



# The Integumentary System



## THE INTEGUMENTARY SYSTEM

### Overview

The integumentary system is the organ system that protects the body from damage, comprising the skin, hair and nails. The integumentary system has a variety of functions; it may serve to waterproof, cushion, and protect the deeper tissues, excrete wastes, and regulate temperature, and is the attachment site for sensory receptors to detect pain, sensation, pressure, and temperature. In most terrestrial vertebrates with significant exposure to sunlight, the integumentary system also provides for vitamin D synthesis.

The integumentary system is the largest of the body's organ systems. In humans, this system accounts for about 12 to 15 percent of total body weight. It distinguishes, separates, and protects the organism from its surroundings.

The human skin is composed of a minimum of 3 major layers of tissue: the epidermis; dermis; and hypodermis. The epidermis forms the outermost layer, providing the initial barrier to the external environment. Beneath this, the dermis comprises two sections, the papillary and reticular layers, and contains connective tissues, vessels, glands, follicles, hair roots, sensory nerve endings, and muscular tissue. The deepest layer is the hypodermis, which is primarily made up of adipose tissue.

### Epidermis

This is the top layer of skin made up of epithelial cells. It does not contain blood vessels. Its main function is protection, absorption of nutrients, and homeostasis. In structure, it consists of a keratinized stratified squamous epithelium comprising four types of cells: keratinocytes, melanocytes, Merkel cells, and Langerhans' cells. The major cell of the epidermis is the keratinocyte, which produces keratin. Keratin is a fibrous protein that aids in protection. Keratin is also a water-proofing protein. Millions of dead keratinocytes rub off daily. The majority of the skin on the body is keratinized, meaning waterproofed. The only skin on the body that is non-keratinized is the lining of skin on the inside of the mouth. Non-keratinized cells allow water to "stay" atop the structure.

The protein keratin stiffens epidermal tissue to form fingernails. Nails grow from thin area called the nail matrix; growth of nails is 1 mm per week on average. The lunula is the crescent-shape area at the base of the nail, this is a lighter colour as it mixes with the matrix cells.

### Dermis

The dermis is the middle layer of skin, composed of dense irregular connective tissues such as collagen with elastin arranged in a diffusely bundled and woven pattern. These layers serve to give elasticity to the integument, allowing stretching and conferring flexibility, while also resisting distortions, wrinkling and sagging. The dermal layer provides a site for the endings of blood vessels and nerves. Many chromatophores are also stored in this layer, as are the bases of integumental structures such as hair and glands.

### Hypodermis

Also called the hypoderm, subcutaneous tissue, or superficial fascia and the bottom layer of the integumentary system in vertebrates (hypoderm and subcutaneous are from Greek and Latin words for "beneath the skin"). Types of cells that are found in the hypodermis are fibroblasts, adipose cells, and macrophages.

### Functions

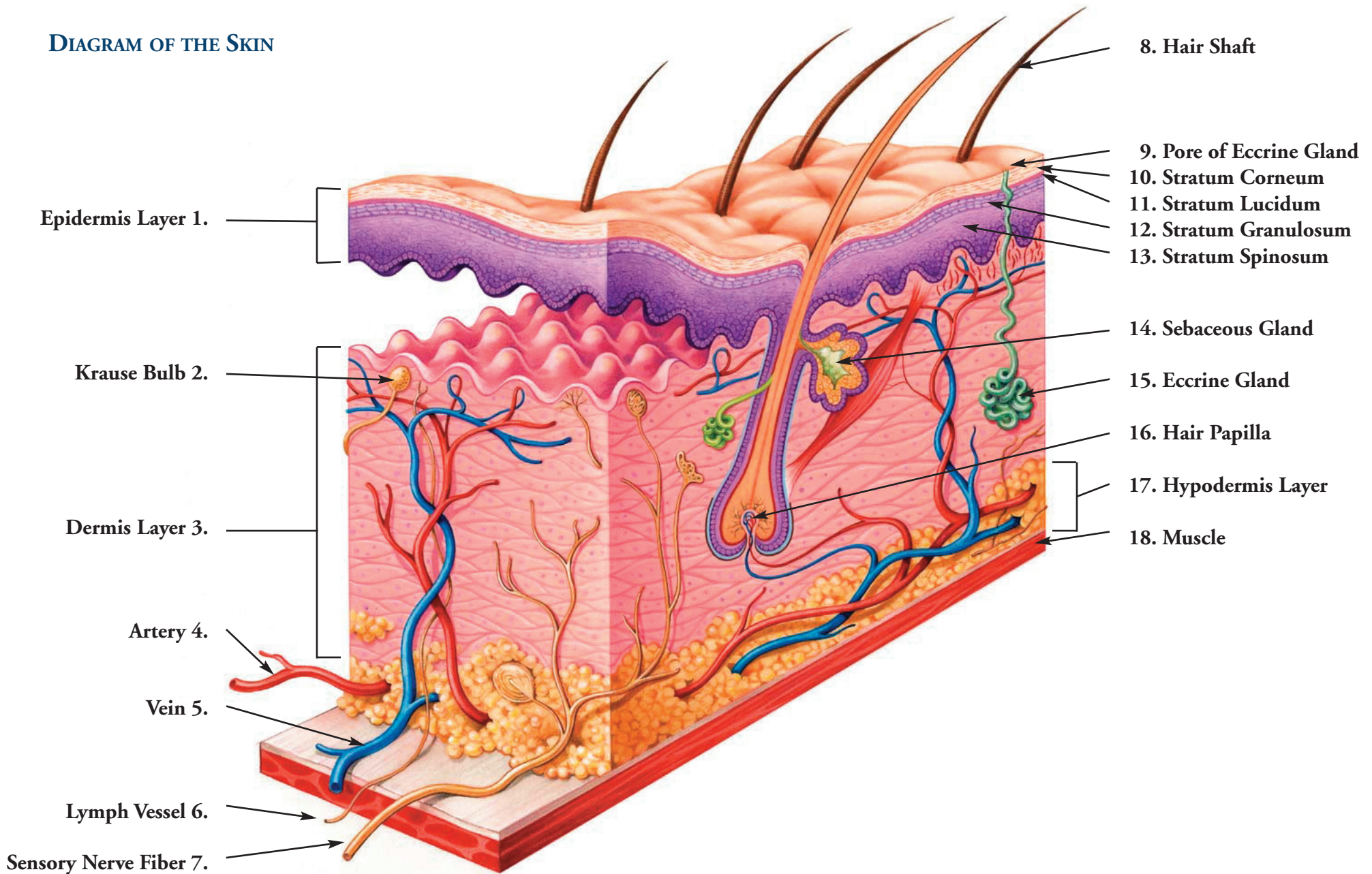
The integumentary system has multiple roles in homeostasis (stable equilibrium). All body systems work in an interconnected manner to maintain the internal conditions essential to the function of the body. The skin has an important job of protecting the body and acts as the body's first line of defense against infection, temperature change and other challenges to homeostasis.

Functions include:

- Protect the body's internal living tissues and organs.
- Protect against invasion by infectious organisms.
- Protect the body from dehydration.
- Protect the body against abrupt changes in temperature.
- Help excrete waste materials through perspiration.
- Act as a receptor for touch, pressure, pain, heat, and cold.
- Protect the body against sunburns by secreting melanin.
- Generate vitamin D through exposure to ultraviolet light.
- Store water, fat, glucose, and vitamin D.
- Maintenance of the body form.
- Formation of new cells to repair minor injuries.
- Aid in physical examination as color of the skin may indicate many conditions: e.g. it becomes yellowish in jaundice.



## DIAGRAM OF THE SKIN



## ELEMENTS OF THE SKIN

### Epidermis Layer

This is the outermost layer of the skin. It is a thin protective layer with many nerve endings. It protects against heat and light, as well as injury and infection. The epidermis is mostly made up of flat, scale like cells called squamous cells. Under the squamous cells are round cells called basal cells. The deepest part of the epidermis contains melanocytes. The epidermis is composed of the following layers; stratum germinativum (basal layer), stratum spinosum, stratum granulosum, stratum lucidum and stratum corneum. This is the layer of concern for the esthetician. This layer thins with age, has reduced collagen repair properties and decreased elasticity. Repeated movement of the skin causes wrinkles of the skin. The appearance of the epidermis is enhanced by the use of effective product ingredients. The epidermis is avascular and is nourished by diffusion from the dermis. The main type or the four principal types of cells which make up the epidermis are keratinocytes, melanocytes, Langerhans cells and Merkel cells. The outermost layer of epidermis consists of 25 to 30 layers of dead cells. The epidermis layer itself is made up of five sublayers that work together to continually rebuild the surface of the skin

### Epidermal Rete Ridge

This is one of two special areas of the epidermis where stem cells are protected. It is the surface area between the epidermis and the dermis attachment. It connects the epidermis to the dermis. These rete ridges (pegs) produce only keratinocytes. It is less prominent on the forehead and ear. It is a conical extension of collagen fibers, capillary blood vessels and sometimes nerves of dermis fit into corresponding spaces on the underside of the epidermis. Ridge is a projecting structure. Rete is a general term used in anatomical nomenclature to designate a network especially of arteries or veins. The epidermal rete ridge strengthens the attachment of the dermis and epidermis. It increases the surface area because of its shape and formation. Recent data shows that stem cells in primate epidermis are concentrated at the bases of rete ridges. Because the early lesions of graft-versus-host disease

(GVHD) in the vertebrate skin are in basal epidermis and hair follicle cells, it is hypothesized that stem cells or their early progeny might be targeted and that rete ridges are the primary sites of attack in early GVHD of the skin.

### Melanocyte

Melanocyte produces granules called melanosomes that contain melanin, a brown, black or red pigment. The melanosomes are transferred from melanocytes to keratinocytes in the granular layer of the skin. Skin has about one melanocyte to 36-40 keratinocytes which is called an epidermal melanocyte unit. The benefit of this is protection. Melanocyte is a pigment producing cell in the skin, hair and eye which determines color. The pigment melanocyte makes is called melanin. The major determination of color is not the number of melanocytes but rather the activity of the melanocytes. Melanoma is a malignant tumor that arises from a mutant melanocyte. In the embryo melanocytes migrate from their origin and take up a position in the basal layer of the epidermis. They have the ability to absorb ultraviolet radiation, thus protecting the basal cells DNA from the mutagenic effect of radiation. The difference in skin color between fair people and dark people is due not to the number (quantity) of melanocytes in their skin, but to the melanocytes' level of activity. Albinos lack an enzyme called tyrosinase. Tyrosinase is required for melanocytes to produce melanin from the amino acid tyrosine. Melanosomes rearrange themselves within the cell in response to external cues such as ultraviolet rays or mutations in their transport system

### Dermal Papillae

Dermal Papillae lies immediately under the epidermis and contains smaller, widely spaced collagen and elastin fibers. It contains large amounts of interfibrillar "gel substance", the ground substance of the dermis. The capillary vessels, small nerves and lymphatic vessels also are in the papillary dermis which accounts for about 10-20% of the dermis. The dermis and epidermis are joined by an undulating membrane that forms ridges and grooves known as papillae. The dermal papillae are extensions of the dermis into the epidermis. Sometimes may be perceived at the surface of the skin.

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Dermal papillae contain vascular loops and specialized nerve endings known as “superficial projections”. In the palms, fingers, soles, and toes, the influence of the papillae projecting into the epidermis forms contours in the skin’s surface. These are called friction ridges, because they help the hand or foot to grasp by increasing friction. Friction ridges occur in patterns that are both genetically and randomly determined and are therefore unique to the individual, making it possible to use fingerprints or footprints as a means of identification. They can sometimes be observed at the surface of the skin.

### **Krauses’s End Bulb**

These are encapsulated endings of myelinated nerves that detect pain and pressure. Pain sensors are spread all through the body. They detect pain caused by mechanical, electrical, chemical stimuli and extremes of temperature. Krause’s End Bulb is a “Bulboid Corpuscle”, a type of small encapsulated nerve ending found in the skin, mucous membranes and conjunctiva. This is thought to function as either thermo receptors for cold or as rapidly adapting receptors. End-bulbs are found in the conjunctiva of eye (where they are spheroidal in shape in humans, but cylindrical in most other animals), in the mucous membrane of the lips and tongue, and in the epineurium of nerve trunks. They are any of numerous encapsulated nerve endings occurring in the skin and mucous membranes, functioning as sensory cold receptors.

### **Meissner’s Corpuscle**

These corpuscles are located in the papillary dermis, palms and soles. They are the most superficial and responsible for touch. Meissner’s corpuscle is limited in their detection because they can only signal when something is touching the skin. They are nerve endings that detect pressure, touch and cold. They are small elliptical tactile end organs in hairless skin containing numerous transversely placed tactile cells and fine flattened nerve terminations. They are named after George Meissner (anatomist and physiologist) in 1852. The number of Meissner corpuscles per square millimeter of human skin on the fingertips drops fourfold between the ages of 12 and 50. The rate at which they are lost correlates well with the age-related loss in touch sensitivity for small probes.

### **Ruffini Corpuscles**

Ruffini corpuscles are cylinder shaped nerve endings that circle hair follicles just below the sebaceous duct. They are round and lie deeper in the dermis. They are complex branching terminal nerve fibers enclosed in a connective tissue compartment consisting of bundles of collagen and elastin fibers as well as connective tissue cells called septal cells. They are touch sensors that detect heat and pressure located in hairy skin. They are a type of lamellate corpuscle in the dermis that is a slowly adapting receptor for sensation of continuous pressure. These are a slowly adapting receptor, a mechanoreceptor that responds slowly to stimulation and continues firing as long as the stimulus continues. This spindle-shaped receptor is sensitive to skin stretch, and contributes to the kinesthetic sense of and control of finger position and movement. It is believed to be useful for monitoring slippage of objects along the surface of the skin, allowing modulation of grip on an object. This spindle-shaped receptor is sensitive to skin stretch, and contributes to the kinesthetic sense of and control of finger position and movement

### **Apocrine Glands**

Apocrine glands are located in the lower dermis and are tubular structures with compound secretory coils. The secretion is thicker and more complex than true sweat glands. They are attached to hair follicles found in the underarm and genital areas. They are believed to excrete pheromones. They are more active during emotional changes and produce odors from the secretions and bacteria on the surface of the skin. It is a gland whose discharged secretion contains part of the secreting cells. As sweat evaporates the body is cooled. This gland is believed to excrete pheromones, which are thought to play a role in sexual attraction. Apocrine sweat glands develop during early- to mid-puberty within the age range of 13 to 15, and release more than normal amounts of sweat for approximately a month, regulating and releasing normal amounts of sweat after a certain period of time. They are located wherever there is body hair.



## **Dermis Layer**

It is located beneath the epidermis. There are nerves, blood vessels and organs of the skin appendages (glands and hairs). The dermis is a tough and highly resilient structure that allows the skin to move, take shock, as well as cools and warms the body. It permits passage of nutrients to the epidermis. It interacts with the constantly occurring changes both inside and outside of the skin. The Dermis layer is a sensitive vascular inner mesodermic layer of the skin. Also known as corium, cutis, cutis vera and derma. The dermis layer is 25 times thicker than epidermis. Tattoo ink is injected into the dermis. Stretch marks are also located in the dermis. It contains blood and lymph vessels, hair follicles and glands.

## **Collagen Partition**

Collagen is the most abundant body protein. It accounts for 1/3 of the body's weight. It gives the body structure and cohesion. There are 11 types of collagen. It plays a significant role in structure and aging changes in maintenance of skin health. It is an insoluble fibrous protein of vertebrates that is the chief constituent of the fibrils of connective tissue (as in skin and tendons) and of the organic substance of bones and yields gelatin and glue on prolonged heating with water. Collagens are widely employed in the construction of artificial skin substitutes used in the management of severe burns. These collagens may be derived from bovine, equine or porcine, and even human sources and are sometimes used in combination with silicones, glycosaminoglycans, fibroblasts, growth factors and other substances.

## **Artery**

Arteries are thick walled muscular and flexible tube that carry oxygenated blood from the heart to the capillaries. The largest artery in the body is the aorta. Over time, elevated arterial blood sugar, lipoprotein cholesterol, high blood pressure, smoking, and other factors can each be involved in damaging both the endothelium and walls of the arteries, resulting in atherosclerosis or Diabetes Mellitus.

## **Vein**

The vein is a thin walled blood vessel, less elastic than the arteries, containing cuplit valves to prevent backflow and carry impure blood from various capillaries back to the heart and lungs. They have thinner walls than the arteries and often valves at intervals to prevent reflux of blood, which flows in a steady stream and is in most cases dark in color due to the presence of red hemoglobin. Veins appear blue because the subcutaneous fat in the skin absorbs lower-frequency light, permitting only the highly energetic blue wavelengths to penetrate through to the dark vein and reflect off. This physical effect is also present in the iris of blue eyes (pigmentless iris in the front, dark retina in the back) and is called Rayleigh scattering.

## **Lymph Vessels**

Lymph vessels are located in the dermis and supply nourishment within the skin. Lymph vessels contain waste products, salts and nitrogenous wastes. They run parallel to the blood supply and return to the deeper lymph nodes where the lymphatic fluid is absorbed, collected, filtered for excretion and transported. 70% of lymphatic vessels are located in the skin, yet they are found in almost all tissues and organs. Generally, lymph flows away from the tissues to lymph nodes and eventually to either the right lymphatic duct or the largest lymph vessel in the body, the thoracic duct. These vessels drain into the right and left subclavian veins respectively.

## **Sensory Nerve Fibers**

Held together by connective tissue through which impulses are transmitted, sensory nerve fibers are connected to specialized receptors such as corpuscles or naked nerve endings.

There are 3 types of sensory fibers:

1. Beta
2. Delta
3. Fibers



### **Muscle spindles**

Muscle spindles are sensory receptors within the belly of a muscle, which primarily detect changes in the length of the muscle. They convey length information to the central nervous system via sensory neurons. This information can be processed by the brain to determine the position of body parts. Any changes in length detected by muscle spindles can also play an important role in regulating the contraction of muscles, by preventing unwanted stretching.

### **Hair Shaft**

The portion of the hair that extends or projects beyond the skin consisting of the outer layer (cuticle), inner layer (medulla) and middle layer (cortex) is the hair shaft. It is lined with epidermal tissue. During the active hair stage, it extends through the dermis to the subcutaneous tissue. The hair shaft is made up of dead, hard protein called keratin in three layers. There are pigment cells that are distributed throughout the cortex and medulla giving the hair its characteristic color.

### **Cuticle**

The cuticle is the outside cell layer of the hair shaft. The cuticle is composed of transparent cells that overlap like scales. The purpose is to protect inner layers of hair. The cuticle is formed by tightly-packed scales in an overlapping structure similar to roof shingles. Most hair conditioning products attempt to affect the cuticle.

### **Cortex**

The cortex is long thin fibers that surround the medulla. It is the middle layer of hair made up of elongated cells of fibrous tissue containing melanin. This is the layer that gives hair its strength, elasticity and vitality. It is the layer that contains the pigment that gives hair its color.

### **Medulla**

Medulla is the spongy, semi-hollow core of the hair shaft, the inner most layer of hair. They are round cells often absent in fine hair, but found in all wavy hair. Curlier hair has a stronger medulla.

### **Hair Root**

The Hair root is part of the hair that lies within the follicle. It is divided into two parts: the External Root Sheath (inner side of follicular canal consisting of epidermal tissue) and the Internal Root Sheath (protects half as far up as the sebaceous gland). These sheaths protect and mold the growing hair shaft. A muscle called an erector pili muscle attaches below the gland to a fibrous layer around the outer sheath. It is when this muscle contracts that it causes the hair to stand up.

### **Eccrine Glands**

Found all over the body, eccrine glands are primarily located on the forehead, palms and soles. They have a duct and pore through which secretions are released. They are responsible for the majority of sweat production and can be stimulated by emotional and thermal stimuli. They produce clear, colorless, odorless liquid containing 98-99% water and inorganic compounds. Underarm wetness comes mostly from the eccrine glands. Human eccrine sweat is composed chiefly of water with various salts and organic compounds in solution. It contains minute amounts of fatty materials, urea and other wastes. The concentration of sodium varies from 35–65 mmol/l, and is lower in people accustomed to a hot environment and in people adapted to physical exercise.

### **Stratum Corneum**

The top outermost layer of the epidermis also referred to as the horny layer. Thickness varies approximately 14 -25 cell layers. Native skin is thicker consisting of 15-20 layers. It is made up of soft keratin providing resiliency and protection to the skin. The stratum corneum influences epidermal proliferation after contacts to irritants by increasing mitotic activity of basal keratinocytes and thus epidermal turnover. This is the primary layer of concern of estheticians. Cells of the stratum corneum contain keratin, a protein that helps keep the skin hydrated by preventing water evaporation. In addition, these cells can also absorb water, further aiding in hydration and explaining why humans and other animals experience wrinkling of the skin on the fingers and toes (colloquially called “pruning”) when immersed in water for prolonged periods.



### **Stratum Lucidum**

This is the clear layer under the stratum corneum. It is made up of small cells that let light pass through. This layer is found on the palms of hands and soles of feet. It is thought to be a barrier of some kind. Thickness varies according to the total thickness of the epidermis. The keratinocytes of the stratum lucidum do not feature distinct boundaries and are filled with eleidin, an intermediate form of keratin.

### **Stratum Granulosum**

This is composed of cells granular in shape, filled with keratin and produces lipids. They move to the surface to replace cells shed from the stratum corneum. The cells contain granules in their cytoplasm. Electron microscopy shows the granules are not membrane bound but free in the cytoplasm and contain proteins. As the cells move to the surface the granules acquire a membrane which fuses with the cell's membrane and their lipid contents are discharged into the intercellular space. Histidine (essential amino acid) is a rich protein that has been identified in the granules. This lipid material is thought to be principle. This is the highest layer in the epidermis where living cells are found; the stratum lucidum above appears clear due to auto-digestion of cellular organelles.

### **Stratum Spinosum**

These are flattened cells that are spiny in shape and are located above the basal layer. Cell appendages become desmosomes, which are structures that assist in holding cells together. Desmosomes give the cells their "spiny" appearance. Cells from the basal layer enter into the stratum spinosum and undergo a change before entering into the stratum granulosum. The thickness of their layer varies according to the total thickness of the epidermis. Their nuclei are often darkened (a condition called pyknosis), which is an early sign of cell death. Their fate is sealed because the nutrients and oxygen in interstitial fluid have become exhausted before the fluid is able to reach them by diffusion.

### **Stratum Germinativum**

This is also known as the basal layer. It is the first layer above the papillary layer of the dermis. It is the lowest layer of cells that make up the living stratum where cell division occurs. This layer also contains melanin, the protective skin pigment. Skin coloring is determined in this layer. Among keratinocytes of the basal layer are the melanocytes which contain the enzyme tyrosinase which is used in the formation of the pigmented polymer melanin. One in ten cells is a melanocyte. Melanosomes are the melanin. These are the synthesizing apparatus of cells. The melanosomes become pigmented and are referred to as melanin granules. These cells undergo rapid cell division, mitosis, to replenish the regular loss of skin by shedding from the surface.

### **Basement Membrane**

This is the anchoring complex joining the epidermis and dermis of the skin. This membrane consists of the epidermal rete ridge. The primary function of the basement membrane is to anchor down the epithelium to its loose connective tissue underneath.

### **Superficial Blood Cells**

These cells carry out the exchange of oxygen and carbon dioxide between the lungs and the body tissues. The erythrocytes make up the largest population of blood cells. White blood cells defend against infecting organisms and foreign agents in tissues and the blood stream. Granulocytes form in bone marrow and account for 70% of all white blood cells. They release histamine and play a role in the inflammatory response to infection. The most important vessels in the system are the capillaries, the microscopic vessels which enable the actual exchange of water and chemicals between the blood and the tissues, while the conduit vessels, arteries and veins, carry blood away from the heart and through the capillaries or back towards the heart, respectively.



## **Monocytes**

Monocytes are derived from phagocytic cells that line vascular and lymph channels. They have a round or kidney shaped nucleus. They migrate into the epidermis. They number 4%-8% of white blood cells and move to areas of infection to act as the main instrument of defense. Monocytes have two main functions in the immune system: (1) replenish resident macrophages and dendritic cells under normal states, and (2) in response to inflammation signals, monocytes can move quickly (approximately 8-12 hours) to sites of infection in the tissues and divide/differentiate into macrophages and dendritic cells to elicit an immune response.

## **Lymphocytes**

Lymph is a colorless water fluid that circulates through the lymphatic system. It is similar in composition to blood plasma and contains white cells. Lymphocytes make up 20%-35% of all white blood cells and proliferate rapidly in the face of infection. "B" lymphocytes migrate and develop into plasma cells that produce antibodies. "T" cells kill invading cells directly and others interact with other immune system cells. Lymphocytes are formed in lymphatic tissue and produced in lymph nodes, spleen and thymus gland. Lymphocytes are the only cells in lymphatic fluid and are transported through lymph vessels where they engulf bacteria and transport it to the lymph nodes for filtration. The three major types of lymphocytes are T cells, B cells and natural killer (NK) cells. NK cells are a part of the innate immune system and play a major role in defending the host from both tumors and virally infected cells.

## **Papillary Layer**

This is the layer that connects the dermis and epidermis. Papillae are small cone shaped structures at the bottom of hair follicles. Superficial capillaries are looped around papillae. Capillaries nourish the epidermis or tactile corpuscles (the nerve endings sensitive to touch and pressure). This layer contains superficial blood cells which consist of elastic collagenous and reticular fibers that are cone-shaped, finger like projections which protrude upward into the epidermis locking the 2 layers together. This layer also forms a connective sheath around hair follicles. Meissner's corpuscles are in this

layer. The papillae provide the dermis with a "bumpy" surface that interdigitates with the epidermis, strengthening the connection between the two layers of skin.

## **Dermal Duct**

Found in most parts of the skin, dermal ducts are funnel shaped apertures which open on the surface of the skin. The sebaceous (oil) glands and sudoriferous (sweat) glands have these. If the duct becomes clogged, comedones form. The duct openings at the surface are pores.

## **Sebaceous Glands**

Sebaceous glands which are connected to the hair follicle, produce oil and protect the surface of the skin. They are found all over the skin, in greater numbers on the scalp, t-zone and cheeks. This gland is responsible for lubricating the hair, preventing it from becoming dry and brittle. It also keeps the epidermis from becoming dry and cracking, as well as preventing bacteria and germs from entering the body. The Sebaceous gland is influenced by the endocrine system. They vary in size and shape and are most active during puberty. A branched type of acinar gland, these glands exist in humans throughout the skin except in the palms of the hands and soles of the feet.

## **Arrector Pili Muscles**

Located in the base of the hair follicle and in the reticular layer. Both fear and cold cause it to contract. When it contracts the hair stands straight up causing goose bumps. It is partly responsible for heat regulation. The Arrector Pili muscles are smooth muscle, not skeletal muscle, which explains why humans cannot voluntarily give themselves goose bumps.

## **Sudoriferous Glands**

These are sweat glands that regulate body temperature and eliminate waste products through sweating. It is controlled by the sympathetic nerve system found deep in dermis. This gland has tubular ducts extending to epidermis. There are two types: Eccrine and Apocrine.



### **Reticular Layer**

This is the deeper layer of dermis containing proteins that give the skin its strength and elasticity. It is the thickest layer of skin. It is composed of protein and collagen fibers that run in parallel layers and is more dense closer to the papillary layer. The reticular layer contains: arrector pili muscles, lymph vessels, blood vessels, nerve endings, fat cells, hair follicles, sebaceous glands and sudoriferous glands.

### **Subcutaneous Layer of the Skin**

Found at the bottom of the reticular layer, it is composed of adipose (fat) tissue which gives contour and smoothness to the body, provides a protective cushion and is a source of energy. It helps to insulate the body by monitoring heat gain or loss. If this layer is overdeveloped, it is a sign of obesity. It contains hair roots, which are contained in a hair follicle. Subcutaneous fat can be measured using calipers giving a rough estimate of total body adiposity.

### **Matrix Cells**

Matrix cells (hair bulb of the follicle) produce hair and the protective external and internal root sheath. Because active mitosis occurs there, the hair matrix cells divide and move up the follicle, differentiating into either hair cells or inner epithelial sheath cells. Among matrix system cells are melanocytes, producing pigment for the hair.

### **Internal & External Root Sheath**

The epidermal root sheath has an outer and inner component that makes up the hair follicle. The external is derived from the dermis and internal from the epidermis. The external sheath is called the dermal root sheath and has 3 layers (Henley's layer, Huxley's layer and cuticle). The outer relates to the Reticular layer in the dermis. The middle layer relates to the papillary layer and the innermost layer (glassy membrane) relates to the basal lamina beneath the epidermis.

### **Hair Bulb**

The hair bulb is made up of cells with multi-potential. It sits just above and around the papilla. The cells undergo mitosis but retain the ability to become any number of structures. As they grow and develop they steadily push the

previously formed cells upward. Melanin (pigment that colors the hair) is produced in the bulb, and as the developing hair moves upwards in the follicle, the melanin is carried upwards in the inner part of the follicular canal.

### **Hair Papilla**

Papilla is filled with tissue containing blood vessels, hormones and cells necessary for hair growth and nourishment of the follicle. Active during the anagen stage, it is separated from the hair shaft during the catagen phase and completely inactive during the telogen stage.

### **Adipose Connective Tissue**

This provides protective cushion that gives the body smoothness and contour, as well as a source of energy. In the Integumentary System, the deepest level, it protects our bodies from the environment. In the subcutaneous layer it provides insulation from heat and cold. This subcutaneous layer separates the dermis from the underlying musculature of body and helps skin to cover many arteries, veins and lymphatics that circulate through this area, as do nerve endings. This tissue decreases with age. In a severely obese person, excess adipose tissue hanging downward from the abdomen is referred to as a panniculus. A panniculus complicates surgery of the morbidly obese. The panniculus may remain as a literal "apron of skin" if a severely obese person quickly loses large amounts of fat a common result of gastric bypass surgery.

### **Vater Pacini (Pacinian Corpuscle)**

These are never ending corpuscles that are present in the skin. They are mechanoreceptors responding to deep pressure touch and particularly to high frequency vibration. They are found in the subcutaneous tissue. Vater pacini are oval in shape, measuring approximately 1mm in length. They lie deeper in the dermis so that more pressure is required to register sensation. These corpuscles are found in mesenteries, especially the pancreas, and are often found near joints.



## CHARACTERISTICS OF THE SKIN

### Sebum Activity Level

#### **Oily Skin:** Activity

- Oily skin is a hereditary condition that develops due to overactive sebaceous glands.
- This activity is controlled by the androgen hormone.
- Oily skin can be recognized by its shiny, thick appearance.
- Pores are enlarged, with many blocked pores and comedones.
- Skin is sallow in appearance and is more prone to pimples and blemishes because of its over-lubrication with excessive oil, but less prone to wrinkles and fine lines.
- The oil also helps keep moisture in the skin from evaporating.

#### **Dry Skin:** No Activity

- Skin appears tight, dull in color.
- Dry skin develops as a result of sebaceous gland under activity.
- Skin dryness, though hereditary like the skin oiliness, also results from the aging process.
- As all body activities slow down, oil gland activity slows as well. Dry skin tends to be dehydrated.
- Dry skin is characterized as very fine, overly delicate and thin.
- Pores are almost invisible.
- The skin tends to wrinkle easily and is often filled with tiny superficial lines.
- As the person advances in years, the body's cell renewal process slows down and the cells are not replaced as quickly as before.
- Massage can be very effective in stimulating skin metabolism.

### Visual/Elasticity

Move the skin; touch it to see how it moves back.

- Good – 1
- Fair – 2
- Poor – 3
- Bad – 4

Elasticity permits the body to move freely without danger of tearing or rupturing when we stretch or bend. This is due mainly to the network of elastin and collagen fibers found in the dermis. Elasticity gives the skin the flexibility to withstand any physical pressure that could puncture it or leave a portion of the body unprotected. Skin bounces back when lightly pinched.

### Visual/Texture

Rub Skin. Is the skin slick?

- Thin/Medium/Thick

Skin has different degrees of thickness on different parts of the body. It is thin around the eyes and thick on the palms of the hands and soles of the feet. In general, a man's skin is thicker than a woman's. The skin has structural folds formed by movement and muscular contraction (i.e. wrinkles). The skin feels smooth because of hair growing on its surface. Is there new scarring? This allows determination of absorption of product or penetration. Signs of acne lesions or scars.

- Temperature Control Extremes

Use back of hand to determine differences in temperatures.

Hot-Dilated; Cold-Constricted

The skin controls the body's temperature by opening or closing its pores and regulating the secretion of sweat from its glands. Hot flashes cause bacteria to be more present; Antiseptic cleansers. If always cold: harder absorption; slower healing; products should lay on skin i.e. heavier.

Pores are either dilated or constricted. When the pore or follicle openings are dilated this creates a pathway for bacteria and free radicals to get into the skin. This can cause different skin conditions.

### Visual/Sensations

Determining touch and facial movement of treatment.

Ask if sensitive to hot or cold.

The skin is the sensory organ with which we touch and feel the world. The nerves in the skin enable us to gather vital information about the environment for our survival in it. (Questions to ask); Is the client sensitive to hot or cold? What is the client's pain tolerance on a level of 1 – 10? Does the client experience sensitivity to smells?



## Visual/Permeability

Stretch skin to check for dehydration

Ask yourself, “is the skin slick?”

The stratum corneum is a waterproof and water resistant barrier that doesn't allow harmful foreign bodies to penetrate. Keratin in the outer cells makes the skin impermeable. Texture of the stratum corneum; Thin, Medium, or Thick?

- Thicker; break it down (light exfoliation) smooth out to allow penetration.
- Ideal: medium texture.
- Thin: Only use hydration cream; no exfoliation. If thin, build it up before treating using products formulated for sensitive skin.

Laser or chemical scarring

## Potential Hydrogen

The pH measures the acidity and quantity of free hydrogen ions found in a solution. pH stands for “potential in hydrogen.” If a solution has more positive hydrogen ions than negative hydroxide ions it is acidic. If the solution has more hydroxide ions it is alkaline. pH measurement charts range from 0 to 14. 7 is the midpoint (neutral). Numbers below 7 indicate acidity, and numbers above 7 indicate alkalinity. pH: 3.5 product pH would normally be used for most product. Lower than 3.0 may cause damage; go deeper than corneum. Product: 3.0 pH = 8% acid.



## SKIN TYPE CLASSIFICATION (FOR RETAIL)

### Normal Skin:

- Appears to be functioning normally, is neither too dry nor oily.
- Has enlarged pores on T-Zone, some blocked pores and few comedones.
- On the cheeks the pores are normal, no blocked pores and no comedones.
- Usually free of blemishes that require extensive treatment.
- Skin metabolism can be improved by stimulation through massage.
- Regular care assures that normal skin functions in a normal way.
- The main objectives of the esthetician are to cleanse the skin of dead cells and remove impurities from the follicles.

### Oily:

- Oily skin is a hereditary condition that develops due to overactive sebaceous glands.
- This activity is controlled by the androgen hormone.
- Oily skin can be recognized by its shiny, thick appearance.
- Pores are enlarged, with many blocked pores and comedones.
- Skin is sallow in appearance and is more prone to pimples and blemishes because of its over-lubrication with excessive oil, but less prone to wrinkles and fine lines. The oil keeps moisture in the skin from evaporating.

### Dry:

- Skin appears tight, dull in color.
- Dry skin develops as a result of sebaceous gland under activity.
- Skin dryness, though hereditary, also results from the aging process.
- As all body activities slow down, oil gland activity slows as well. Dry skin tends to be dehydrated.
- Dry skin is characterized as very fine, overly delicate and thin.
- Pores are almost invisible.
- The skin wrinkles easily and is often filled with tiny superficial lines.
- As the person advances in years, the body's cell renewal process slows down and the cells are not replaced as quickly as before.
- Massage can be very effective in stimulating skin metabolism.

### Combination Skin:

- This skin is characterized by two or more different conditions.
- T-zone which consists of the forehead, nose, and chin is oily, but the rest of the face is normal or even dry.
- The condition must be treated separately or with products especially formulated for combination skin.
- Skin types are hereditary and are the result of oil glands functioning.
- Skin types can be classified into four categories. Normal, oily, dry, and in most cases, individuals have a combination of skin types, such as an oily T-Zone (forehead, nose, and chin) and normal cheeks.
- The notion that one person's skin can be oily and dry is more commonly confusion in concept than reality. For example, when people describe the skin as being oily and suddenly being dry, they are referring to an oily skin type that is losing moisture.
- Moisture can be lost because of excessive use of astringents, soaps and scrubs in an attempt to reduce the amount of oil secretion.
- While the skin is an oily type, this dryness should be considered a skin condition and is properly referred to as dehydration, lack of moisture, rather than oil.

