

The Integumentary System

INTEGUMENTARY SYSTEM

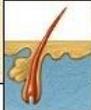
Skeletal System

Skin protects bones; helps provide vitamin D for Ca^{2+} absorption.



Bones provide support for skin.

How the Integumentary System works with other body systems



Lymphatic System/Immunity

Skin serves as a barrier to pathogen invasion; Langerhans cells phagocytize pathogens; protects lymphatic vessels.



Lymphatic vessels pick up excess tissue fluid; immune system protects against skin infections.

Muscular System

Skin protects muscles; rids the body of or conserves heat produced by muscle contraction.



Muscle contraction provides heat to warm skin.

Respiratory System

Skin helps protect respiratory organs.



Gas exchange in lungs provides oxygen to skin and rids body of carbon dioxide from skin.

Nervous System

Skin protects nerves; helps regulate body temperature; skin receptors send sensory input to brain.



Brain controls nerves that regulate size of cutaneous blood vessels, activate sweat glands and arrector pili muscles.

Digestive System

Skin helps to protect digestive organs; helps provide vitamin D for Ca^{2+} absorption.



Digestive tract provides nutrients needed by skin.

Endocrine System

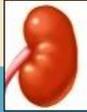
Skin helps protect endocrine glands.



Androgens activate sebaceous glands and help regulate hair growth.

Urinary System

Skin helps regulate water loss; sweat glands carry on some excretion.



Kidneys compensate for water loss due to sweating; activate vitamin D precursor made by skin.

Cardiovascular System

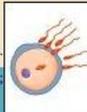
Skin prevents water loss; helps regulate body temperature; protects blood vessels.



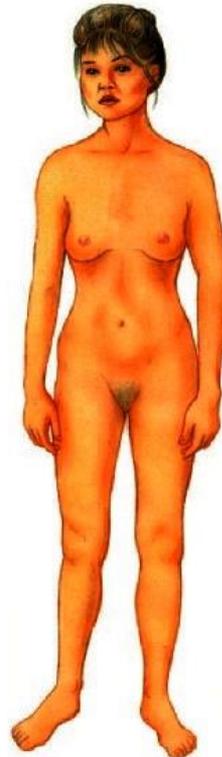
Blood vessels deliver nutrients and oxygen to skin; carry away wastes; blood clots if skin is broken.

Reproductive System

Skin receptors respond to touch; mammary glands produce milk; skin stretches to accommodate growing fetus.



Androgens activate oil glands; sex hormones stimulate fat deposition, affect hair distribution in males and females.



Introduction

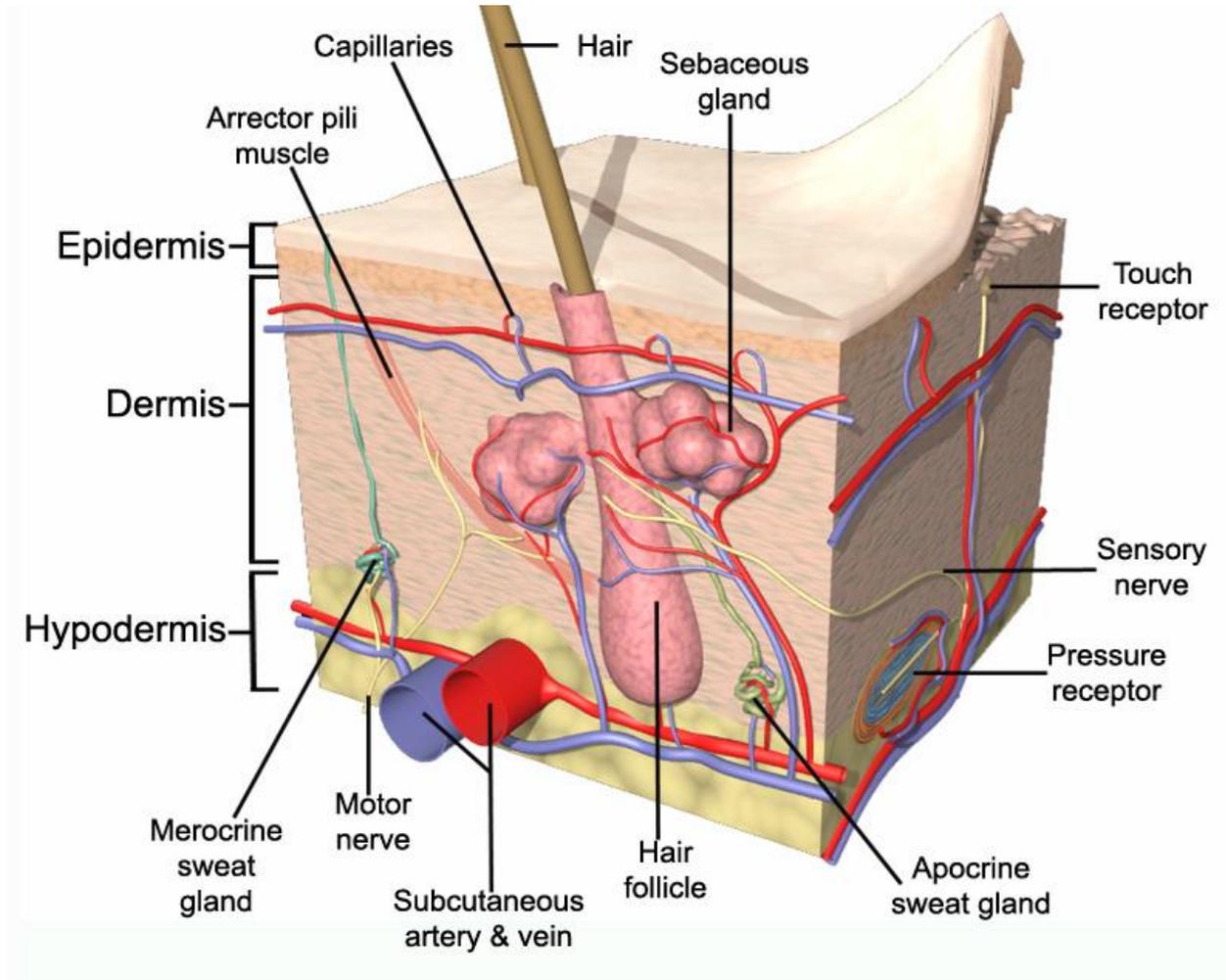
- The **integumentary system** consists of the skin, hair, nails, the subcutaneous tissue below the skin and assorted glands.
- The most obvious function of the integumentary system is the **protection** that the skin gives to underlying tissues.
- The skin not only keeps most harmful substances out, but also prevents the loss of fluids.
- A major function of the **subcutaneous tissue** is to connect the skin to underlying tissues such as muscles.



- **Hair on the scalp provides insulation from cold for the head.**
- **The hair of eyelashes and eyebrows helps keep dust and perspiration out of the eyes, and the hair in our nostrils helps keep dust out of the nasal cavities.**
- **Any other hair on our bodies no longer serves a function, but is an evolutionary remnant.**
- **Nails protect the tips of fingers and toes from mechanical injury.**
- **Fingernails give the fingers greater ability to pick up small objects.**

Skin

Structure and Function



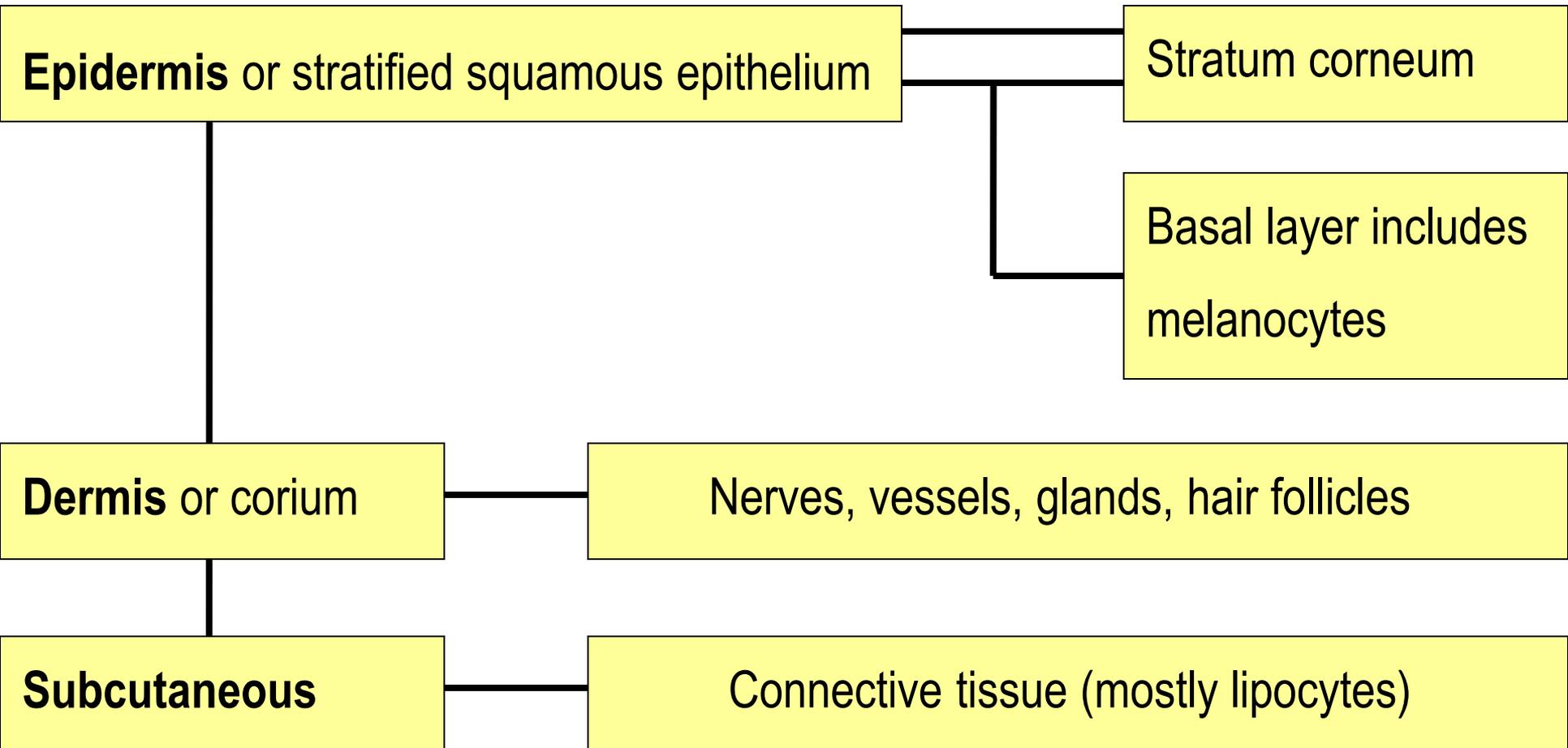
Structure and Function

Skin is the largest organ of the body, and serves to:

- **Protect against injury**
- **Protect against the sun UV rays**
- **Prevent entry of harmful microorganisms**
- **Maintain the proper internal body temperature**
- **Excrete waste materials through perspiration**
- **Function as a sense organ**

Structure and Function

Three Layers of the Skin

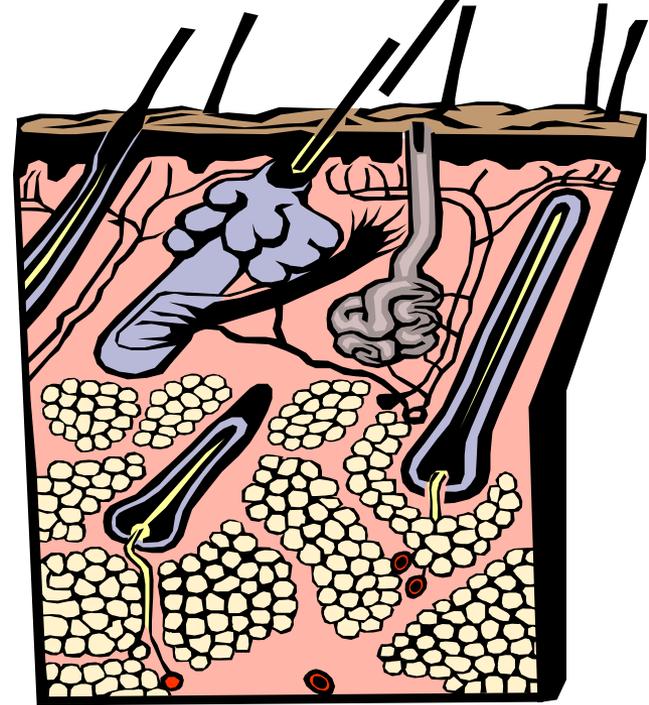


Structure and Function

epidermis

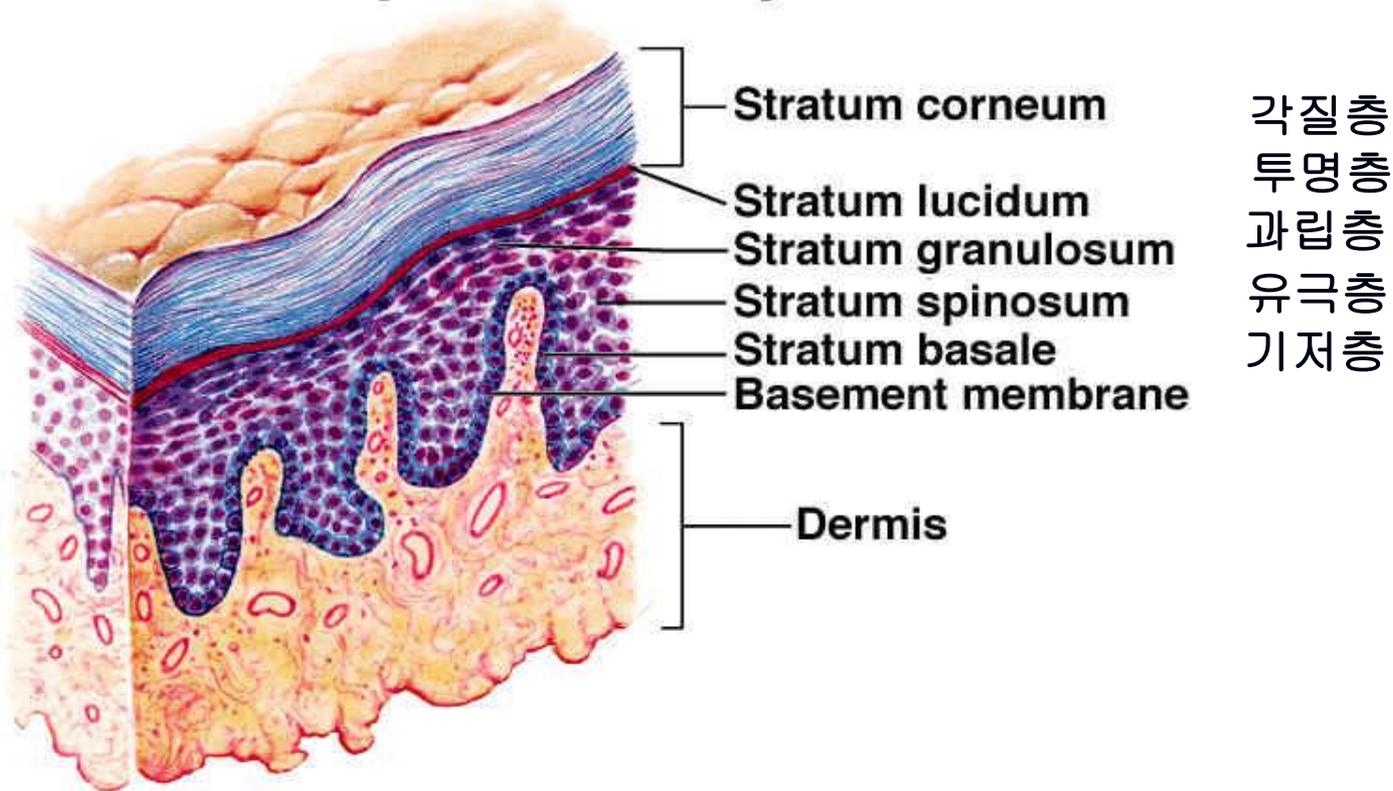
Epidermal Layer

- **Outermost skin layer**
- **Consists of several sublayers**
- **Top sublayer is called the stratum corneum**
- **Nonvascular**
- **Keratin is found in the cells**



- **Stratum germinativum is the bottom sublayer where new cells are produced that push up toward the stratum corneum**

Epidermal Layer



The epidermis can be further subdivided into the following *strata* (beginning with the outermost layer): corneum, lucidum, granulosum, spinosum, basale.

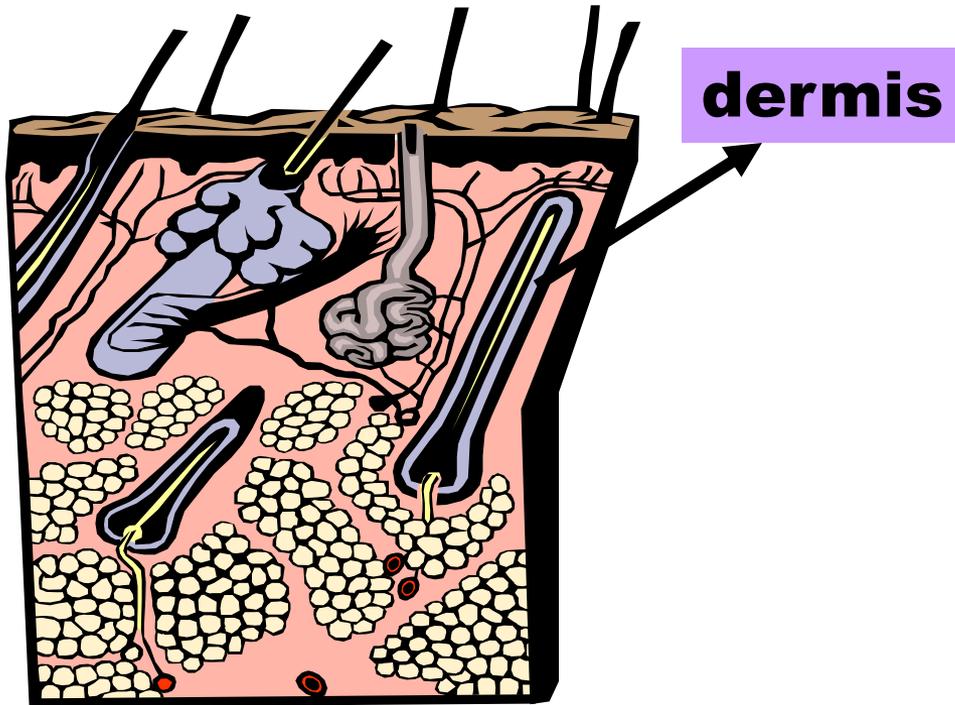
Epidermis (표피)

- **The epidermis is the outer layer of skin.**
- **The majority of cells (95%) are specialized epithelial cells called **keratinocytes** which produce a tough protein called **keratin**.**
- **There are five distinct sub-layers of cells that represent the different stages in the keratinization process.**
- **New skin cells are produced at the basal membrane (deepest epidermal layer) pushing the older cells towards the surface. (Stratum germinativum)**

- **As the *keratinocytes* get older and migrate closer to the skin's surface they change from being square-shaped to flat, they become engorged with *keratin* (각질) and eventually die, losing all of their internal structures.**
- **These overlapping, closely packed layers of keratinized cells form a permeable barrier and are able to withstand scuffs and scrapes. It takes 40-60 days for keratinocytes to reach the surface of the skin where they are sloughed away.**

- **Other cells in the epidermis include melanocytes and Langerhans cells.**
- ***Melanocytes* are responsible for the surface colour of the skin, they produce melanin which protects the skin from UV radiation.**
- ***Langerhans cells* are part of the skin's immune response and engulf foreign material.**
- **The epidermis does not contain any blood vessels but is nourished by the capillaries in the dermis below.**

Structure and Function



Dermal Layer

- Also called the ***corium***
- Contains two sublayers the ***papillary*** layer and the ***reticular*** layer
- Holds many capillaries, lymph cells, nerve endings, sebaceous and sweat glands and hair follicles

• Collagen fibers are found in the connective tissue and when collagen fibers stretch, they form ***striae***

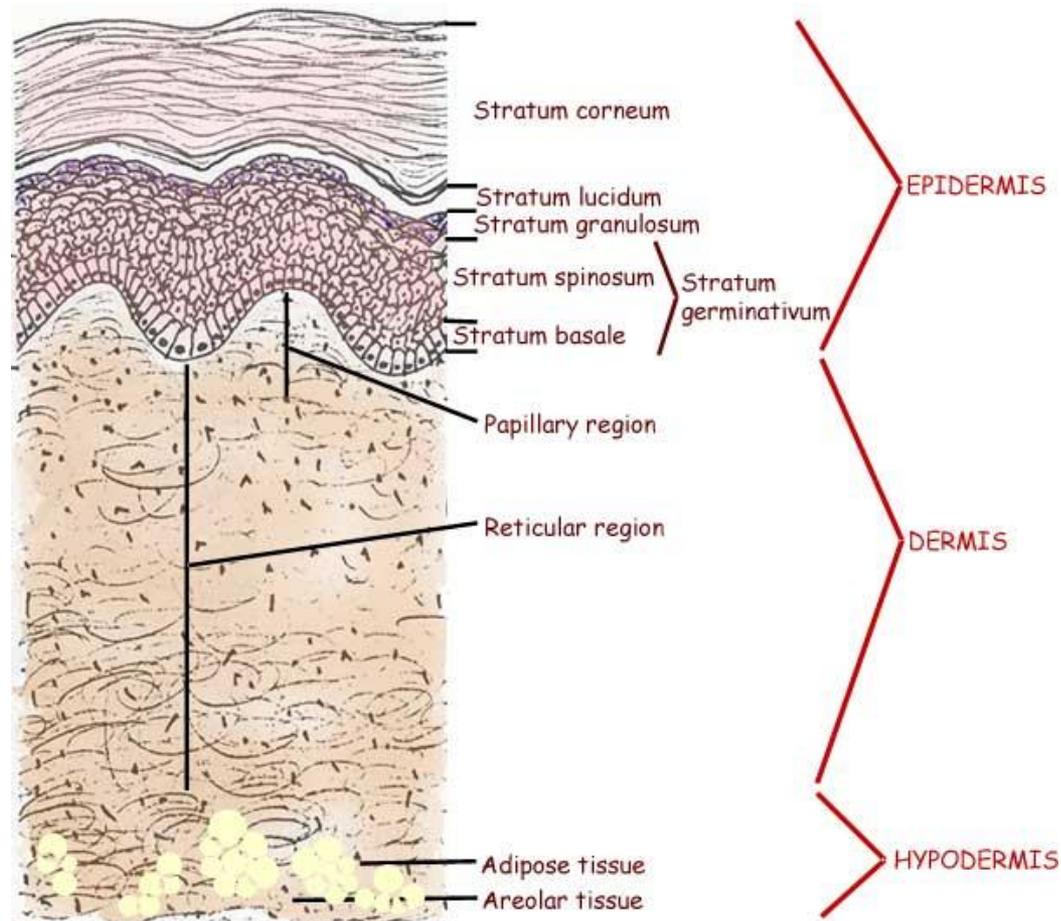
Dermis (진피)

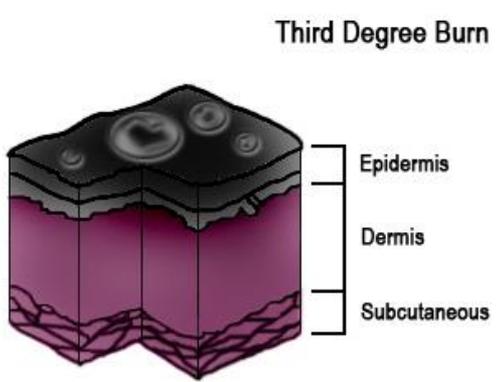
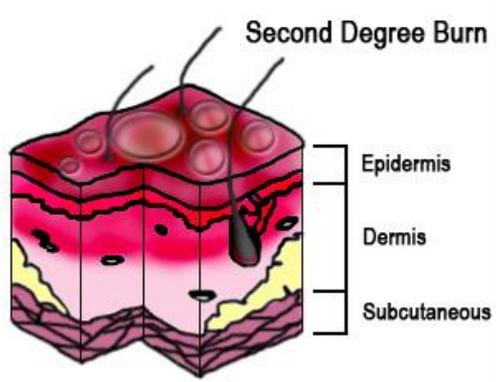
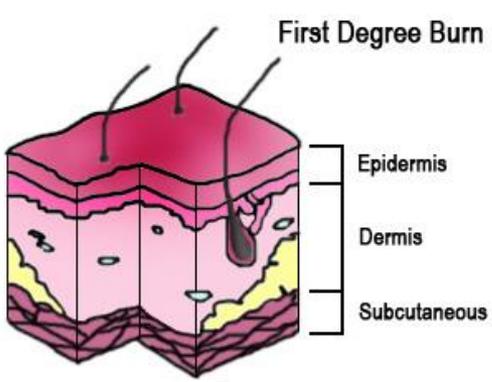
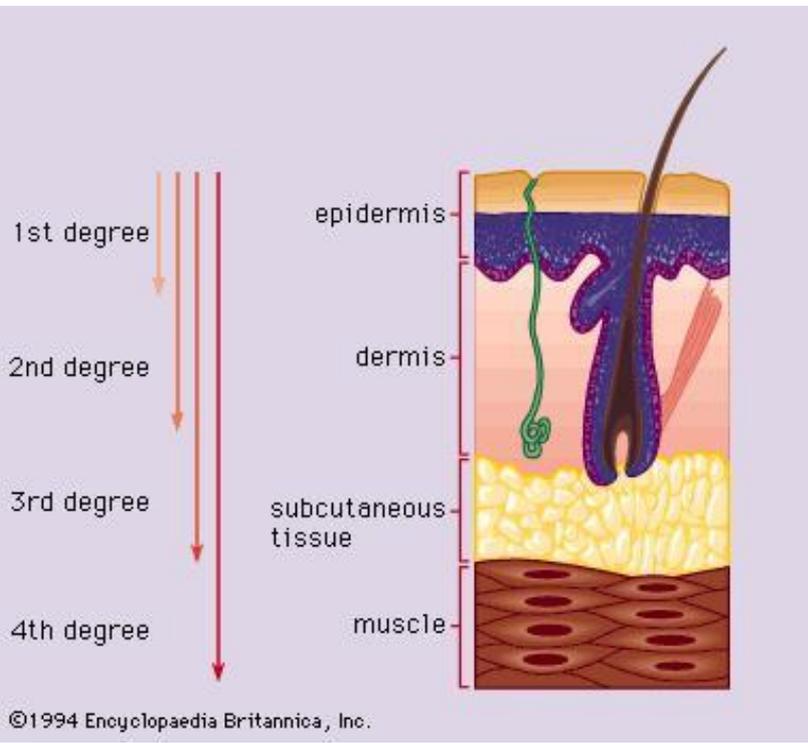
- **The dermis is much thicker than the epidermis and lies immediately underneath it.**
- **It is a **collagen rich** connective tissue that contains *fibroblast cells* that produce collagen and elastin, which are responsible for the pliability and strength of skin.**
- **It is connected below to the hypodermis.**
- **The dermis is made up of two layers, reticular (deeper) and papillary (superficial).**
- **The dermis contains the sensory nerve endings, hair follicles, arrector pili muscles, sweat glands, sebaceous glands, lymphatics and capillaries.**

- **The papillary layer (유두층) is outermost and extends into the epidermis to supply it with vessels. It is composed of loosely arranged fibers.**
- **Papillary ridges** make up the lines of the hands giving us **fingerprints**.
- **The reticular layer (망상층) is more dense and is continuous with the hypodermis.**
- **It contains the bulk of the structures (such as sweat glands).**
- **The reticular layer is composed of irregularly arranged fibers and resists stretching.**

Hypodermis (피하조직)

The hypodermis is not a skin layer but lies below the dermis, and is a *subcutaneous tissue* which contains fat, blood vessels and sensory receptors.





Functions

Skin Layers	Properties	Function
Epidermis	Outer layer of skin, composed of 5 zones of stratified epithelium (keratinocytes); contains melanocytes and Langerhans cells.	Responsible for the continual replenishing of skin, resists friction, waterproof, prevents water loss.
Stratum corneum (Horny layer)	15-25 layers of dead, flat, keratinized squamous epithelial cells , without nuclei. Normally thin but thick over the soles of the feet and palms of the hands.	Resists friction, waterproof, prevents water loss.
Stratum lucidum (Clear layer)	Only found in thick skin (palms and soles of the feet). Transition between the corneum and lucidum layer.	Resists friction, waterproof, prevents water loss.
Stratum granulosum (Granular layer)	3-5 layers of keratinocytes containing keratin granules.	They form keratin and expel lipids which stick the cells together and form a waterproof barrier.

Skin Layers	Properties	Function
Stratum spinosum (Prickly layer)	Usually the thickest layer of keratinocyte cells, they are joined together by desmosomal connections. Also contains Langerhans cells.	Langerhans cells are part of the immune response.
Stratum basale (Basal cells)	A layer of cuboidal-shaped cells, lined up on a basal membrane. It contains stem cells, keratinocytes, and melanocytes (pigment cells).	Keratinocyte cell division occurs here to replenish skin. Melanocytes protect the skin from UV.
Dermis	Deep layer of skin, composed of collagen and elastin rich connective tissue. It contains hair follicles, sebaceous glands, blood vessels and sense receptors.	It is responsible for the elasticity and mechanical support of skin. Supplies the epidermis with nutrients. Important in thermoregulation.
Papillary	Projections push into the epidermis. Highly vascular and innervated.	Forms finger prints, brings capillaries closer to the avascular epidermis.
Reticular	Dense, interlacing connective tissue, predominantly parallel to the skin's surface.	Forms lines of skin tension, cleavage lines.
Hypodermis	Not part of skin layer. Subcutaneous connective tissue, rich in fat and vessels.	Protective cushion and insulator.

Accessory skin structures

Skin Appendage	Structure	Function
Hair	Hairs originate in the dermis and are shafts of modified keratinized epithelium which grow from the roots of hair follicles.	Sensory role, retains heat of the head and protects it from UV, advertises sexual maturity and disperses scents.
Arrector pili muscles	Smooth muscle cells which extend from the hair follicle to the papillary layer of the dermis.	Cause the hair to stand on end – "Goose Bumps".
Sweat glands (한선)	There are two types; merocrine and apocrine. They consist of coiled tubes embedded in the dermis or hypodermis and open out onto the skin surface.	Produce a watery substance to cool the body, excretion of wastes, excretion of body scents.

Accessory skin structures (contin.)

Skin Appendage	Structure	Function
Nails	The nail plate is composed of dead hard keratinized cells which lie on top of a nail bed and which grow from the nail matrix under the skin.	Allows the tips of our fingers to be soft and sensory. They serve as tools to aid in the manipulation of objects.
Sebaceous glands	Flask shaped glands, located in the dermis and open into the hair follicles.	Produce sebum, an oily Secretion which prevents the hair and skin becoming dry.

2. Skin Function

- **Protection:** Skin gives an anatomical barrier between the internal and external environment in bodily defense; Langerhans cells in the skin are part of the immune system
- **Sensation:** Skin contains a variety of nerve endings that react to heat, cold, touch, pressure, vibration, and tissue injury; see somatosensory system and touch.
- **Heat regulation:** The skin contains a blood supply far greater than its requirements which allows precise control of energy loss by radiation, convection and conduction. Dilated blood vessels increase perfusion and heat loss while constricted vessels greatly reduce cutaneous blood flow and conserve heat. Erector pili muscles are significant in animals.

Homeostasis

- **As a whole, the integumentary system plays a big part in maintaining homeostasis.**
- **The integumentary system is the outermost organ system of the body and many of its functions are related to this location.**
- **The skin protects the body against pathogens and chemicals, minimizes loss or entry of water, and blocks the harmful effects of sunlight.**
- **Sensory receptors in the skin provide information about the external environment, helping the skin regulate body temperature in response to environmental changes and helping the body react to pain and other tactile stimuli.**

- **The large surface area of the skin makes it ideal for **temperature regulation**.**
- **The rate of heat loss can be **regulated by the amount of blood flowing** through the blood vessels in the dermis close to the surface of the skin.**
- **When the body temperature rises, as for example during exercise, sympathetic tone is reduced and this brings **about dilation of the blood vessels** supplying the skin.**

- **The increase in skin blood flow allows heat to be lost more rapidly so that body temperature does not rise above the normal homeostatic range.**
- **The rate of heat loss can also be boosted by the **production of sweat**, which takes up additional heat as it evaporates.**
- **Conversely, if heat production is less than required, **the dermal vessels constrict**, sweating stops, and heat is conserved by the body.**

Combining Forms

Combining Form

•adip(o)



•dermat(o)



•hidr(o)



•ichthy(o)



•kerat(o)



•lip(o)



Meaning

fatty

skin

sweat, sweat glands

fish, scaly

horny tissue

fatty

Combining Forms

Combining Form

•melan(o) →

•myc(o) →

•onych(o) →

•pil(o) →

•seb(o) →

•steat(o) →

•trich(o) →

Meaning

black, very dark

fungus

nail

hair

sebum

fat

hair

목성도 만만치 않은데요!!!!

목성

토성

천왕성

해왕성

지구

명왕성

