International Journal of Humanities Social Science and Management (IJHSSM)
Volume 3, Issue 5, Sep.-Oct., 2023, pp: 361-368 www.ijhssm.org

Integumentary Factors

D.Rama Brahma Reddy* *Department Of Pharmaceutical Chemistry Principal & Professor Of Nalanda Institute Of Pharmaceutical Sciences Kantepudi(v),Sattenapalli(M),Guntur(Dist)-522438*
K.Malleswari**Associate Professor Of Nalanda Institute Of Pharmaceutical Sciences Kantepudi(v),Sattenapalli(M),Guntur(Dist)-522438*

K.Sudeep, *Nalanda Institute Of Pharmaceutical Sciences, Kantepudi(v) Sattenapalli(M),Guntur(D)*
L.Pradeep kumar, *Nalanda Institute Of Pharmaceutical Sciences, Kantepudi(v) Sattenapalli(M),Guntur(D)*
R.LikhithKumar, *Nalanda Institute Of Pharmaceutical Sciences, Kantepudi(v) Sattenapalli(M),Guntur(D)*
S.Chethan kumar, *Nalanda Institute Of Pharmaceutical Sciences, Kantepudi(v) Sattenapalli(M),Guntur(D)*
Corresponding author: D.Rama Brahma Reddy

Date of Submission: 06-09-2023 Date of Acceptance: 18-09-2023

ABSTRACT:
Skin diseases affect 20-33% of the population at any one time, and around 54% of the UK population will experience a skin condition in a given year. Nurses observe the skin of their patients daily and it is important they understand the skin so they can recognise problems when they arise. This article, the first in a two-part series on the skin, looks at its structure and function.
Key words: skin role of skin, function of skin,anatomy and physiology of skin.

I. INTRODUCTION

The integumentary system is the largest organ of the body that forms a physical barrier between the external environment and the internal environment that it serves to protect and maintain. The integumentary system includes the epidermis, dermis, hypodermis, associated glands, hair, and nails. In addition to its barrier function, this system performs many intricate functions such as body temperature regulation, cell fluid maintenance, synthesis of Vitamin D, and detection of stimuli. The various components of this system work in conjunction to carry out these functions—for example, body temperature regulation occurs through thermoreceptors that lead to the adjustment of peripheral blood flow, degree of perspiration, and body hair.

Organ System involved

Components of the Integumentary System
Skin:
The skin is made up of two layers—the superficial epidermis and the deeper dermis.
The epidermis is the tough outer layer that acts as the first line of defence against the external environment. It is composed of stratified squamous epithelial cells that further break down into four to five layers. From superficial to deep, the primary layers are the stratum corneum, stratum granulosum, stratum spinosum, and stratum sale. In the palms and soles, where the skin is thicker, there is an additional layer of skin between the stratum corneum and stratum granulosum called the stratum lucidum. The epidermis regenerates from stem cells located in the basal layer that grow up towards the corneum. The epidermis itself is devoid of blood supply and derives its nutrition from the underlying dermis.
The dermis is the underlying connective tissue framework that supports the epidermis. It further subdivides into two layers—the superficial papillary dermis and the deep reticular layer. The papillary layer forms finger-like projections into the epidermis, known as dermal papillae, and consists of highly vascularized, loose connective tissue. The reticular layer has dense connective tissue that forms a strong network. The dermis as a whole contains blood and lymph vessels, nerves, sweat glands, hair follicles, and various other structures embedded within the connective tissue.

Hypodermis: The hypodermis lies between the dermis and underlying organs. It is commonly referred to as subcutaneous tissue and is composed of loose areolar tissue and adipose tissue. This layer provides additional cushion and insulation through its fat storage function and connects the skin to underlying structures such as muscle.

Hair: Hair is derived from the epidermis but grows its roots deep into the dermis. Its structure divides into the externally visible hair shaft and the hair follicle within the skin. The hair follicle has an intricate structure that contains the hair bulb that actively divides to extend the hair shaft vertically. Hair generally categorizes into hormone-dependent, thicker terminal hairs in regions such as the axilla, pubic areas, scalp, chest, etc., and androgen-independent vellus hairs that cover the rest of the areas. Hair growth has multiple phases called anagen (growth phase), catagen (non prolife relative phase), and telogen (resting phase) that cycles depending on hormones and nutrients. Hair covers the majority of the body with the few exceptions of the palms, soles, lips, and portions of external genitalia. Hair serves as mechanical protection for the skin, increases sensory function, and aids in regulating body temperature. Arrector pili muscles located in the dermis attach to hair follicles, helping the shaft to stand and trap air close to the epidermis for temperature control.

Nails: Nails form as layers of keratin and appear at the dorsal tips of the fingers and toes. The nail growth begins at the nail matrix that creates new cells and pushes old cells out distally. The visible portion of the nail is the nail plate covering the nail bed, where it adheres to the finger. Nails function to protect the fingers and toes while increasing the precision of movements and enhancing sensation.

Associated Glands: There are four types of exocrine glands within human skin—sudoriferous, sebaceous, ceruminous, and mammary glands.

Sudoriferous glands, also known as sweat glands, are further divided into eccrine and apocrine glands. Eccrine glands are distributed throughout the body and primarily produce serous fluid to regulate body temperature. Apocrine glands are present in the axilla and pubic area and produce milky protein-rich sweat. These glands are responsible for odor as bacteria break down the secreted organic substances.

Sebaceous glands are part of the pilosebaceous unit, including the hair, hair follicle, and arrector pili muscle. It secretes an oily substance called sebum, a mixture of lipids that forms a thin film on the skin. This layer adds a protective layer, prevents fluid loss, and also plays an antimicrobial role.

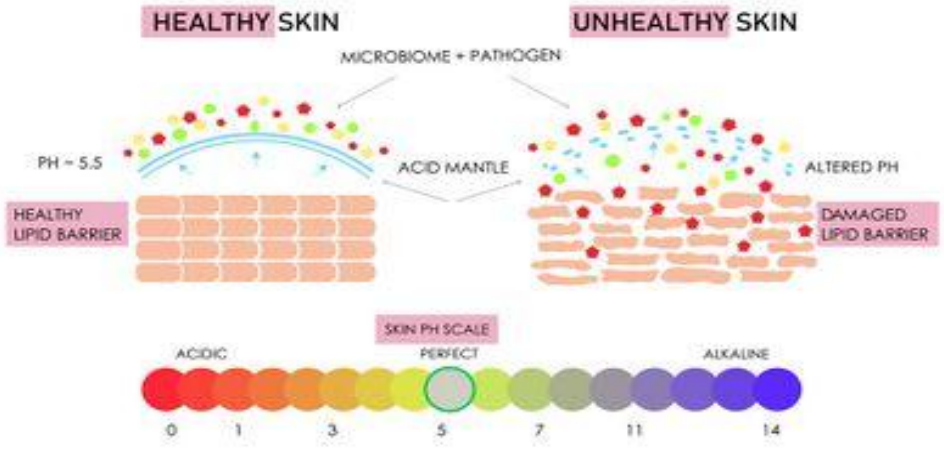
The Role of the Skin:

Skin provides numerous functions vital to life and is important for overall health. The skin's health and appearance can be an indicator of general health, and skin integrity failure often accompanies the failure of other organ systems within the body.

Eight Key Functions of the Skin:

1. **Protection**: Skin acts as a physical barrier to the external environment and provides protection for internal organs against external threats.
2. **Immune function**: Our skin contains a protective acidic barrier called the acid mantle. This acidic layer has a pH between 4.2 and 6.0, which creates a hostile environment for harmful invading organisms while maintaining a favourable environment for beneficial microbes. The acid nature of skin is a key requisite for healthy skin. Skin pH can affect the synthesis and maintenance of a competent skin barrier, play a role in skin pigmentation, and ion homeostasis.

International Journal of Humanities Social Science and Management (IJHSSM)
Volume 3, Issue 5, Sep.-Oct., 2023, pp: 361-368 www.ijhssm.org

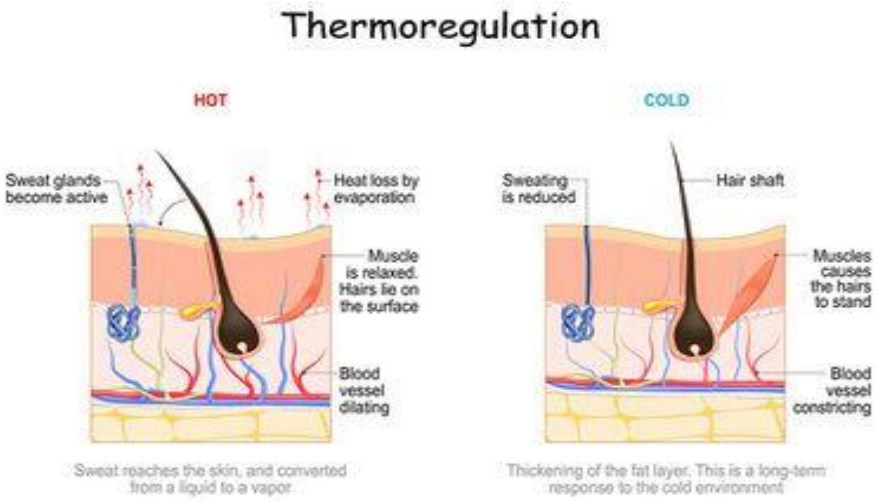


The skin's acid mantle

Skin pH tends to be lower in people with darker skin because melanin by-products are acidic. Skin pH also tends to increase slightly as we age, which can contribute to an increased risk of infection and alter our healing ability.

Specific immune cells and proteins contained in the dermis activate the immune response and attack invading microbes. These cells include Langerhans cells, memory.

The surface of our skin houses millions of bacteria, fungi and viruses that compose the skin microbiome and serves as a physical barrier to prevent the invasion of pathogens. As in our gut, the skin microbiome plays essential roles in the protection against invading pathogens, the education of the immune system, and contributing

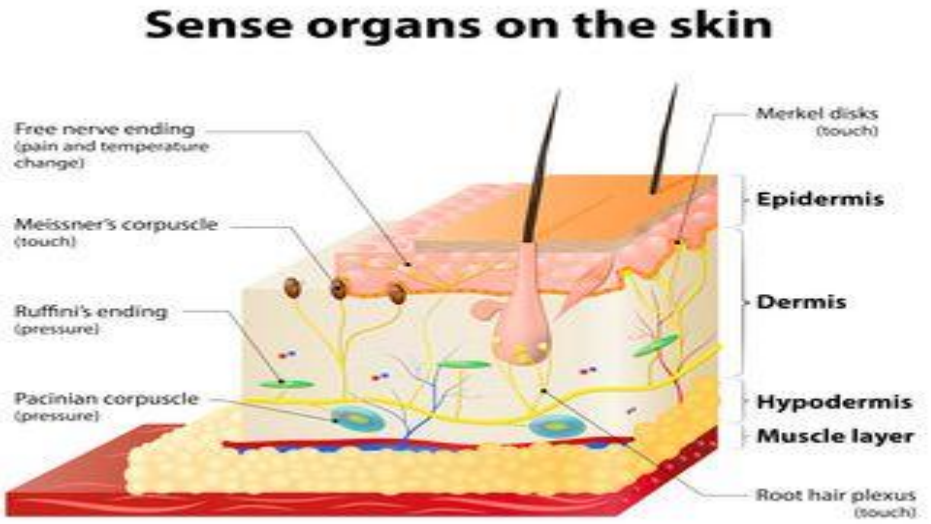


3. Thermoregulation: Humans, and all mammals, can maintain a stable core body temperature via thermoregulatory responses. By increasing blood flow to the skin through vessel dilation, body temperates are lowered by evaporative cooling of moist/sweaty surfaces to release body heat. However, if water lost to evaporative cooling is not replaced, body fluid homeostasis will be challenged.

4. Prevention of fluid loss: In addition to the physical barrier provided by skin, it also contains lipids, proteins, amino acids, and salts that work to maintain internal body homeostasis by attracting and holding onto water. Due to this mechanism, under normal circumstances, the outer layer of our skin is about 30% water.

International Journal of Humanities Social Science and Management (IJHSSM)
Volume 3, Issue 5, Sep.-Oct., 2023, pp: 361-368 www.ijhssm.org

5. Synthesis of vitamin D: Vitamin D is recognised as a pro-hormone, also known as calciferol. There are two major forms of vitamin D: D2 which is human-made and fortified into foods (such as milk, cheese, yogurt, cereals, and juices) and D3 which is synthesised by the skin and from eating animal-based foods (fatty fish, fish liver oil, and egg yolk). While vitamin D can be ingested through food or supplements, the skin and exposure to sunlight is the body's primary source of vitamin Vitamin is essential for calcium and phosphate absorption, bone formation, renal function, and our immune function.



Skin sensory organs are located throughout the layers of the skin.

6. Protection from ultraviolet radiation: Ultraviolet radiation (UVR) can cause DNA photodamage, sunburn, and both local and systemic immunosuppressive properties. Melanin and carotene give skin its colour and serve to reflect UVR as a protective mechanism to radiation damage. Melanin also has antioxidant and radical scavenging properties. Melanin is produced by melanocytes in response to increased sunlight, which is why populations that evolved in areas with more sun exposure tend to have darker skin.

7. Interaction with the environment: Our skin gathers sensory information through free nerve endings, hairs, receptors to touch, temperature, and pain. In addition, through physiological processes like sweating or blushing, information is shared about our internal state to the outside world.

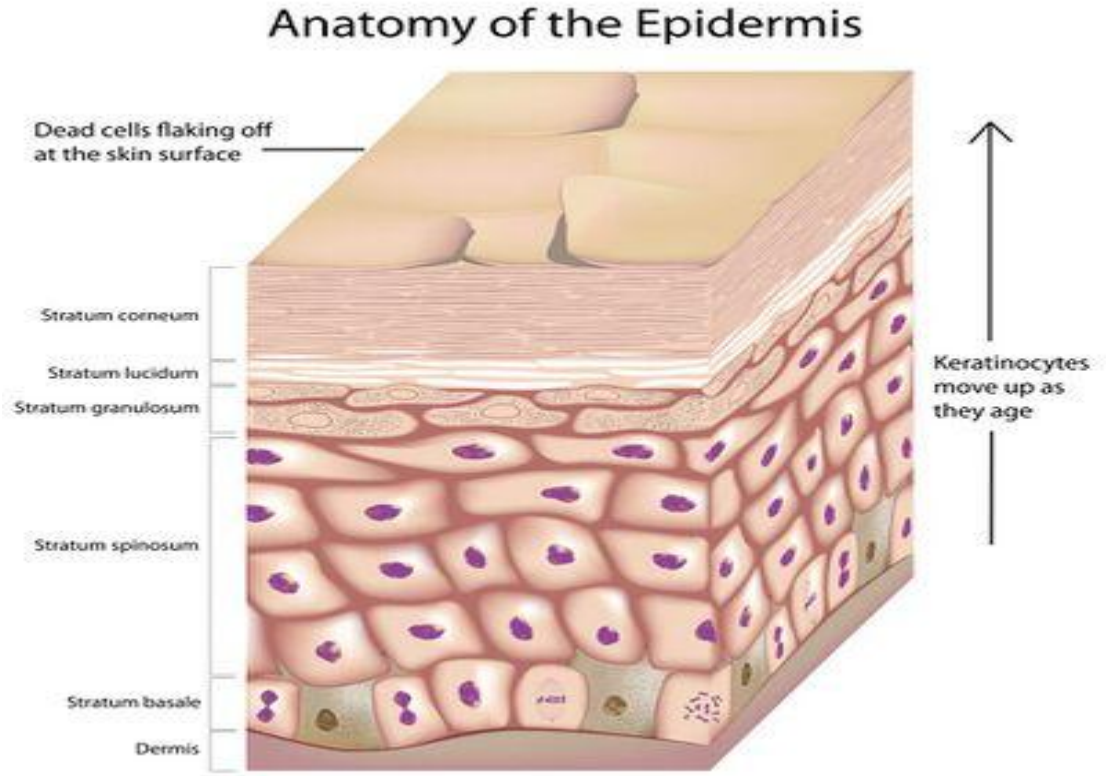
8. Healing: Tissue restoration in response to injury.

Skin Anatomy and Physiology:

It is important to understand the layers of our skin so that we can understand how healing occurs differently based on depth. The skin has two principal layers, the epidermis and the dermis. The hypodermis is considered an extension of the skin by some sources, but not by others.

International Journal of Humanities Social Science and Management (IJHSSM)
Volume 3, Issue 5, Sep.-Oct., 2023, pp: 361-368 www.ijhssm.org

The Epidermis:



Composed of five layers:

- It is avascular
- Its thickness varies based on location. For example, it is thickest on the heels and thinnest on the eyelids. Areas that have increased use from friction or weight bearing can build up thicker layers of skin (e.g., where a pencil rubs your writing finger or shoe rubs against your foot).
- It has no nerves, but free nerve endings from the dermis do extend into the mid layers of the epidermis.

Five layers of the epidermis (most to least superficial):

Stratum corneum

- Composed of 15 to 30 layers of keratinocytes called squames or corneocytes. These are dead keratinocytes. They contain a high concentration of keratin which provides a waterproof barrier for the skin, hair, and nails.
- This layer is continually being shed from the body. Shed cells are replaced via the process of skin cell migration from the stratum basale. This process takes an average of 30 days, but this varies based on age and certain health conditions.

Stratum lucidum

- Contains two to three layers of keratinocytes and is not living. It can be penetrated or shaved off without awareness.
- It is only found in areas of thick skin, like the palms of the hand and the soles of the feet. Present in calluses.

Stratum granulosum

- This layer contains the greatest concentration of free nerve endings that extend from the dermis. Free nerve endings are unencapsulated dendrites originating from a sensory neuron. They are the most common nerve endings in skin and provide sensory information about painful stimuli, hot and cold, and light touch. However, they are less sensitive to abrupt changes in stimulation.
- This is the most superficial layer of the epidermis which contains living cells.

Stratum spinosum

- Contains Langerhans cells and lymphocytes which play an important role in the immune system.

International Journal of Humanities Social Science and Management (IJHSSM)
Volume 3, Issue 5, Sep.-Oct., 2023, pp: 361-368 www.ijhssm.org

Stratum basale

- The only layer that undergoes continuous mitosis to produce new cells.
- Keratinocytes are constantly being produced in the stratum basale and they move up through the layers until they reach the outermost layer. Keratinocytes are the most dominant cell type in the skin. They play a critical role in wound healing as they are structural cells and they perform important immune functions.
- Melanocytes are also produced in the stratum basale. They produce melanin, which contributes to the colour of skin. Humans have approximately the same amount of melanocytes. Therefore, skin colour is based on the amount of melanin that these melanocytes produce in response to their environment.
- endocrine actions. They can synthesise and store locally produced hormones and neurotransmitters. They function as mechanoreceptors for light and selective tactile perception, but not for hard touch and vibration; they are also involved in the transfer of nociceptive signals.

The Dermis

- Located deep to the epidermis.
- Contains blood vessels and nerves which supply the epidermis via capillary loops and free nerve endings.
- Composed of two layers.

Two layers of the dermis (most to least superficial):

Papillary layer

- Interdigitates with the epidermis.
- The ridges of this layer give rise to our unique fingerprints.
- Contains fibroblasts which are responsible for the production of collagen, elastin, and proteins. These qualities give skin strength and flexibility.
- Contains mast cells which produce heparin and histamine, important factors in clot formation and the inflammatory response.
- Contains macrophages which play an important role in the immune response, wound repair, cancer defence, salt balance, and hair regeneration. They are known for destroying foreign invaders through phagocytosis (the process by which a phagocyte, a type of white blood cell, engulfs and digests foreign cells and removes dead cells.
- Contains leukocytes which are crucial to the inflammatory response following an injury to the skin. Leukocytes are essential for clearing infection and normal wound healing.

Reticular layer:

- Located between the papillary layer and the subcutaneous layer or hypodermis.
- It is made up of collagen, blood vessels, nerve endings, T-cells, hair follicles and glands.
- The hair follicles contain stem cells that produce keratinocytes that will become hair. They play an important role in wound healing by contributing epithelial cells for wound closure.
- The T-lymphocytes are responsible for destroying pathogens and malignant cells.
- Nerves located within the dermis detect sensations such as itching, touch, pressure, vibration, pain, and temperature.
- Injuries which reach into the dermis can result in pain due to nerve exposure and or damage. There will be an absence of pain if the nerves are completely destroyed and or severed by an injury.

THE HYPODERMIS

- Located below the dermis and contains subcutaneous tissue.
- It is made up of loose connective tissue, adipose tissue. It is well vascularised and well innervated.
- It helps to attach the skin to the muscles and bones through superficial fascia, and provides insulation and cushioning through fat storage.

Functions of the skin

The skin has three main functions:

1. Protection
2. Thermoregulation
3.Sensation

Within this, it performs several important and vital physiological functions, as outlined below.

Protection :

The skin acts as a protective barrier from: l Mechanical, thermal and other physical injury; l Harmful agents; l Excessive loss of moisture and protein; l Harmful effects of UV radiation.

Thermoregulation:

One of the skin's important functions is to protect the body from cold or heat, and maintain a constant core temperature. This is achieved by alterations to the blood flow through the cutaneous vascular bed. During warm periods, the vessels dilate, the skin reddens and beads cold periods, the blood vessels constrict, preventing heat from escaping (vasoconstriction = less blood flow = reduced heat loss). The secretion and evaporation

of sweat from the surface of the skin also helps to cool the body.

Sensation:

Skin is the 'sense-of-touch' organ that triggers a response if we touch or feel something, including things that may cause pain. This is important for patients with a skin condition, as pain and itching can be extreme for many and cause great distress. Also touch is important for many patients who feel isolated by their skin as a result of colour, disease or the perceptions of others as many experience the fact that they are seen as dirty.

Immunological surveillance

The skin is an important immunological organ, made up of key structures and cells. Depending on the immunological response, a variety of cells and chemical messengers (cytokines) are involved. These specialised cells and their functions will be covered later.

Biochemical functions

The skin is involved in several biochemical processes. In the presence of sunlight, a form of vitamin D called cholecalciferol is synthesised from a derivative of the steroid cholesterol in the skin. The liver converts cholecalciferol to calcidiol, which is then converted to calcitriol (the active chemical form of the vitamin) in the kidneys. Vitamin D is essential for the normal absorption of calcium and phosphorous, which are required for healthy bones (Biga et al, 2019). The skin also contains receptors for other steroid hormones (oestrogens, progestogens and glucocorticoids) and for vitamin A.

Social and sexual function

How an individual is perceived by others is important. People make judgements based on what they see and may form their first impression of someone based on how that person looks. Throughout history, people have been judged because of their skin, for example, due to its colour or the presence of a skin condition or scarring. Skin conditions are visible – in this skin- beauty- and image-conscious society, the way patients are accepted by other people is an important consideration for nurses.

II. CONCLUSION:

The three layers of the skin form an effective barrier to the external environment, allow the transmission of sensory information, and serve a significant role in maintaining homeostasis. The dynamic epidermis continually produces a protective outer layer of corneocytes as cells undergo the process of keratinization and terminal differentiation. Collagen and elastic filaments of the dermal layer provide the underlying tensile strength of the skin, whereas the layer of subcutaneous fat provides a store of energy for the body. The high rate of cell proliferation in the epidermis and in epithelial tissue in general and the fact that this tissue is most frequently exposed to physical and chemical damage result in the exceedingly high rate of skin cancers found in humans as compared with other types of cancer.

REFERENCE:

[1]. Palmer, D. Skin Anatomy, Physiology, and Healing. Physiotherapy Wound Care Programme. Plus. 2022.3:20-35
[2]. Crivelli C, Fridlund AJ. Facial displays are tools for social influence. Trends in cognitive sciences. 2018. 5:88-99.
[3]. Sussman C, Bates-Jensen BM, editors. Wound care: a collaborative practice manual. Lippincott Williams & Wilkins; 2007.4;40-55
[4]. Naik S. One Size Does Not Fit All: Diversifying Immune Function in the Skin. The Journal of Immunology. 2022. 2:27-34.
[5]. Harris-Tryon TA, Grice EA. Microbiota and maintenance of skin barrier function. Science. 2022. 7:40-70
[6]. Surber C, Humbert P, Abels C, Maibach H. The acid mantle: a myth or an essential part of skin health?. pH of the Skin: Issues and Challenges.2018. 4:20-40
[7]. Byrd AL, Belkaid Y, Segre JA. The human skin microbiome. Nature Reviews Microbiology. 2018. 3:43-55.
[8]. McKinley MJ, Martelli D, Pennington GL, Trevaks D, McAllen RM. Integrating competing demands of osmoregulatory and thermoregulatory homeostasis. Physiology. 2018. 3:70-81.
[9]. Ross AC, Taylor CL, Yaktine AL, Del Valle HB. Committee to review dietary reference intakes for vitamin D and calcium. Food and Nutrition Board. 2011. 6:30-66
[10]. Finlayson L, Barnard IR, McMillan L, Ibbotson SH, Brown CT, Eadie E, Wood K. Depth penetration of light into skin as a function of wavelength from 200 to 1000 nm. Photochemistry and Photobiology. 2022. 4:74-81.

[11]. Brenner M, Hearing VJ. The protective role of melanin against UV damage in human skin. Photochemistry and photobiology. 2008. 3:39-40
[12]. Finlayson L, Barnard IR, McMillan L, Ibbotson SH, Brown CT, Eadie E, Wood K. Depth penetration of light into skin as a function of wavelength from 200 to 1000 nm. Photochemistry and Photobiology. 2022. 4:74-81.
[13]. Brenner M, Hearing VJ. The protective role of melanin against UV damage in human skin. Photochemistry and photobiology. 2008. 3:39-49.
[14]. Molnar C and Gair J. Concepts of Biology – 1st Canadian Edition. BCcampus. Retrieved from 2015.9:20-45
[15]. Finlayson L, Barnard IR, McMillan L, Ibbotson SH, Brown CT, Eadie E, Wood K. Depth penetration of light into skin as a function of wavelength from 200 to 1000 nm. Photochemistry and Photobiology. 2022. 4:74-80
[16]. Brenner M, Hearing VJ. The protective role of melanin against UV damage in human skin. Photochemistry and photobiology. 2008. 3:39-47
[17]. Molnar C and Gair J. Concepts of Biology – 1st Canadian Edition. BCcampus. Retrieved from 2015 .2:44-67.