**03. The Skin**

The skin is an outer protective layer, also known as an integument.

The skin is the largest organ. It covers the whole body and is water-resistant. There are two main layers: the epidermis and the dermis. The skin has many functions including protecting and shaping the body.

**TOPIC 1: STRUCTURE**

**WHAT IS THE EPIDERMIS?**

The epidermis is the layer of skin that we can see. It varies in thickness, depending on the part of the body e.g. it is thickest on the soles of the feet and palms of the hand and thinnest on eyelids and nipples. The cells on the surface are constantly coming off (shedding): this is called desquamation. They are also constantly replaced from below as cells in the basal layer of the epidermis multiply and are pushed up to the surface. The basal layer of the epidermis receives its blood supply, nutrients and fluids from the dermis. In total there are five layers in the epidermis.

**STRUCTURE OF EPIDERMIS**

1. **Stratum corneum - surface**

* hardened, Flattened dead cells
* constantly being shed - desquamation
* cell membrane is not visible.

1. **Stratum lucidum - clear layer**

* denucleated cells but not completely hard
* most easily visible under a microscope (only on palms and soles)
* cell membranes becoming less visible

1. **Stratum granulosum - granular layer**

* cells have a distinct nucleus but cell membranes are dying
* contains granules which are visible in healing tissue after trauma.

1. **Stratum spinosum - prickle cell layer**

* cells are living and membranes are intact; they have fibrils which interlock
* capable of mitosis under friction or pressure i.e. on soles of feet or palms of hands.

1. **Stratum germinativum - basal layer**

* the primary site of cell division/ reproduction (mitosis) in the skin
* cells are living. It is in this layer that cells are made. They take about 28-30 days to move up from here through the five layers of the epidermis before being shed.
* this layer contains a pigment known as melanin that gives skin its natural colour, whether red, yellow or black. Melanin is produced by cells called melanocytes.

**WHAT IS THE DERMIS?**

The dermis is commonly known as the true skin. Unlike the epidermis, this layer is connected to the blood and lymph supply as well as the nerves. The dermis contains sweat and sebaceous glands, hair follicles and many living cells. It is made of connective tissue, mainly areolar tissue which is tough and elastic, and contains white collagen fibres and yellow elastic tissue known as elastin. Collagen plumps the skin and elastin keeps it supple and elastic. Both diminish with age.

The dermis contains eight main types of structure:

1. **Specialised cells**

* **Fibroblasts:** responsible for the production of areolar tissue, collagen and elastin. Fibroblasts can be damaged by ultraviolet light.
* **Mast cells:** produce histamine as an allergic response and heparin, an anti-coagulant
* **Histiocytes:** also produce histamine
* **Leucocytes:** white blood cells which help to fight infection and disease.

1. **Nerve endings:**

* alert the brain and thus the body to heat, cold, pressure and pain
* part of the defence system of the body.

1. **Sweat glands**

Sweat glands which stretch from deep in the dermis to the outer layer of the epidermis. Sweat contains mainly water, urea and salts (mostly sodium chloride), and is produced by two kinds of gland:

* **eccrine:** these excrete watery sweat and control body temperature, and are found all over the body, but especially on the palms of the hands and the soles of the feet.
* **apocrine:** these are found in the groin and axillae (armpits), and excrete a milky fluid which, when it mixes with bacteria on the surface of the skin, produces body odour.

1. **Hair follicles:**

* travel through the epidermis and the dermis.
* tiny muscles, called erector pili, are attached to each hair and help with the temperature control of the body by pulling the hair upright and trapping a layer of air- goose pimples.

1. **Sebaceous glands:**

* connected with hair follicles, and produce sebum, a fatty acid which keeps the skin moist and which lubricates the hair shaft. They are therefore found in hairy areas, not on the palms of the hands or soles of the feet.
* sweat and sebum combine on the surface of the skin to form the acid mantle, a protective shield which helps to control bacteria levels and prevents infections and disease and also acts as a natural moisturiser. The pH balance of the skin is 4.5-5.6 and this acid environment helps to prevent bacterial growth.

1. **Blood supply:**

* A system of blood vessels including microscopic capillaries which are one cell thick.

1. **Lymphatic capillary:**

* Works in conjunction with the blood supply to carry waste products away from the area.

1. **Papilla:**

* Small conical projections at the base of the hair
* Contain blood vessels and nerves which supply the hair with nutrients.

**TOPIC 2: FUNCTIONS**

**SECRETION**

The skin secretes sebum from the sebaceous glands. This fatty substance lubricates the hair shafts and when combined with perspiration on the surface of the skin, it creates a natural moisturiser which acts as a protective barrier against bacteria.

**HEAT REGULATION**

Body temperature is maintained in healthy humans at 37Ž (98.6‹F). Organs involved in heat production are the muscles, liver and digestive organs. Heat is absorbed and maintained in the subcutaneous layer of adipose tissue. Heat regulation is controlled in the following ways:

* **Cooling**

**Vasodilation:** when the body becomes hot, the capillaries dilate allowing more blood to reach the surface of the skin. The pores dilate allowing the heat to be lost from the body. This causes the skin to flush -this is known as hyperaemia. Sweating will occur simultaneously and the evaporation of perspiration from the surface has a cooling effect on the body.

* **Warming**

**Vasoconstriction:** when cold, the body protects itself by moving blood from the extremities to the major organs, thus ensuring that they are kept warm. With the blood diverted to the deeper parts of the body, the capillaries contract as do the pores. As a result, the skin appears pale and heat loss is inhibited.

The erector pili muscles contract, causing body hair to stand on end, trapping air against the surface of the skin, which is then warmed by body heat. Shivering occurs, caused by rapid and repeated muscle contractions which work to raise body temperature.

**WHAT DOES BEING SHED MEAN**

If you look around any room you will see dust. Dust, amongst other things, contains millions of shed, or desquamated skin cells that have fallen off the body. Whereas dead blood cells are destroyed inside the body, dead skin cells are destroyed outside the body that is on the outer layer, the skin. Once they are dead, they exfoliate - peel off. This is known as desquamation. Try rubbing your skin when it is very dry and you will see small particles coming away from the surface. These are dead skin cells.

**ABSORPTION**

The skin is a waterproof covering but some chemical substances, such as drugs and essential oils, can penetrate the skin through the layers, the hair follicles and sweat glands. The amount of penetration is affected by the health and condition of the skin.

**PROTECTION**

The skin acts as a barrier to the body’s invasion by micro-organisms like bacteria. The naturally acid pH of the skin’s surface inhibits bacterial production. Splits, cuts, tears and irregularities caused by disease or disorder increase the risk of infection. Melanin, the pigment produced by the melanocytes in the basal layer of the epidermis, has a protective function. It helps to protect against ultraviolet light damage to tissues. Sensory nerve endings found at differing levels in the dermis warn of possible trauma and, by reflex action, prevent greater damage to the body.

**ELIMINATION**

Some toxins are eliminated from the body through the skin via the sweat glands. The toxins normally take the form of waste salts and water.

**SENSATION**

Specialised nerve endings found in the dermis make the body aware of its surroundings. They warn of pain, cold, heat, pressure and touch. Different receptors lie at different levels in the skin. Pain and touch receptors are closer to the surface. All receptors warn of and help prevent trauma to the skin and underlying structures.

**VITAMIN D FORMATION**

Vitamin D is essential for the formation and maintenance of bone. Vitamin D production is stimulated by ultraviolet light which converts 7-dehydro-cholesterol in the sebum into vitamin D. This circulates in the blood and any excess is stored in the liver. Lack of Vitamin D can result in rickets in children.

**MELANIN FORMATION**

In the sun, the hormone MSH stimulates the melanocytes in the basal layer of the epidermis to produce melanin, a substance which produces a darkening of the skin to protect the underlying structures. The pigment protects the body from harmful effects of the sun’s rays since dark colours absorb radiation.

**DID YOU KNOW?**

The skin is the largest organ in the human body. If you stretched it out flat it would measure from eleven to eighteen square metres in area and total about 12% of the weight of a human.

**TOPIC 3: DISEASES AND DISORDERS (PATHOLOGIES)**

**CONGENITAL**

* **Eczema:** found all over the body but most often on the inside of the knee (in the popliteal space) and elbow joints, on the face, hands and scalp. The skin becomes extremely dry and itchy causing great discomfort. Skin has scaly dry patches with bleeding at points. Not contagious.
* **Psoriasis:** chronic inflammatory skin disease characterised by red patches covered with silvery scales that are constantly shed. Size of scales vary from minute spots to quite large sheets of skin. Points of bleeding may occur beneath scales. Affects whole body or specific areas, like face and scalp. Not infectious.

**BACTERIAL**

* **Acne rosacea:** gives a flushed, reddened appearance. Occurs on the face, this condition can be aggravated by anything causing vasodilation - heat, sunshine, spicy food, alcohol, cold. Affects both men and women especially menopausal women. Not related to acne vulgaris. Not contagious.
* **Acne vulgaris:** normally caused by hormonal imbalances which increase sebum production leading to blocked glands and infection. The skin has a shiny, sallow appearance with papules, pustules and comedones. It is prone to open pores. Where pustules have cleared there is often pitting and scarring. The main sites for infection are the face, back, chest and shoulders. Not contagious.
* **Boils:** a bacterial infection of the skin, causing inflammation around a hair follicle.
* **Carbuncles:** Is a skin infection that often involves a group of hair follicles. The infected material forms a lump which occurs deep in the skin.
* **Folliculitis:** bacterial infection of the pilosebaceous duct (sebaceous gland and hair follicle) causing inflammation. Common in adolescence. Possible link with acne vulgaris.
* **Impetigo:** a bacterial infection causing thin-roofed blisters which weep and leave a thick, yellow crust. Highly contagious.

**VIRAL**

* **Warts:** a small horny tumour found on the skin, often on fingers and thumbs. Caused by viral infection. Highly contagious.
* **Verrucas:** warts found on the feet. Highly contagious.
* **Herpes simplex:** a viral infection commonly known as cold sores; not confined to the mouth, can spread over the face and other parts of the body. Appears as small blisters which if left alone will dry up leaving a crust which falls off. Highly contagious when active.
* **Herpes zoster:** a viral infection commonly known as shingles. Adult form of chicken pox. Usually affects spinal nerves and one side of the thorax. Highly contagious.

**FUNGAL**

* **Tinea corporis, pedis:** infections which attach themselves to keratinised structures like the skin. Tinea corporis is commonly known as ringworm and can be found anywhere on the body. Tinea pedis is commonly known as athlete’s foot. Highly infectious.

**PARASITICAL INFESTATION**

* **Pediculosis:** The infestation with lice resulting in severe itching. This can occur on the head (capitis), body (corporis) and pubic (pubis) areas.
* **Scabies:** A contagious skin infection caused by the itch mite; characterized by persistent itching and skin irritation

**DID YOU KNOW?**

The colour of your hair is affected by the amount of melanin in your body. For example, grey hair is caused by a decrease in melanin production. Instead of the pigment (providing colour), there are air bubbles in the hairs and to the naked eye the hair now looks grey.

**PIGMENTATION DISORDERS**

* **Dermatosis Papulosa Nigra:** Is a condition of many small, benign skin lesions, characterized by dark-brown papular lesions on the face and upper body, mainly found on a black skin.
* **Papilloma:** A benign epithelial tumour forming a rounded mass.
* **Vitiligo:** a complete loss of colour in well-defined areas of the face and limbs. A form of leucoderma (an abnormal whiteness of the skin due to absence of pigmentation); begins in patches but may converge to form fairly large areas; most obvious in darker skins.
* **Albinism:** complete lack of melanocytes resulting in lack of pigmentation in skin, hair and eyes. Sufferers have poor eyesight and extreme ultraviolet sensitivity. This is an inherited condition.
* **Chloasma:** butterfly mask often caused by pregnancy and the contraceptive pill; a hyper pigmentation condition involving the upper cheeks, nose and occasionally forehead. Discolouration usually disappears spontaneously at the end of pregnancy.
* **Ephelides:** freckles; small pigmented areas of skin which become more evident on exposure to sunlight and are found in greatest abundance on the face, arms and legs; fair-skinned individuals suffer most from the condition.
* **Lentigo:** also known as liver spots; dark patches of pigmentation which appear more distinct than freckles and have a slightly raised appearance and more scattered distribution.
* **Moles (papilloma):** a common occurrence on the face and body and present in several different forms, varying in size, colour and vascular appearance. Flat moles are called sessile whilst those raised above the surface, or attached by a stalk are pedunculated.
* **Naevae:** birth mark; if pigmented may occur on any part of the body and are often found on the neck and face, being sometimes associated with strong hair growth. Vary in size from pinhead to several centimetres and in rare cases may be extremely large. Pigmentation varies from light brown to black. Strawberry naevae (pink or red birth marks) often affect babies, eventually disappearing after a few years.
* **Port wine stain:** a large area of dilated capillaries causing a pink to dark red skin colour which makes it contrast vividly with the surrounding skin. The stain is commonly found on the face.

**GENERAL**

* **Blisters:** An elevation of the skin filled with serous fluid.
* **Cyst:** Is a closed sac having a distinct membrane and division on the nearby tissue. It may contain air, fluids, or semi-solid material.
* **Keloid scars:** Is a type of scar which results in an overgrowth of tissue at the site of a healed skin injury. Keloids are firm, rubbery lesions or shiny, fibrous nodules and can vary in colour.
* **Striae:** Are also known as stretch marks.
* **Verrucae filliformis:** Are soft, small, flesh-coloured skin flaps on the neck, armpits, or groin which are often known as skin tags.
* **Xanthomas:** Is a deposit of yellowish cholesterol-rich material in tendons and other body parts.
* **Burns:** An injury caused by exposure to heat, flame or friction leaving a sore mark on the skin.
* **Cellulitis:** An inflammation of body tissue (especially that below the skin) characterized by fever, swelling, redness and pain.
* **Methicillin-resistant Staphylococcus aureus (MRSA):** A serious and potentially fatal infection caused by Staphylococcus aureus bacteria (often called "Staph") that is resistant to the broadspectrum antibiotics commonly used to treat it.
* **Pressure sores / bed sores:** Ulcers that occur on areas of the skin that are under pressure from lying in bed, sitting in wheelchairs, wearing a cast, or being immobile fora long period of time.
* **Broken capillaries:** dilated capillaries on a fine skin texture often affecting large areas of the face. The skin responds fiercely to stimulation and permanent dilated vessels are apparent, particularly on the upper cheeks and nose. Ruptured blood vessels assume a line-like appearance in surface tissues and can become bulbous and blue in colour due to the congestion in the blood vessels of the area.
* **Crow’s feet:** fine lines around the eyes caused by habitual expressions and daily movement, associated with ageing of muscle tissue. Premature formation may be due to eye strain and is often associated with oedema (swelling) around and under the eyes.
* **UV damage:** UV rays stimulate rapid production of basal cells. This causes the stratum corneum to thicken. Over- exposure to UVA may cause premature ageing whereas over-exposure to UVB may cause skin cancer.
* **Urticaria -** hives, nettle rash: often an allergic reaction. Characterised by weals or welts of pinkish colour produced by extreme dilation of capillaries. Very itchy. Can lead to secondary infection by bacteria through scratching.
* **Allergic reaction:** when irritated, the body produces histamine (part of the defence mechanism) in the skin. This can cause red, blotchy patches on skin, watery, stinging eyes, swellings and runny nose. Can be slight or intense, depending on each body’s reaction.
* **Comedones:** commonly known as blackheads, these are caused by a build-up of sebaceous secretions which have become trapped in the hair follicles and have subsequently dried out and hardened. The colour comes from oxidation. Common in puberty.
* **Dermatitis:** an allergic inflammation of the skin characterised by erythema - redness of the skin, itching and various skin lesions. Commonly known as contact dermatitis, there are many causes including plants, drugs, clothing, cosmetics and chemicals. Not contagious.

* **Milia:** commonly present as tiny white bumps or whiteheads, these form when sebum becomes trapped in a blind duct with no surface opening. The condition is most common on dry skin and milia appear on the obicularis oculi muscle area and between the eyebrows. Milia can form after injury, e.g. sunburn on the face or shoulders, and are sometimes widespread.

**SUDIFEROUS GLAND DISORDERS –**

* **Bromidrosis/osmidrosis:** Fetid or foul-smelling perspiration which is caused by decomposition of the sweat and cellular debris by the action of bacteria and yeasts.
* **Anhidrosis:** The reduced ability or inability to sweat.
* **Hyperhidrosis:** Is the condition characterized by abnormally increased perspiration.

**SKIN CANCER**

* **Basal cell carcinoma**

Occurs on exposed parts of the skin, especially face, nose, eyelid, cheek.

* **Squamous cell carcinoma**

Squamous cells are those found on the surface of the body, on the top layer of the skin.

Squamous cell carcinoma is said to be caused by sunlight, chemicals or physical irritants. It starts very small but grows rapidly, becoming raised.

* **Malignant melanoma**

A malignant tumour of melanocytes. It usually develops in a previously benign mole. The mole has become larger and darker, ulcerated and the tumour eventually spreads.

**Summary**

**The skin:**

* Skin is composed of two layers, the epidermis and the dermis
* The skin has eight functions: secretion; heat regulation; absorption; protection; elimination; sensation; Vitamin D production; melanin production.
* The skin is affected by seven different types of disease: congenital; bacterial; viral; fungal; pigmentation disorders and skin cancers and other general conditions