin is able to absorb small amounts of oily substances and some water-soluble substances.

4) Secretion

The sebaceous gland secretes an oily substance, which is good for keeping the skin and hair soft and protecting the skin from bacteria.
5) Excretion

The body (skin) through the sweat pore – 99% water and 1% waster, urea, salt and other impurities

6) Sensory organ

The skin contains various nerve endings, which can detect: cold, heat, pressure, pain and touch found in various levels of the dermis.

7) Production of vitamin D

Ultra violet rays from the sunshine changes a chemical called “dehydrocholesterol” into vitamin D; this passes into the blood that is important for the growth of teeth and bones (with calcium).

The Epidermis

The epidermis is made up of five layers.

- Stratum corneum - horny layer
- Stratum lucidum - transparent layer
- Stratum granulosum - granular layer
- Stratum spinosum - prickle cell layer
- Stratum germinativum - basal layer

The thickness varies all over the body, i.e. the eyelids being the thinnest and the soles of the feet being the thickest.

Stratum germinativum and the Stratum spinosum are the active areas of cell renewal, where as the others are the upper area where cells are changing from living to dead, i.e. a living cell containing nucleus changes to dead horny flat cells with no nucleus. These are constantly shed from the surface of the skin.

Basal Layer – Stratum Germinativum

The deepest layer of the epidermis, its lower surface is attached to the dermis. From the dermis it receives nutrient fluid from the blood vessels. In this layer mitosis (new cells) occurs. As the new cells are produced the older cells are gradually displaced towards the surface. Also melanin is formed in this layer, which is the skins natural protection against harmful effects from UV light, it is also responsible for tanning when exposed to the sun.
Prickle Cell Layer - Stratum Spinosum

These cells are immediately above the basal layer. Nourishment from the protoplasm or tissue fluid is received through fine threads or filaments, which connects the cells. Keratinization starts in this layer – where a living cell containing nucleus changes to flat cells composed of hard durable protein.

Granular Layer – Stratum Granulosum

Cells become flattened, as this is the final stage of keratinization takes place here. The nucleus begins to disintegrate – loss of fluid that contributes to the transformation of cells into keratin. This is a tough fibrous protein.

Transparent Layer – Stratum Lucidum

No nucleus is in these cells, which are transparent packed, small and tight. Thought to be the barrier zone controlling transmission of water through the skin. This layer is between the horny layer and the granular layer.

Horny Layer – Stratum Corneum

The superficial layer is constantly being shed. The cells below contain an epidermal fatty substance which helps keep the skin waterproof and prevent the skin tissue from cracking and letting bacteria in which would cause infection. There are several layers of keratinised cells packed tightly together.
Cell regeneration of the epidermis

Cells in the deepest layer, the stratum germinativum or basal layer, of the epidermis divide constantly by the process called mitosis to make new cells.

The new cells are pushed towards the surface of your skin. In the prickle-cell and granular layer, the cells are transformed by a process called keratinisation, here the cells die and are filled with tough fibrous protein called Keratin.

Keratin provides your body with a durable overcoat, which protects deeper cells from damage, infection and drying out.

Special cells called melanocytes which produce, melanin are present at the basal, prickle-cell and granular layers of the epidermis. Melanin is injected into neighbouring cells and is responsible for the colour of the skin and hair and helps protect the skin from UV damage.

The dead cells are push up towards the surface. The cells on the surface of your skin rub and flake off steadily and are continuously replaced with new ones. About every 30 days, your body produces a totally new epidermis.

Effects on the skin

Age

The process of ageing affects the skin and it’s condition, as we get into the mid thirties, the skin starts to lose it’s firmness and line fines and wrinkles appear. In our forties and fifties the wrinkles and lines deepen. The connective tissue begins to lose it’s elasticity and becomes less firm. Loss of muscle tone means that the skin begins to sag, especially around the cheeks and neck. As we get older cell regeneration slows, and the skin becomes thinner, and appears drier and dull.

Sunlight

Sunlight, particularly UVA ultraviolet light and be dangerous for the skin, as it can prematurely age the skin. It penetrates deep into the dermis, where highly reactive molecules call free radicals are formed which cause skin cells to degenerate and lose their elasticity. UVB can cause sunburn, where the skin becomes red and inflamed, and it may blister. UVB is also implicated in skin cancer, particularly malignant melanoma.
Chemicals

Alkaline chemicals in some detergents and soaps can strip the sebum from the skin’s surface. This can cause a loss of moisture and can lead to dry flaky skin.

Medication

Medication may have side effects with respect to the skin that can cause dehydration, oedema, sensitivity and/or an allergic reaction.

The environment

Air pollution, such as carbon from car exhausts, chemicals from factories are absorbed into the skin, breaking down it’s acid mantle and protective properties, leaving the skin vulnerable and potentially damaging the skin’s cells.
Layers of the skin

Layers of the Skin Diagram
The Dermis

The dermis is the supportive layer for the epidermis.

The primary function of the dermis is to provide nourishment to the epidermis and to give to give a supportive framework to the tissues.

The dermis is composed of highly elastic, tough, flexible connective tissue; this creates the contour, strength, elasticity and smoothness of the skin. Being highly sensitive and fibrous, comprised of:

Collagen – provides support to the skin.

Fibroblast cells – these are responsible for manufacturing collagen and a lesser degree of elastin.

Elastin – gives the skin resilience and elasticity.

The dermis also contained:

- Papillary muscles
- Nerve endings
- Blood and lymph vessels
- Hair follicles
- Sweat and sebaceous gland

The dermis having higher water content than other areas of the skin, it also provides nourishment to the epidermis. The dermis has two layers:

Upper papillary layer

Upper papillary layer:

- Irregular in shape with protrusions into the epidermis called papillae.
- Several nerve endings including: touch, pain, heat, cold and pressure, these have delicate branched nerve endings.
- Fine capillaries – carry away waste products, bring nourishment and oxygen to the skin. Important and active part of the skin.
Deep reticular layer

Deep reticular layer:

- Found below the papillary layer.
- Tough, elastic collagen fibres interwoven with elastic fibres in this layer. Responsible for general tone and elasticity of the skin.
- Sweat and sebaceous glands, also the arrector pili muscle, bundles of small involuntary muscles fibres, which are attached to the hair follicles.
- Fine veins and arteries passing through this area, linking up with the papillary capillaries.
- Lymph vessels also form a network through the dermis allowing removal of waste from the skin.

Arrector Pili Muscle

Cold, aggression or fright stimulates this muscle and causing it to contract. Pulls the hair follicle to and causes the hair to stand up right. The muscle is attached at an angle to the base of the follicle.

Sweat and Sebaceous glands

The Sebaceous glands are situated in the dermis opening into the hair follicle and are found all over the body. More numerous in the scalp area, on the face particularly around the forehead, chin, cheeks and nose. The glands secrete sebum, the skin’s natural moisturiser – can also attract dirt on skin and trapping it there, causing comedones, pustules and papules. The skin is sometimes also unable to produce enough sebum (asteatosis) causing dry patches and irritation may occur. When the skin produces excess sebum (seborrhea) the skin takes on a very oily appearance.

Sweat glands (sudoriferous) are a tube like duct which rises through the epidermis ending at the skin’s surface to form a sweat pore, consist of a coiled base emanating from the deeper layers of the dermis. There are two forms of these;

Eccrine glands

Are found all over the body, having a duct and a pore through which secretions are brought to the skin’s surface.
Apocrine glands

Are connected with hair follicles and are found in the areas of; breast, genital and underarm. The glands secrete fatty substances as well as salt and water, which reacts to the air and causes what is know as body odour.

Nerve Endings

In the dermis there are several different types of sensory nerve endings, e.g. pain, pressure, heat, cold, touch temperature. The look of these nerve endings is varied. Sending messages to the central nervous system and the brain, letting us know what is going on outside the body and the skin surface.

Hair Follicles

Downward growths into the dermis of the epidermal tissue. Found all over the body except on the lips, soles of the feet and the palm of the hands. Each hair follicle has a cluster of cells called germinal matrix at the base. Reproduce to form lower part of the hair (bulb). Supplied with nerves and blood vessels. The hair papillae, nourishes the cells. Cells move up the follicle from the hair bulb, changing in structure and forming a hair. The follicle is attached to the base of the epidermis by the arrector pili muscle.

The Subcutaneous Layer

The subcutaneous layer is thicker in women than in men, that is why women have more rounded contours than men.

The main functions of the subcutaneous layer is :-

- It supports delicate structures such as blood vessels and nerve endings.
- It contains the major arties and veins which supply the skin with blood and nutrients.
- It is an area where fat is formed and stored. Fat is a poor conductor of heat, thus the subcutaneous layer helps to reduce the loss of heat through the skin and so keep the body warm.

The subcutaneous layer consists of:

- Areolar tissue – elastic fibres, helping to make this layer elastic and flexible.
- Adipose tissue – containing fat cells.
Skin colour

Your skin contains specialised cells called melanocytes. They produce melanin, a brown substance, which absorbs some of the Sun’s harmful ultraviolet rays. Fair-skinned people only have melanin in the lower layers of their epidermis. People with dark skin have larger amounts of melanin in all layers. Freckles and moles are nothing else but small patches of skin with more melanin than in the surrounding area.

Wrinkles

As you age, the number of collagen and elastic fibres in your dermis decreases. Additionally, you lose fat from the tissue under your skin. As a result, your skin becomes less elastic and begins to sag and wrinkle.

Cell Metabolism

Metabolism refers to the chemical reactions that take place in a cell. These are catabolism or anabolism.

- Catabolism is the chemical reactions that take place within a cell to break down nutrients received into their simplest forms for the production of energy and subsequent waste products.

- Anabolism refers to the chemical reactions that take place within a cell to produce new parts of the cell.

Mitochondria are organelles within the cell that provide the cell’s ATP (adenosine triphosphate) which is the compound which stores the energy required by the cell. Cellular respiration provides the oxygen required for cellular metabolism to take place, and enzymes, which are proteins work with the mitochondria to speed up the chemical reaction. Two of the waste products produced are carbon dioxide and water.

Cellular respiration is the controlled exchange of the gases oxygen and carbon dioxide. Oxygen is absorbed through the cell’s semi permeable membrane. Oxygen allows the chemical reaction to take place and carbon dioxide and water are a waste products that are passed out of the cell through it’s semi permeable membrane.