Background Knowledge

- This section covers the basic knowledge of normal skin structure and function required to help understand how skin diseases occur.

Learning outcomes:

1. **Ability to describe the functions of normal skin**
2. **Ability to describe the structure of normal skin**
3. **Ability to describe the principles of wound healing**
4. **Ability to describe the difficulties, physical and psychological, that may be experienced by people with chronic skin disease**

Functions of normal skin

- These include:
    - i) Protective barrier against environmental insults
    - ii) Temperature regulation
    - iii) Sensation
    - iv) Vitamin D synthesis
    - v) Immunosurveillance
    - vi) Appearance/cosmesis

Structure of normal skin and the skin appendages

- The skin is the largest organ in the human body. It is composed of the epidermis and dermis overlying subcutaneous tissue. The skin appendages (structures formed by skin-derived cells) are hair, nails, sebaceous glands and sweat glands.

Epidermis

- The epidermis is composed of 4 major cell types, each with specific functions (Table 11).

Table 11. Main functions of each cell type in the epidermis

Cell types	Main functions
Keratinocytes	Produce keratin as a protective barrier
Langerhans' cells	Present antigens and activate T-lymphocytes for immune protection
Melanocytes	Produce melanin, which gives pigment to the skin and protects the cell nuclei from ultraviolet (UV) radiation-induced DNA damage
Merkel cells	Contain specialised nerve endings for sensation

- There are 4 layers in the epidermis (Table 12), each representing a different stage of maturation of the keratinocytes. The average epidermal turnover time (migration of cells from the basal cell layer to the horny layer) is about 30 days.

Table 12. Composition of each epidermal layer

Epidermal layers	Composition
Stratum basale *(Basal cell layer)*	Actively dividing cells, deepest layer
Stratum spinosum *(Prickle cell layer)*	Differentiating cells
Stratum granulosum *(Granular cell layer)*	So-called because cells lose their nuclei and contain granules of keratohyaline. They secrete lipid into the intercellular spaces.
Stratum corneum *(Horny layer)*	Layer of keratin, most superficial layer

- In areas of thick skin such as the sole, there is a fifth layer, stratum lucidum, beneath the stratum corneum. This consists of paler, compact keratin.

- Pathology of the epidermis may involve:
  a) changes in epidermal turnover time - e.g. psoriasis (reduced epidermal turnover time)
  b) changes in the surface of the skin or loss of epidermis - e.g. scales, crusting, exudate, ulcer
  c) changes in pigmentation of the skin - e.g. hypo- or hyper-pigmented skin

Dermis

- The dermis is made up of collagen (mainly), elastin and glycosaminoglycans, which are synthesised by fibroblasts. Collectively, they provide the dermis with strength and elasticity.
- The dermis also contains immune cells, nerves, skin appendages as well as lymphatic and blood vessels.
- Pathology of the dermis may involve:
    a) changes in the contour of the skin or loss of dermis e.g. formation of papules, nodules, skin atrophy and ulcers
    b) disorders of skin appendages e.g. disorders of hair, acne (disorder of sebaceous glands)
    c) changes related to lymphatic and blood vessels e.g. erythema (vasodilatation), urticaria (increased permeability of capillaries and small venules), purpura (capillary leakage)

Hair

- There are 3 main types of hair:
    a) lanugo hair (fine long hair in fetus)
    b) vellus hair (fine short hair on all body surfaces)
    c) terminal hair (coarse long hair on the scalp, eyebrows, eyelashes and pubic areas)
- Each hair consists of modified keratin and is divided into the hair shaft (a keratinized tube) and hair bulb (actively dividing cells, and melanocytes which give pigment to the hair).
- Each hair follicle enters its own growth cycle. This occurs in 3 main phases:
    a) anagen (long growing phase)
    b) catagen (short regressing phase)
    c) telogen (resting/shedding phase)
- Pathology of the hair may involve:
    a) reduced or absent melanin pigment production e.g. grey or white hair
    b) changes in duration of the growth cycle e.g. hair loss (premature entry of hair follicles into the telogen phase)
    c) shaft abnormalities

Nails

- The nail is made up of a nail plate (hard keratin) which arises from the nail matrix at the posterior nail fold, and rests on the nail bed.
- The nail bed contains blood capillaries which gives the pink colour of the nails.
- Pathology of the nail may involve:
    a) abnormalities of the nail matrix e.g. pits and ridges
    b) abnormalities of the nail bed e.g. splinter haemorrhage
    c) abnormalities of the nail plate e.g. discoloured nails, thickening of nails

Sebaceous glands

- Sebaceous glands produce sebum via hair follicles (collectively called a pilosebaceous unit). They secrete sebum onto the skin surface which lubricates and waterproofs the skin.
- Sebaceous glands are stimulated by the conversion of androgens to dihydrotestosterone and therefore become active at puberty.
- Pathology of sebaceous glands may involve:
    a) increased sebum production and bacterial colonisation e.g. acne
    b) sebaceous gland hyperplasia

Sweat glands

- Sweat glands regulate body temperature and are innervated by the sympathetic nervous system.
- They are divided into two types: eccrine and apocrine sweat glands.
- Eccrine sweat glands are universally distributed in the skin.
- Apocrine sweat glands are found in the axillae, areolae, genitalia and anus, and modified glands are found in the external auditory canal. They only function from puberty onwards and action of bacteria on the sweat produces body odour.
- Pathology of sweat glands may involve:
    a) inflammation/infection of apocrine glands e.g. hidradenitis suppurativa
    b) overactivity of eccrine glands e.g. hyperhidrosis

Principles of wound healing

- Wound healing occurs in 4 phases: haemostasis, inflammation, proliferation and remodelling (Table 13).

Table 13. Stages of wound healing

Stages of wound healing	Mechanisms
Haemostasis	● Vasoconstriction and platelet aggregation ● Clot formation
Inflammation	● Vasodilatation ● Migration of neutrophils and macrophages ● Phagocytosis of cellular debris and invading bacteria
Proliferation	● Granulation tissue formation (synthesised by fibroblasts) and angiogenesis ● Re-epithelialisation (epidermal cell proliferation and migration)
Remodelling	● Collagen fibre re-organisation ● Scar maturation