Anatomy and Physiology of the Skin

CHAPTER 1

The skin or integumentary system functions as an important shield for the body, ensuring its survival using a range of protective mechanisms. Without skin and its protective mechanisms, the human being would not survive. The skin's constant visibility allows it to reflect both our emotional and physiological states, such as blushing or cyanosis (Stephens 2021). Given its constant exposure, the skin is highly prone to diseases and infections, despite its near-complete waterproof nature.

SKIN

HOMEOSTASIS

The skin has a multifaceted role in maintaining homeostasis and safeguarding overall health. Homeostasis refers to the body's ability to maintain stability and balance amidst changing external and internal conditions (Evans 2022). Within the context of the skin, homeostasis manifests in various ways, notably in regulating body temperature. The body is constantly striving to keep its internal environment within a narrow range that is conducive to optimal function. When exposed to heat, such as on a hot day, the skin carefully works to dissipate excess heat through mechanisms such as sweating, thereby preventing overheating and maintaining equilibrium.

The skin appendages are specialised structures derived from the skin itself, each serving a unique purpose. They are integral to the skin's function. Hair follicles, sweat glands and sebaceous glands are among the significant appendages, each contributing to the skin's protective and regulatory functions. Sweat glands, for example, act as a coolant, secreting sweat to cool the body during physical exertion or exposure to high temperatures.

An adult possesses a skin surface area ranging from 1.5 to 2 m^2, weighing roughly 4.1 kg, which surpasses the weight of the brain twofold. Within this vast expanse, an intricate network thrives. There are approximately 4.5 million blood vessels, 3.6 million nerves, 2.6 million sweat glands, 1500 sensory receptors and over 3 million cells undergoing continuous turnover (Peate 2020). Notably, the skin commands a significant portion of the body's circulatory resources, receiving nearly one-third of the total blood flow (McLaughlin 2018).

Moving away from the numbers associated with the skin, the profound influence of the skin on human health and well-being is important. Much like the bricks and mortar of a sturdy house, the skin forms a resilient framework that shields the body from external attacks. The skin fends off environmental hazards and microbial invaders. Its protective competence reaches beyond mere physical barriers, incorporating complex immune mechanisms that safeguard against the harmful effects of pathogens and foreign substances.

The importance of the skin extends beyond safeguarding the body; it serves as a hub of sensory experiences, facilitating tactile sensations and emotional expressions. The delight of a gentle touch and the comfort of an affectionate hug are all facilitated by the skin's intricate

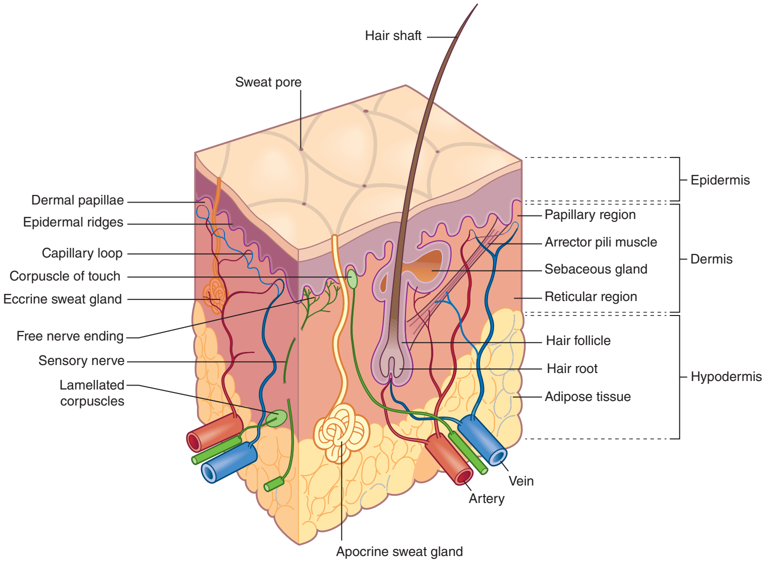

FIGURE 1.1 The skin and associated structures

array of receptors. The skin has the ability to allow a person to experience pleasure, pain and other stimuli from the external environment (Peate 2019).

Any disruption in the skin's integrity can bring on a cascade of physical and psychological repercussions, highlighting its indispensable role in preserving quality of life. Whether it is a minor cut or a long-standing skin condition, the repercussions extend well beyond the skin's surface, impacting our overall well-being.

The skin transcends its superficial appearance; it represents a remarkable feat of biological engineering, intricately integrated into the essence of human existence. Exploring the skin's intricacies further, our appreciation for this steadfast protector grows, as it diligently maintains the body's well-being amid life's constant flux. As we delve deeper into its complexities, we develop a heightened admiration for the skin's resilience as it preserves the body's integrity among life's ever-changing circumstances.

The skin is one of the body's most adaptable organs, comprised of two primary layers: the epidermis and the dermis. Beneath the dermis lies the subcutaneous fascia, also known as the hypodermis. This layer, consisting of loose connective and adipose tissue, attaches to the skin and underlying organs; however, it is distinct from the skin itself (see Figure 1.1).

EPIDERMIS

The outermost layer of the skin is known as the epidermis. It is both superficial and thin, making it the most visible part of the skin. Although the skin envelops the entire body, there are notable regional differences that are associated with flexibility, hair distribution and type, gland density and type, pigmentation, vascularity, innervation and thickness. The thinnest section of skin, for example, is found on the eyelids. This measures just 0.5 mm in thickness, while the thickest aspect is found at the heel, where it reaches 4.0 mm. The epidermis is made up of epithelium called keratinised stratified squamous epithelium and contains four key cell types. These are:

1. Keratinocytes
2. Melanocytes
3. Langerhans cells
4. Merkel cells.

See Figure 1.2.

Keratinocytes Arranged into four layers, these cells play a vital role in synthesising keratin, a durable, fibrous protein that is necessary for shielding the skin and underlying tissues from heat, microorganisms and chemicals. Additionally, the keratinocytes contribute to the skin's water-resistant qualities, serving as a protective barrier that minimises both water ingress and egress. Furthermore, these cells function as a sealant, preventing the infiltration of foreign substances.

Melanocytes During embryonic development, melanocytes produce the pigment melanin, which contributes to the natural colouration of the skin. Melanocytes are most abundant in specific areas of the epidermis, such as the penis, nipples, areola, face and limbs. These cells feature elongated projections that interweave with keratinocytes, facilitating the transfer of melanin granules. Melanin serves a crucial role in shielding the skin from the harmful effects of sunlight.

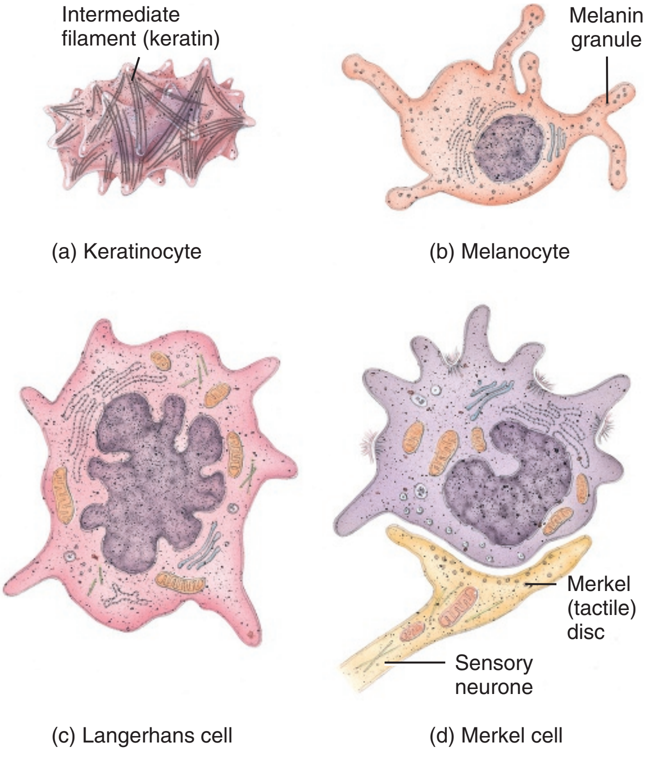

FIGURE 1.2 (a–d). The types of cells in the epidermis

Exposure to excessive sunlight prompts melanocytes to increase melanin production, absorbing more ultraviolet (UV) rays. Consequently, the skin darkens, resulting in a suntanned appearance – an indication of the skin's attempt to protect itself from damage. Although all individuals possess a similar number of melanocytes, those with brown or black skin produce more melanin, accounting for variations in skin colour. This increased melanin production and distribution provides greater natural protection against harmful UV radiation from the sun. Moles, also known as naevi, are clusters of melanocytes closely situated together. Figure 1.3 illustrates variations in skin colour and sensitivity to UV-induced burning.

Langerhans Cells Langerhans cells are integral to the immune system, originating from the red bone marrow. After migrating from the bone marrow to the epidermis, they constitute a small portion of epidermal cells. These cells play a crucial role in regulating immune responses within the skin, serving as a defence against invading microorganisms. However, when exposed to sunlight, the Langerhans cells become delicate, impacting their function. Primarily, Langerhans cells are responsible for processing microbial antigens, which aids in stimulating lymphocytes. Their primary function is to support other immune cells in identifying and responding to microorganisms, ultimately facilitating the destruction of invading pathogens.

	Natural skin colour	UV sensitivity and tendency to burn
1	Very fair, pale white, often freckled	**Highly sensitive** Always burns, never tans
2	Fair, white skin	**Very sensitive** Burns easily, tans minimally
3	Light brown	**Sensitive** Burns moderately, usually tans
4	Moderate brown	**Less sensitive** Burns minimally tans well
5	Dark brown	**Minimally sensitive** Rarely burns
6	Deeply pigmented, dark brown to black	**Minimal sensitivity** Never burns

FIGURE 1.3 Skin colour and sensitivity to ultraviolet (UV)-induced burning

Merkel Cells Merkel cells possess the capacity to establish contact with a flattened process of a sensory neurone, forming a synaptic connection known as a tactile disc or Merkel disc. These Merkel cells, along with the tactile discs, are not very common in the epidermis but are highly skilled at detecting sensations of touch. These cells, along with the tactile discs, which are the least abundant cells in the epidermis, are adept at detecting sensations of touch.

LAYERS OF THE EPIDERMIS

Similar to the two distinct layers of skin, the dermis and epidermis, there are several other layers. These layers gradually form over time and comprise the epidermis. Known as strata, these layers are observable under a microscope (see Figure 1.4).

The superficial and deeper levels of the skin are:

- The stratum basale
- The stratum spinosum
- The stratum granulosum
- The stratum lucidum
- The stratum corneum.

Table 1.1 summarises the layers of the epidermis.

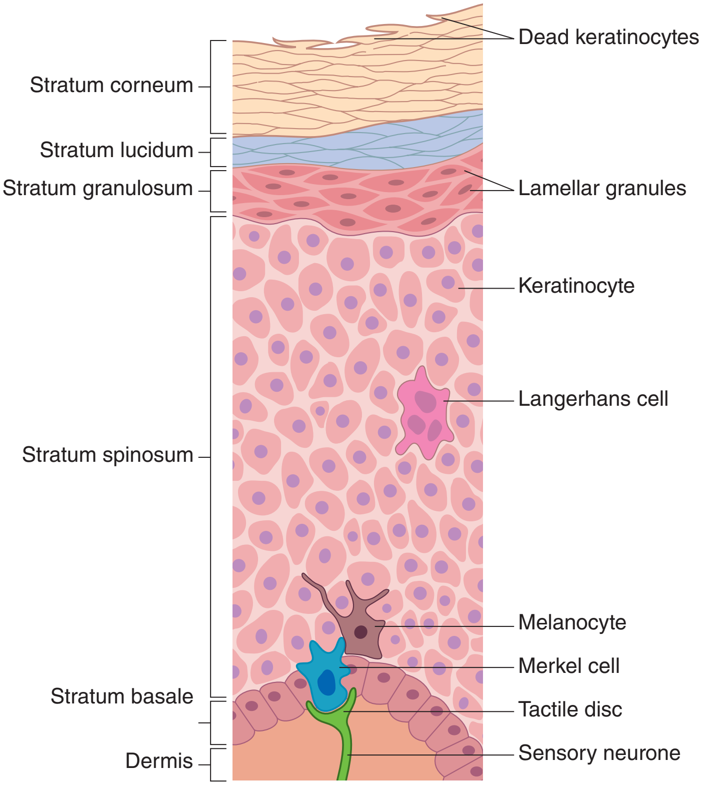

FIGURE 1.4 The layers of the epidermis

Table 1.1 Layers of the epidermis

Epidermal layer	Location	Description
Stratum basale (also known as the basal cell layer)	The deepest layer. It sits directly above the dermis.	Cuboidal cells arranged as a single row; these are constantly dividing and growing. The stratum basale also contains melanocytes and Merkel cells.
Stratum spinosum	Above the stratum basale and below the stratum granulosum.	These keratinocytes are tightly packed and flat and have spine-like projections.
Stratum granulosum	Under the stratum corneum.	Flattened cells arranged in around three to five layers. Protecting the body from losing fluid and from harm. Compact brittle cells as they lose their nucleus.
Stratum lucidum	When present, it is situated between the stratum corneum and the stratum granulosum.	These cells are not present on the soles and palms. The cells have no nucleus and are tightly packed.
Stratum corneum	The most superficial of layers.	Several layers of keratinised, dead epithelial cells. These cells are flattened and have no nucleus.

Stratum Basale The deepest layer of the epidermis, the stratum basale, rests upon the basement membrane, marking the boundary between the dermis and epidermis. Composed of a single row of columnar keratinocytes, it serves as the origin for new skin cells. These stem cells continually divide, generating daughter cells that gradually move upward through the epidermal layers until they reach the surface. This ongoing regeneration process ensures the skin's renewal.

Stratum Spinosum Situated above the stratum basale, the stratum spinosum houses keratinocytes with spiny projections, hence the name 'spinosum'. These keratinocytes are densely packed, providing the skin with strength and flexibility.

Stratum Granulosum Moving towards the surface, the next layer is the stratum granulosum, consisting of three to five layers of flattened keratinocytes. These cells contain granules, including water-resistant lipid granules, which protect against fluid loss and microbial invasion. As pressure from below flattens the cells, they undergo apoptosis, losing their nucleus and becoming compact and brittle in a process called keratinisation. This layer, located beneath the stratum lucidum, contributes to the skin's toughness and readiness for protective functions.

Stratum Lucidum Present below the stratum corneum, the stratum lucidum, or clear layer, consists of five layers of flat, dead cells lacking a nucleus. Found only in areas of thick skin, such as the heels, these tightly packed cells serve as a barrier to fluid loss.

Stratum Corneum The outermost layer of the epidermis, the stratum corneum, comprises approximately 25 layers of overlapping, scale-like dead cells predominantly made of keratin. With most of their fluid content lost, these tough, horny cells are covered in lipids, providing a protective barrier and structural strength. Continual friction leads to the shedding (sloughing off) of this layer, ensuring the skin's renewal.

DERMIS

The dermis, situated beneath the epidermis, constitutes the deepest layer of the skin. Primarily, it consists of dense connective tissue that is rich in collagen and elastic fibres, which houses a number of structures, including:

- Blood vessels
- Nerves
- Lymph vessels
- Smooth muscles
- Sweat glands
- Hair follicles
- Sebaceous glands

The elastic properties of the dermis offer support to the structures above it, which enables the skin to flex during movement and return to its original shape when at rest. Divided into two layers, the dermis comprises the papillary aspect and the reticular aspect. The papillary layers, resembling small projections, significantly increase the dermal surface area and anchor it to the epidermis, giving rise to fingerprints. Meanwhile, the deeper aspect of the dermis connects to the subcutaneous layer. Figure 1.5 illustrates the relationship between the epidermis, dermis and subcutaneous layer.

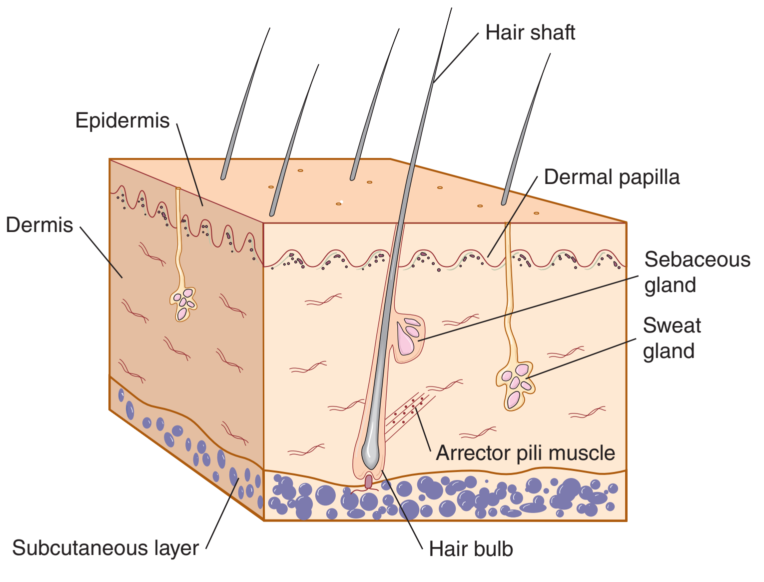

FIGURE 1.5 The epidermis, dermis and subcutaneous layer

Papillary and Reticular Aspects The terms papillary aspect and reticular aspect refer to the two distinct layers or regions within the dermis, the deeper layer of the skin located beneath the epidermis. This is the superficial layer of the dermis characterised by finger-like projections known as papillae. These papillae extend upward and interlock with the epidermis, forming the boundary between the epidermis and dermis. The papillary aspect is responsible for the formation of ridges that are known as friction ridges, aiding in grip by increasing friction, particularly in the hands and feet.

Within the papillary aspect lies a network of capillaries and specialised sensory receptors known as Meissner's corpuscles, which respond to touch and temperature sensations. Nerve endings in this region are highly sensitive to various tactile stimuli, including warmth, coolness, pain and itching.

Attached to the subcutaneous layer, the reticular aspect comprises irregular, dense connective tissues containing fibroblasts, collagen bundles and coarse elastic fibres. The reticular aspect provides structural support and elasticity to the skin, allowing it to withstand stretching and deformation. This layer also contains additional sensory receptors, such as Pacinian receptors for deep sensory pressure. Furthermore, it accommodates accessory structures such as sweat glands, lymph vessels, smooth muscles and hair follicles.

THE SUBCUTANEOUS TISSUES

Subcutaneous tissues are also referred to as the subcutis or hypodermis, representing the deepest layer of the skin.

Comprising an essential protective barrier, the subcutaneous tissue consists of an insulating layer of fat and blood vessels. Its thickness varies across different body regions and among individuals. The fat within this layer serves to safeguard organs and bones, contributing to the regulation of body temperature by collaborating with blood vessels to maintain normal and consistent temperatures. Additionally, sweat glands in this layer play a vital role in thermoregulation. With advancing age, the subcutaneous tissue undergoes a natural thinning process.

ACCESSORY STRUCTURES OF THE SKIN

The accessory structures are also known as the appendages. The accessory structures of the skin include:

- Hair
- Skin glands
- Nails

HAIR

Hair is present on most areas of the body except for the palms, soles and lips, with variations in amount, distribution, colour and texture influenced by factors such as geographical location, gender, age and ethnicity. Different types of hair emerge during fetal development,

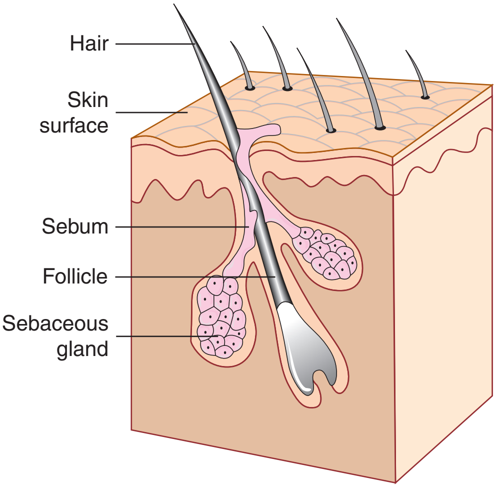

FIGURE 1.6 A pilosebaceous unit

starting with lanugo, a fine, non-pigmented downy hair that covers the fetus's body around the fifth month. Before birth, this lanugo is shed from areas such as the eyelashes, eyebrows and scalp, replaced by longer, coarser and pigmented hair (Brewster 2024).

Hair contributes to a person's distinctive appearance, with its colour influenced by melanocytes within the hair bulb. The greying of hair results from a progressive decline in melanin production, determined by genetic and hormonal factors.

Comprised of dead keratin, each hair is a thread that is formed from cells at the base of a follicle. Hair serves various functions, including sexual and social roles, thermoregulation and protection against external elements (Peate 2024). Primarily, hair acts to retain body heat, as hair follicles cover the entire skin surface, trapping heat between the hairs. The arrector pili muscles that are attached to each hair follicle contract in response to cold, fear or emotion, causing goosebumps on the skin.

Hair on the scalp shields the scalp from sun damage, while eyelashes and eyebrows protect the eyes from foreign particles and nose hair helps to prevent inhalation of foreign material. Sebaceous glands accompany hair follicles, secreting sebum, a liquid substance that lubricates the skin and hair, waterproofs them and removes waste. Sebum possesses antibacterial and antifungal properties, with the distribution of sebaceous glands being most prominent on the scalp, face, upper torso and anogenital region, particularly active during puberty due to hormonal influences. The base of the onion-shaped bulb – the follicle – contains blood vessels, providing nourishment for the developing hair. Figure 1.6 illustrates a pilosebaceous unit comprising the follicle, hair shaft, sebaceous gland and arrector pili muscle.

SKIN GLANDS

Within the skin, various glands act as miniature organs, serving multiple functions. Sweat glands (also known as sudoriferous glands), for instance, consist of coiled tubes that are composed of epithelial tissue that extends to pores on the skin surface (see Figure 1.7). Each gland has its own nerve and blood supply, producing a slightly acidic fluid containing water and salts. Sweat glands are classified into two types: eccrine and apocrine.

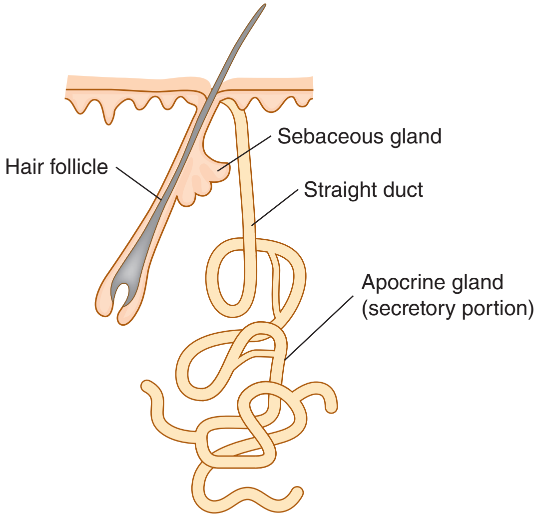

FIGURE 1.7 A sweat gland

ECCRINE GLANDS

The eccrine glands are primarily responsible for thermoregulation, which is the regulation of body temperature. They produce sweat, which is mainly composed of water and electrolytes. When the body becomes overheated, such as during physical activity, pyrexia or exposure to high temperatures, the eccrine glands release sweat onto the skin's surface. As this sweat evaporates, it helps to cool the body down, thus preventing overheating and maintaining a stable internal temperature. Additionally, eccrine sweat can also help to flush out toxins from the body and maintain hydration of the skin. These types of glands are located all over the body; however, there are sites where they are more numerous, such as the forehead, axillae, soles and palms.

APOCRINE GLANDS

The apocrine glands, like the eccrine glands, also have a coiled structure. However, they are less abundant and are localised in specific areas such as the pubic and axillary regions, nipples and perineum. The exact function of the apocrine glands is not fully understood; they become more active during puberty, producing thicker secretions than the eccrine glands, particularly during periods of stress or heightened emotions.

Several specialised types of apocrine glands exist. These include those that are located on the eyelids, the cerumen-producing glands found in the external auditory canal (ear wax glands) and also the milk-producing glands in the breasts.

Initially appearing on the palms and soles, apocrine glands gradually develop throughout the body. They are believed to secrete pheromones, which are released into the environment and communicate with others of the same species via olfaction, potentially eliciting sexual arousal reactions. When activated by surface bacteria, these glands secrete a viscous substance that results in body odour.

NAILS

The nails serve as a protective shield for the fingertips and toes. Composed of tightly packed, keratinised epidermal cells, they form a firm, solid layer over the digits (see Figure 1.8).

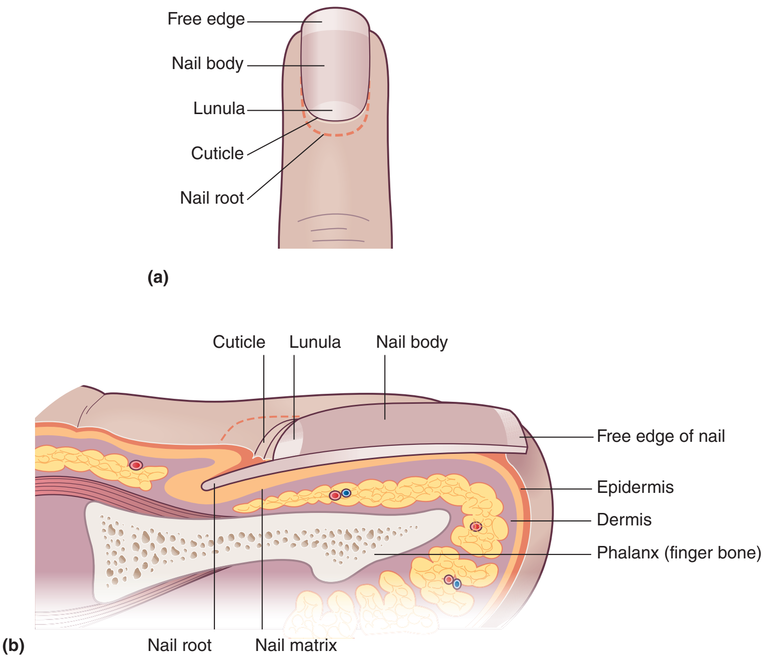

FIGURE 1.8 Nail

The horn-like structure of nails results from the concentrated keratin content. There are no nerve endings in nails. Nails serve as a tactile counterforce to fingertips, which are rich in nerve endings, enabling individuals to perceive sensations when objects are touched.

The pink hue of the nail body is due to underlying blood capillaries, while the white crescent-shaped area at the base, known as the lunula, results from air mixing with the keratin matrix. The size of the lunula varies among individuals. The cuticle, also called the eponychium, is a layer of stratum corneum extending over the proximal end of the nail body.

Fingernails grow faster than toenails, with nail growth slowing down as individuals age. On average, nails grow at a rate of 0.01 cm per day (equivalent to 1 cm per 100 days). It takes approximately four to six months for fingernails to completely regrow, while toenails require 12–18 months. Several factors, including age, season, level of physical activity and genetics, influence nail growth. Trauma, inflammation, injury or infection can delay nail growth and affect nail integrity. Additionally, systemic diseases such as chronic cardiopulmonary conditions or fungal infections can manifest through nail abnormalities.

ETHNICITY

Skin colour and ethnicity can influence various aspects of nail health and appearance.

Individuals with darker skin tones may have nails that appear darker due to increased melanin production in the nail matrix. Conversely, those with lighter skin tones may have nails with a lighter appearance. Additionally, certain ethnicities may exhibit unique nail characteristics, such as differences in lunula size or nail shape.

Nail growth rates can also vary depending on skin colour and ethnicity. People with darker skin tones may experience slower nail growth compared to those with lighter skin tones. This difference in growth rate may be attributed to variations in blood circulation and metabolism influenced by genetic factors and environmental conditions.

Furthermore, certain skin conditions, such as melanoma or psoriasis, may affect the appearance and health of the nails differently based on skin colour and ethnicity. For example, individuals with darker skin tones may be at a higher risk of developing subungual melanoma, a type of skin cancer that affects the nail unit, due to delayed diagnosis or misinterpretation of symptoms. See Mukwende, Tamony, and Turner (2020) for a handbook of clinical signs in black and brown skin.

Understanding these nuances can be important in clinical settings for accurately diagnosing and treating nail disorders, as well as for recognising potential indicators of systemic diseases that may manifest through nail abnormalities. It highlights the importance of considering skin colour and ethnicity as factors in assessing overall nail health and identifying any associated risks or concerns.

THE FUNCTIONS OF THE SKIN

A fundamental understanding of skin structure, as described in this chapter, can help the reader to begin to understand its multifaceted functions, which include:

- Sensation
- Thermoregulation
- Protection
- Excretion and absorption
- Synthesis of vitamin D

SENSATION

Located throughout the skin, there are numerous receptor sites that are capable of detecting changes in temperature and pressure in the surrounding environment. Comprising a diverse group of nerve endings, these receptors are distributed throughout the skin. Usually, the information that is gathered by these various receptors is relayed to the brain and the intricacies of sensory perception take place.

Sensations that originate in the skin are termed cutaneous sensations, while others include those that are related to vibration, tickling and irritation. Certain regions of the body boast a higher density of sensory receptors, such as the lips, genitalia and fingertips. Pain sensation may indicate either existing or potential tissue damage.

THERMOREGULATION

Thermoregulation is a vital function of the skin in maintaining homeostasis, ensuring that the body's temperature remains within narrow limits even during various activities. This process involves intricate adjustments to adapt to changes in external conditions. Effective thermoregulation is essential for survival, as temperature fluctuations can impact enzyme function and cellular composition.

The skin serves as a temperature regulator through a series of complex mechanisms. Modulation of blood vessel size in the skin is one such mechanism. When body temperature increases, blood vessels dilate (vasodilation), which facilitates the transfer of heat from deeper tissues to the skin's surface, where it can dissipate.

PROTECTION

The skin provides essential protection for the body through various mechanisms. For instance, melanin production shields against the harmful effects of UV light. Additionally, the skin maintains bodily integrity by accelerating cell turnover when necessary, shedding dead skin and facilitating cell migration, a key component of wound healing.

Through its network of over 2 million pores, the skin aids in eliminating waste products, thereby preventing the accumulation of toxins within the body. Moreover, it regulates fluid balance by controlling the secretion of sweat, preventing both dehydration and excessive fluid loss. Acting as a waterproof barrier, the skin also safeguards against harmful substances in the external environment from infiltrating the body. Sebum, excreted by the skin, contains antimicrobial compounds that can effectively eradicate surface bacteria. Additionally, the acidic pH of sweat production has the capacity to hinder bacterial growth. Within the dermis, phagocytic macrophages possess the capability to engulf and eliminate viruses and bacteria that have breached the skin's surface.

In Table 1.2, the skin's protective functions are explored further.

Table 1.2 The skin's protective functions

Protective function	Discussion
Barrier against pathogens	The skin serves as a physical barrier, preventing pathogens such as bacteria, viruses and fungi from entering the body. The outermost layer of the skin, the stratum corneum, is composed of tightly packed dead skin cells embedded in lipids, creating an impermeable barrier that microbes struggle to penetrate. Additionally, the slightly acidic pH of the skin's surface inhibits the growth of many microorganisms.
Immune response	Despite being a physical barrier, the skin is also an active participant in the body's immune response. Specialised immune cells, such as Langerhans cells and dendritic cells, patrol the skin, detecting and neutralising invading pathogens. These cells play a crucial role in initiating an immune response by presenting antigens to T cells, activating the body's adaptive immune system.
Sebum production	Sebaceous glands within the skin secrete an oily substance called sebum, which lubricates the skin and hair. Sebum contains antimicrobial properties that help prevent the growth of harmful bacteria on the skin's surface. By keeping the skin moisturised and creating a slightly acidic environment, sebum contributes to the skin's overall defence against pathogens.
Regulation of pH	The skin maintains a slightly acidic pH, typically ranging from 4.5 to 5.5. This acidic environment inhibits the growth of many harmful microorganisms while promoting the growth of beneficial bacteria that help protect against pathogens. Disruptions in the skin's pH balance can compromise its protective function and increase susceptibility to infections.
Physical protection	Beyond its role in immune defence, the skin provides physical protection against environmental hazards such as UV radiation, extreme temperatures and mechanical injuries. The epidermis, dermis and subcutaneous tissue work together to absorb and distribute impact forces, reducing the risk of tissue damage from bumps, falls or other traumatic events.
Sensory protection	Sensory receptors in the skin provide feedback to the central nervous system, alerting the body to potential threats or hazards in the environment. Pain receptors, for example, signal tissue damage, prompting protective responses such as reflex withdrawal or behavioural avoidance.

The skin's protective functions encompass a sophisticated collection of physical, chemical and immunological mechanisms that work together to safeguard the body from external threats and maintain its overall health and integrity.

EXCRETION AND ABSORPTION

The skin possesses the capacity to eliminate substances from the body; sweat, for instance, comprises water, sodium, carbon dioxide, ammonia and urea. Jenkins and Tortora (2016) highlight that despite its nearly impermeable nature, the body can excrete around 400 mL of water daily. Individuals leading sedentary lifestyles typically excrete less, whereas those engaged in more active pursuits excrete more.

Moreover, the skin serves as a conduit for absorption from the external environment. Various materials are absorbed into body cells from the surroundings, some of which, upon absorption, can pose toxicity risks, such as heavy metals, for example, lead and mercury. Additionally, certain therapeutic and non-therapeutic medications can be absorbed through the skin. Notably, fat-soluble vitamins A, D, E and K, as well as oxygen and carbon dioxide, are among the substances that can be absorbed through the skin.

SYNTHESIS OF VITAMIN D

The skin plays an active role in synthesising vitamin D. Sunlight triggers a process in the skin that produces vitamin D, a vital nutrient for bone health and overall well-being. This process begins when sunlight activates a molecule in the skin, leading to the formation of vitamin D. The newly formed vitamin D then undergoes transformations in the liver and kidneys, ultimately converting into its active form, known as calcitriol (a hormone). Calcitriol plays a crucial role in facilitating the absorption of calcium from the diet, essential for maintaining bone strength, muscle function and overall health. Insufficient levels of calcitriol can lead to weakened bones and increased susceptibility to various health issues. Therefore, ensuring adequate exposure to sunlight and consuming foods rich in vitamin D are important for maintaining optimal health.

CONCLUSION

The anatomy and physiology of the skin extends beyond its structural intricacies to encompass its dynamic interactions with the body's internal systems and external environment. Beyond its protective barrier function, the skin serves as a sensory interface that conveys tactile sensations, temperature changes and emotional responses. Its role in thermoregulation ensures the maintenance of optimal body temperature, while its vascular network facilitates nutrient exchange and waste removal.

Additionally, the skin's immune surveillance mechanisms act as vigilant defenders against invading microbes and harmful pathogens, highlighting its essential role in the body's defence system. The skin's ability to synthesise vitamin D underlines its metabolic significance, influencing calcium homeostasis, bone health and immune function.

In the field of pathology, the skin reveals a diverse range of conditions, from benign dermatological disorders to life-threatening diseases. Understanding the underlying pathophysiology of skin conditions enables those who offer care and support to diagnose, treat and manage these conditions effectively.

GLOSSARY OF TERMS

Apocrine glands: Sweat glands found in areas such as the axillary and pubic regions, activated during emotional stress and puberty.

Basal layer: Also known as the stratum basale, the deepest layer of the epidermis where new skin cells are produced.

Collagen: A protein present in the dermis that provides structural support and elasticity to the skin.

Dermis: The middle layer of the skin containing blood vessels, nerves, sweat glands and hair follicles.

Epidermis: The outermost layer of the skin responsible for providing waterproofing and protecting against external threats.

Follicle: The structure surrounding the root of a hair strand within the skin.

Keratin: A protein found in the epidermis that provides strength and waterproofing to the skin.

Hypodermis: Also known as the subcutaneous layer, it consists of fat and connective tissue that insulates the body and anchors the skin to underlying structures.

Immune system: The body's defence mechanism against pathogens and foreign invaders, including those affecting the skin.

Keratinocytes: Cells found in the epidermis responsible for producing keratin, the primary structural protein of the skin.

Langerhans cells: Specialised immune cells found in the epidermis that help protect against pathogens.

Melanin: A pigment produced by melanocytes in the epidermis that gives skin its colour and provides protection against ultraviolet (UV) radiation.

Sebaceous glands: Glands in the skin that produce sebum, an oily substance that lubricates and protects the skin and hair.

Sweat glands: Eccrine glands in the skin that produce sweat, helping to regulate body temperature and excrete waste products.

Thermoregulation: The process by which the body maintains a stable internal temperature through mechanisms such as sweating and shivering.

UV radiation: Invisible rays from the sun that can damage the skin and increase the risk of skin cancer.

Vitamin D: A nutrient synthesised by the skin in response to sunlight exposure, essential for calcium absorption and bone health.

MULTIPLE CHOICE QUESTIONS

1. What is the outermost layer of the skin called?
   a) Dermis
   b) Epidermis
   c) Hypodermis
   d) Basal layer

2. Which pigment is responsible for giving colour to the skin?
   a) Melatonin
   b) Haemoglobin
   c) Melanin
   d) Keratin

3. Which layer of the skin contains blood vessels, nerves and hair follicles?
   a) Epidermis
   b) Dermis
   c) Hypodermis
   d) Basal layer

4. What is the primary function of sebaceous glands?
   a) Producing sweat
   b) Regulating body temperature
   c) Producing sebum to lubricate the skin and hair
   d) Secreting melanin

5. Which type of sweat glands are responsible for regulating body temperature?
   a) Eccrine glands
   b) Apocrine glands
   c) Sebaceous glands
   d) Ceruminous glands

6. What is the primary protein found in the skin, hair and nails?
   a) Collagen
   b) Elastin
   c) Keratin
   d) Melanin

7. What type of cells are responsible for producing new skin cells in the epidermis?
   a) Melanocytes
   b) Keratinocytes
   c) Langerhans cells
   d) Merkel cells

8. What is the function of Langerhans cells in the epidermis?
   a) Producing melanin pigment
   b) Detecting deep pressure and vibration
   c) Regulating body temperature
   d) Acting as immune cells against pathogens

9. What is the primary function of hair on the body?
   a) Detecting touch sensations
   b) Regulating body temperature
   c) Protecting against UV radiation
   d) Providing insulation and sensation

10. What is the main function of the arrector pili muscles associated with hair follicles?
    a) Regulating body temperature
    b) Contracting to produce goosebumps
    c) Producing sebum to lubricate the skin
    d) Stimulating melanocytes to produce melanin

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