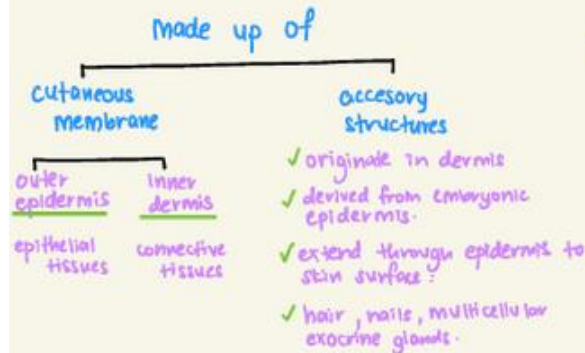


Integumentary System

Skin, Hair, Nails and Glands

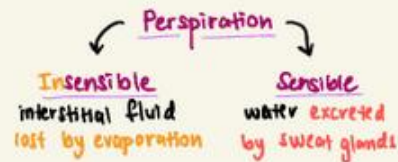
Integumentary System



protect underlying tissue & organs
maintain body temperature
stores lipid

Function of skin

- excretes salt, water & organic waste
- synthesizes vitamin D₃
- detect touch, pain, pressure & temperature



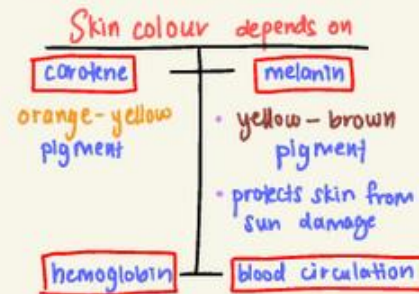
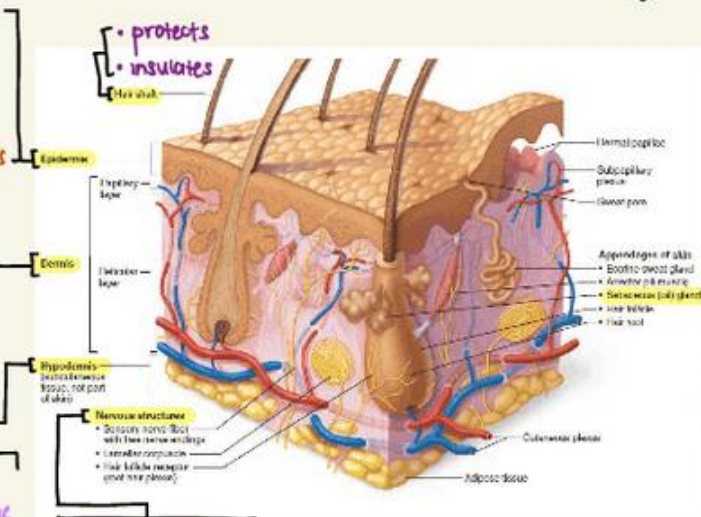
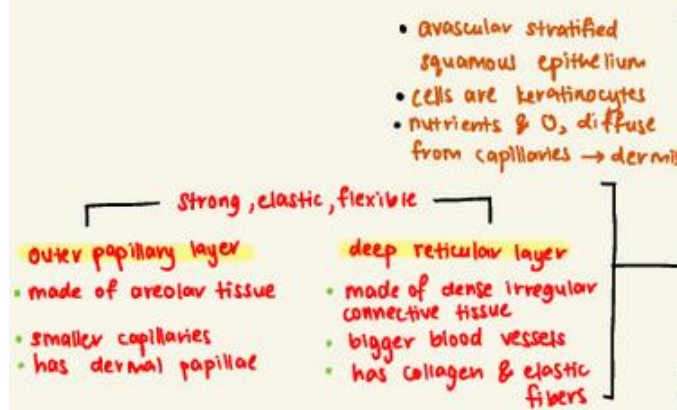
Dehydration
water loss through skin

Hydration
water gain through skin



Stratum corneum
Stratum lucidum
Stratum granulosum
Stratum spinosum
Stratum germinativum

Thin skin vs Thick skin	
Thin skin covers most of the body	Thick skin on palms, soles
✓	✓
✓	✓
✓	✓
✗	✓
✓	✓



Illness & Skin Colour

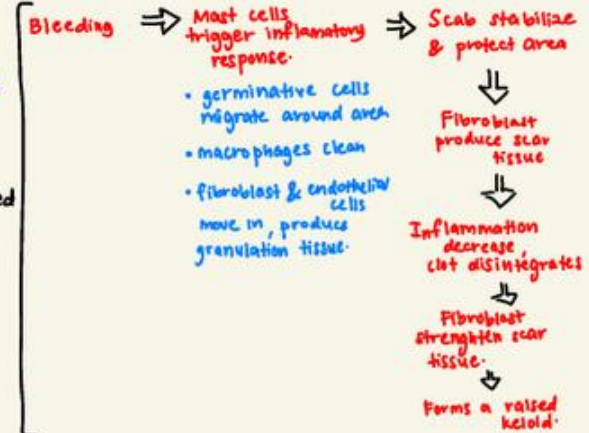
vitiligo - loss of melanocytes
- loss skin colour

jaundice - buildup of bile
- yellow colour

cyanosis - bluish skin tint
- caused by severe reduction in blood

- secrete sebum
- inhibits bacteria
- protect epidermis

Repair of Localized Injuries to Skin



Importance of Integumentary System

- protects & interacts with all organ systems
- changes in skin appearance - use to diagnose disease

Skin conditions

dermatitis - inflamed papillary layer
- itch/pain

skin damage - sagging
- wrinkles

Stretch marks - excessive skin stretching

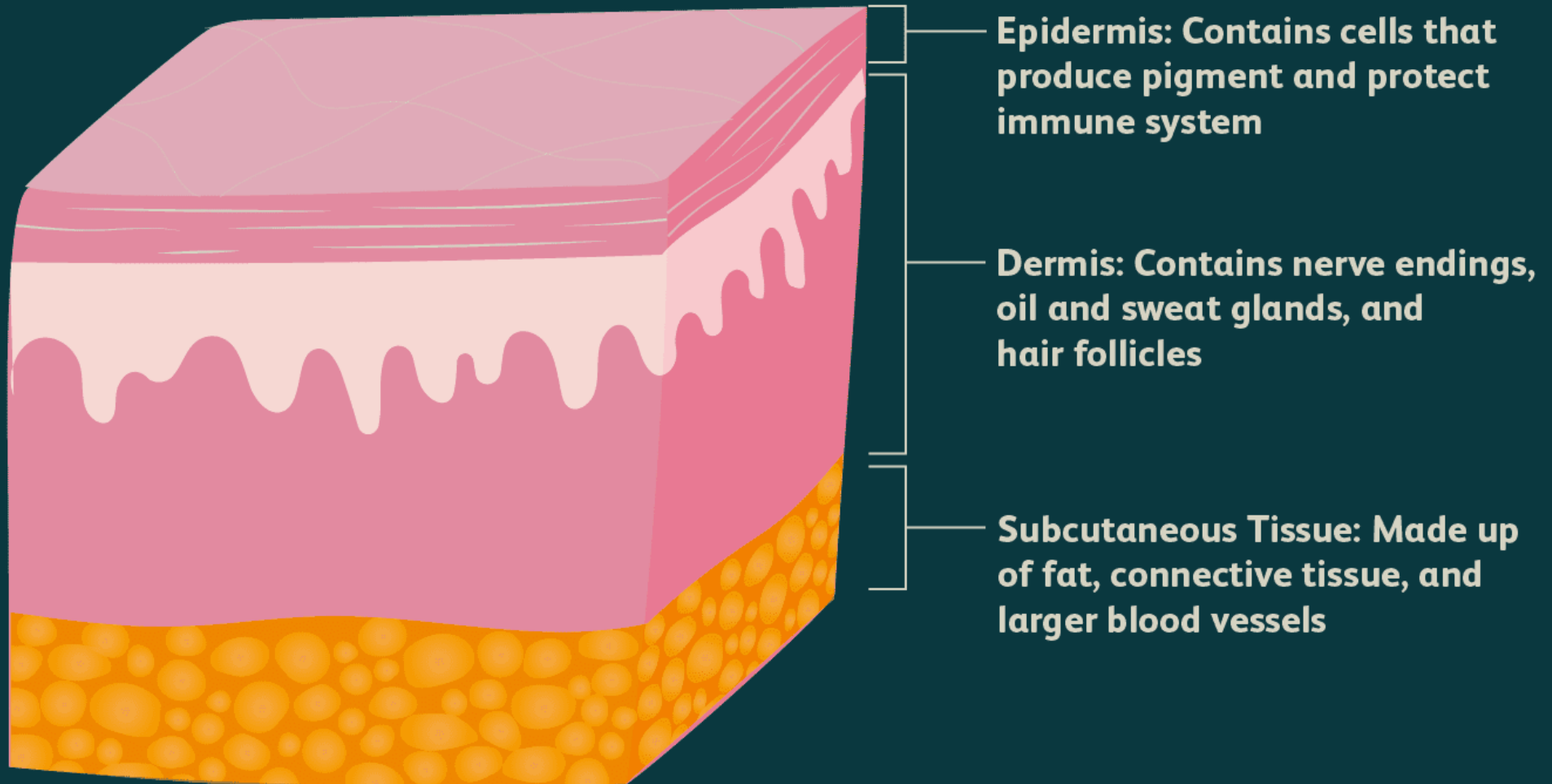
Subcutaneous layer

- ✓ loose connective tissue
- ✓ below dermis
- ✓ site of hypodermic injections
- ✓ stabilizes the skin
- ✓ allows separate movement

nerve fibers in skin controls:

- ✓ blood flow
- ✓ gland secretions
- ✓ sensory receptors

Layers of the Skin



Epidermis: The First Layer of the Skin

Dead keratin layer

Lamellar granule

Desmosome

Langerhans cell

Keratinocyte

Melanocyte

Stratum corneum

Horny layer

Stratum lucidum

Glassy layer

Stratum granulosum

Granular layer

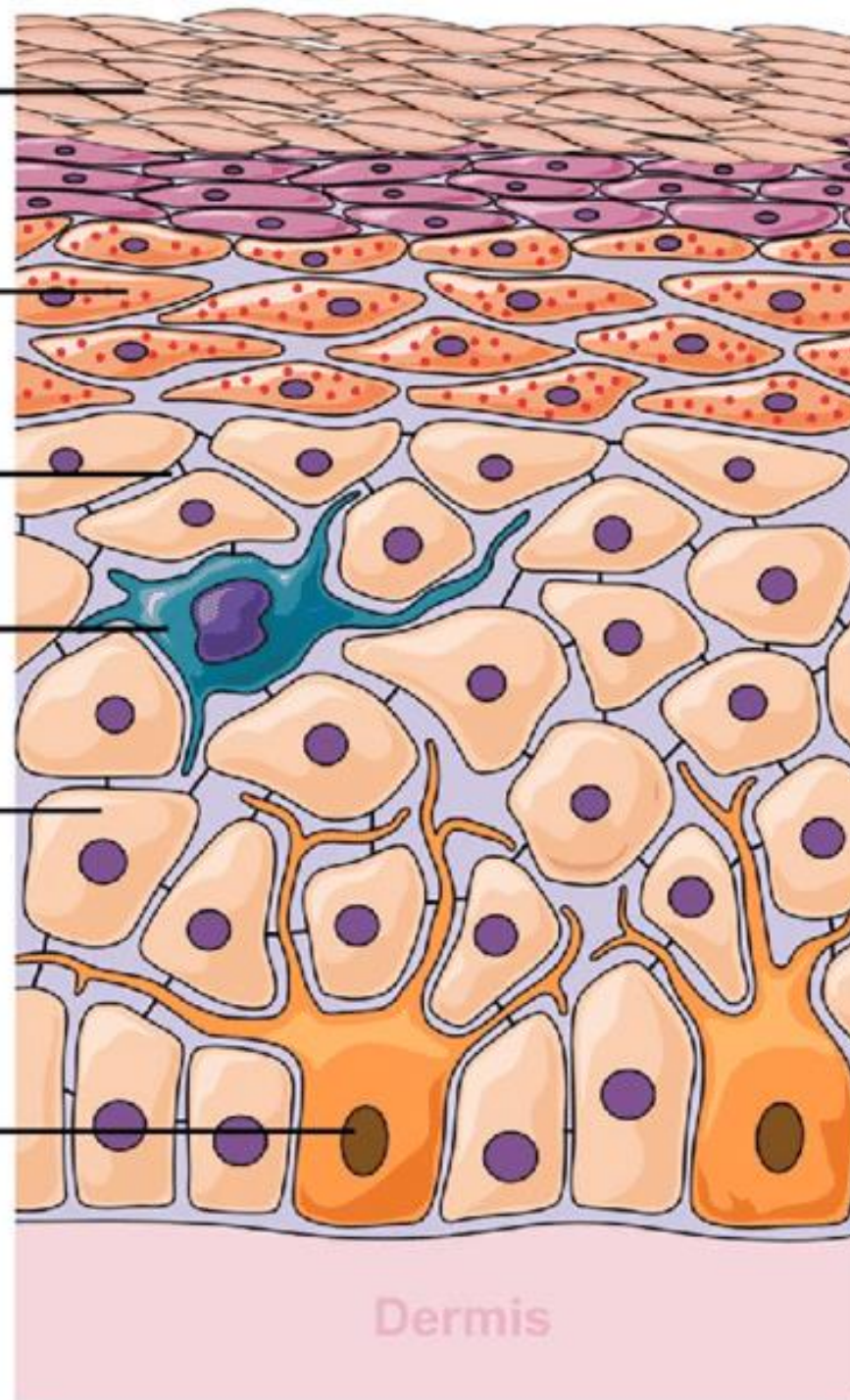
Stratum spinosum

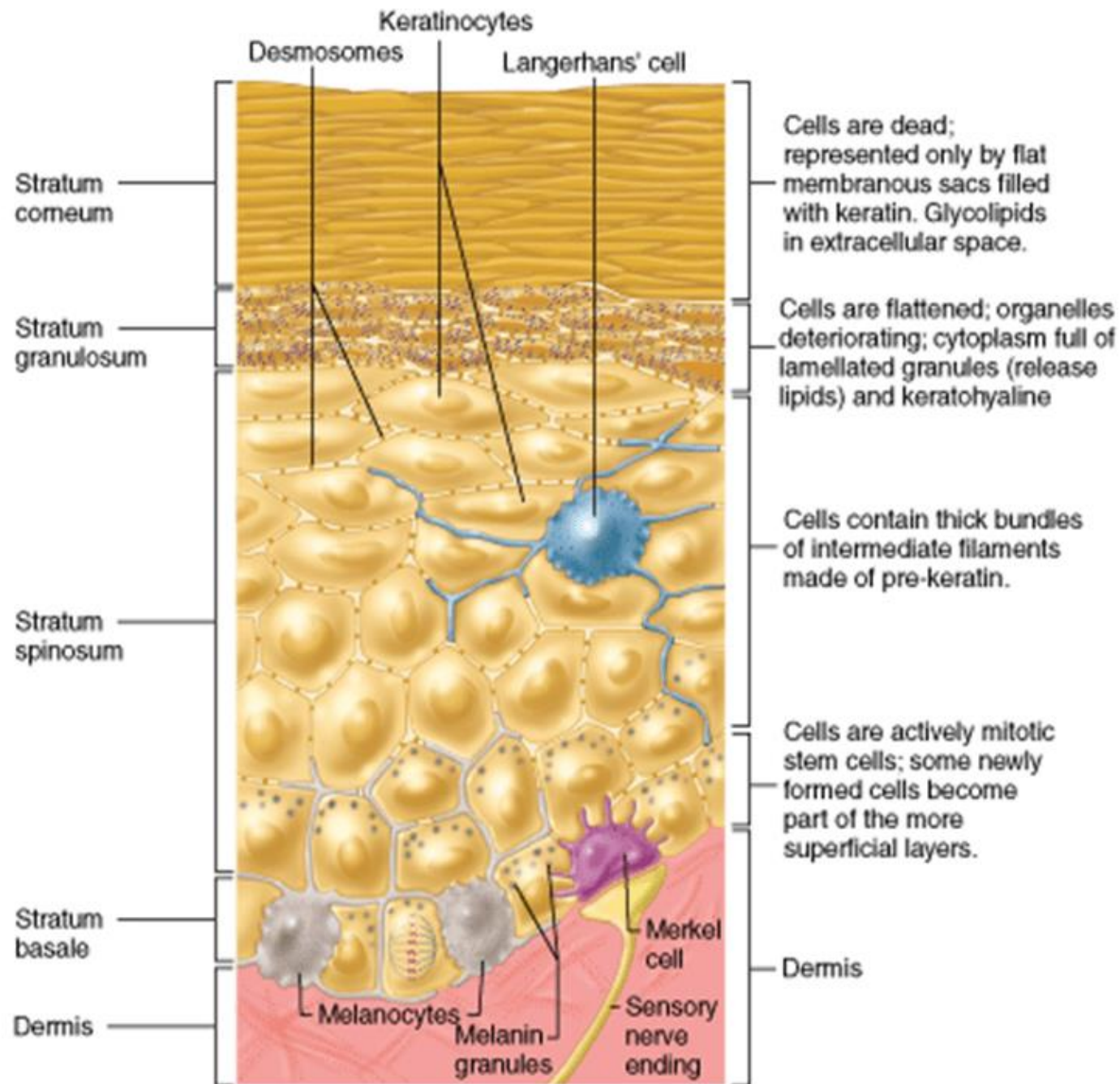
Spiny layer

Stratum basale

Germinating layer

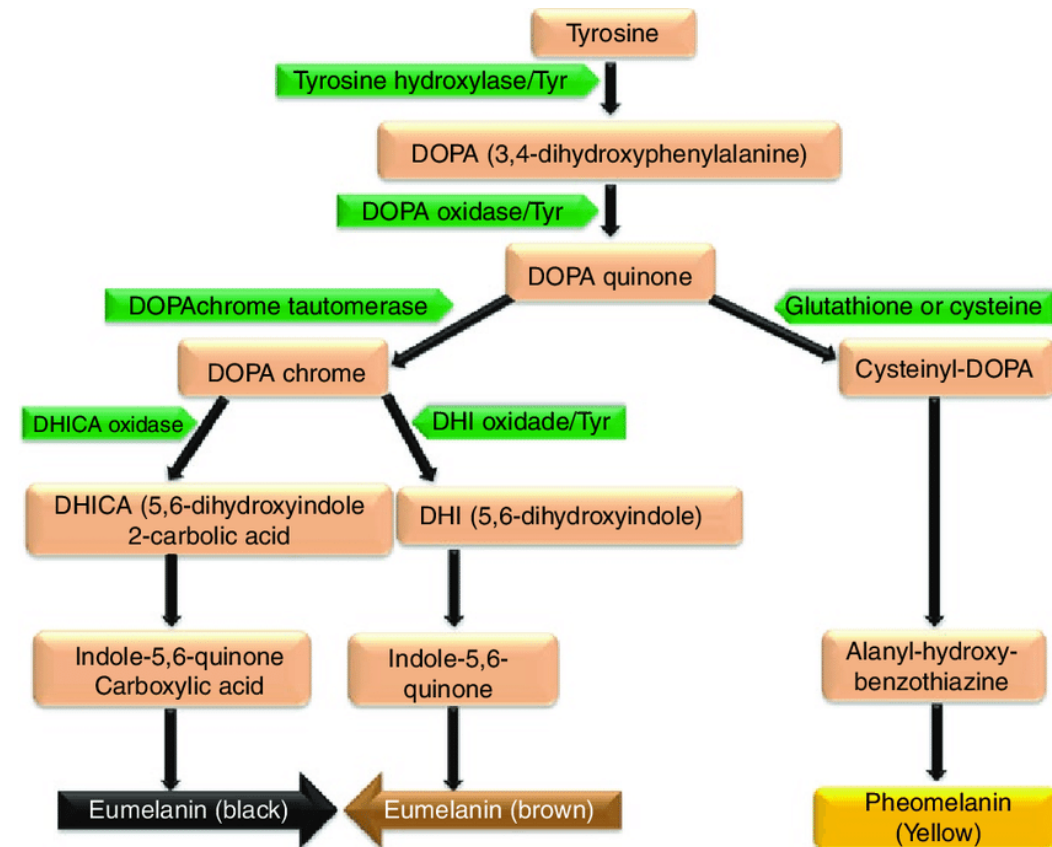
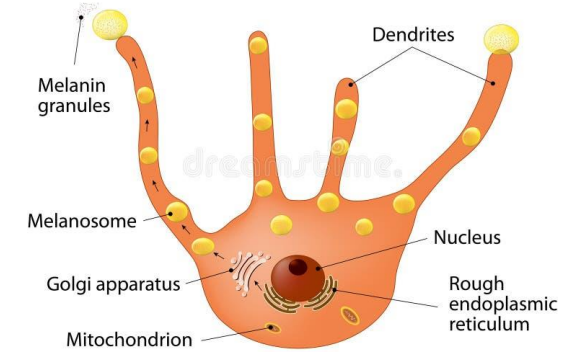
Dermis





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MELANOCYTE



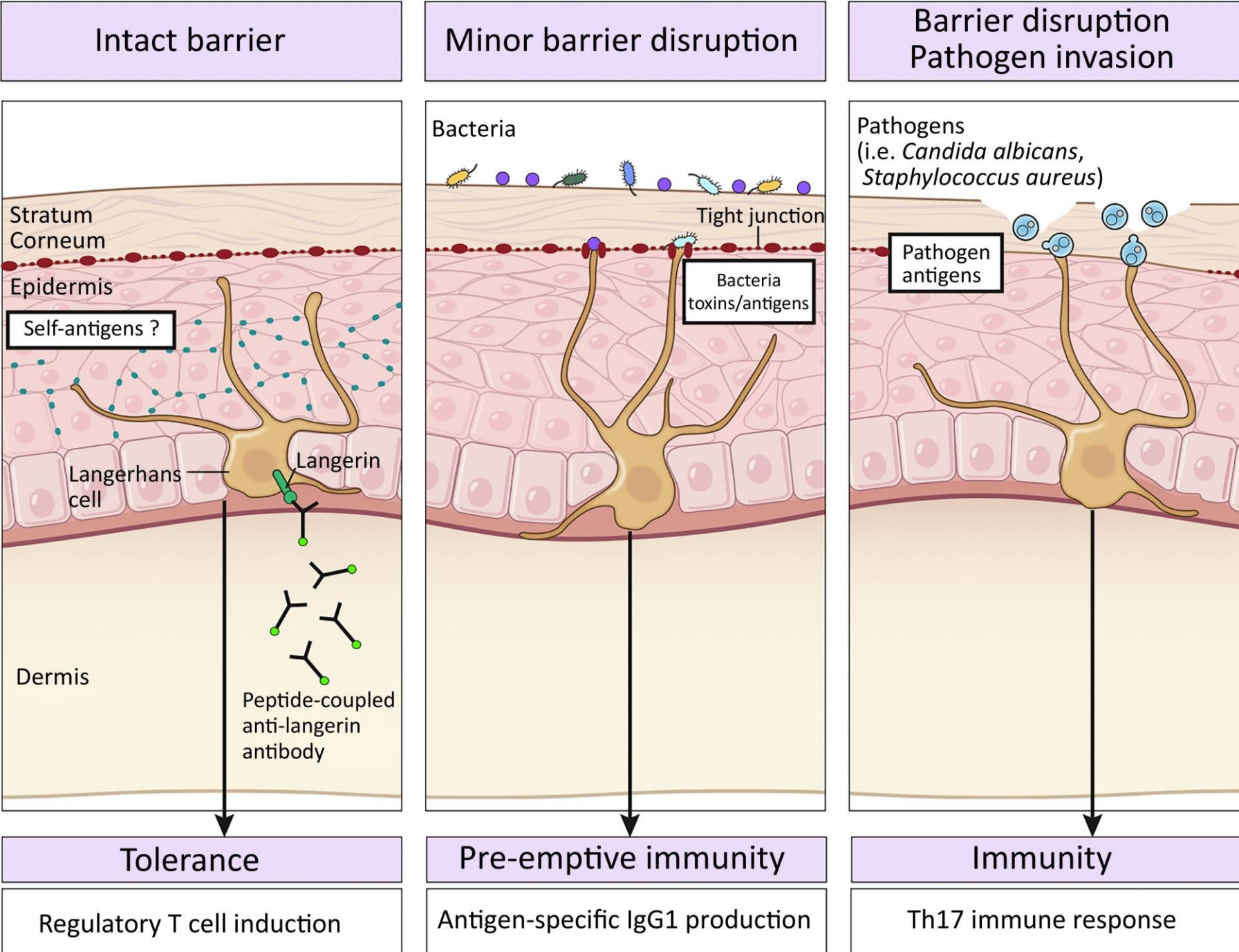
Factors Affecting Skin Coloration

Melanin – brown pigment

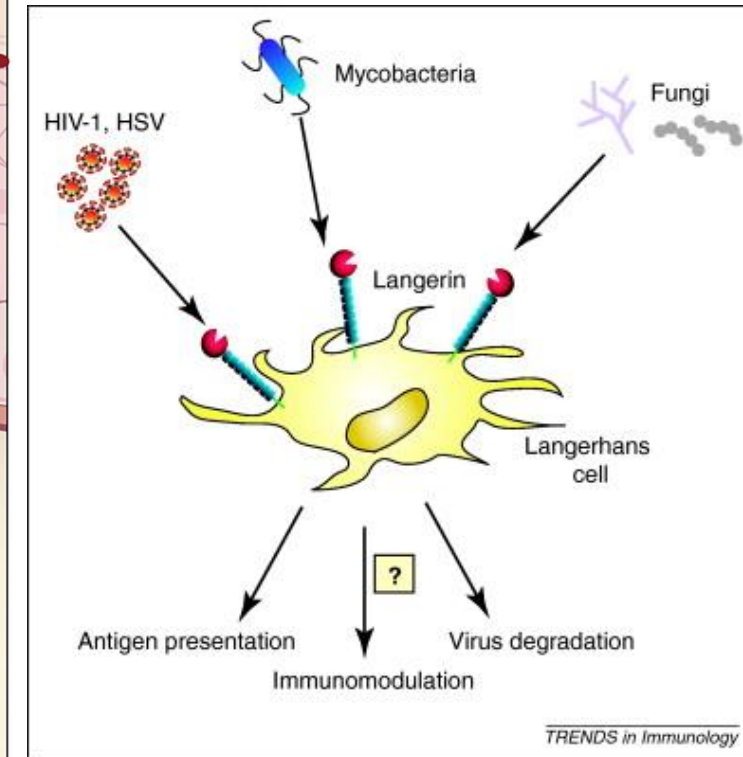
Carotene – yellow pigment

Haemoglobin – reddish color



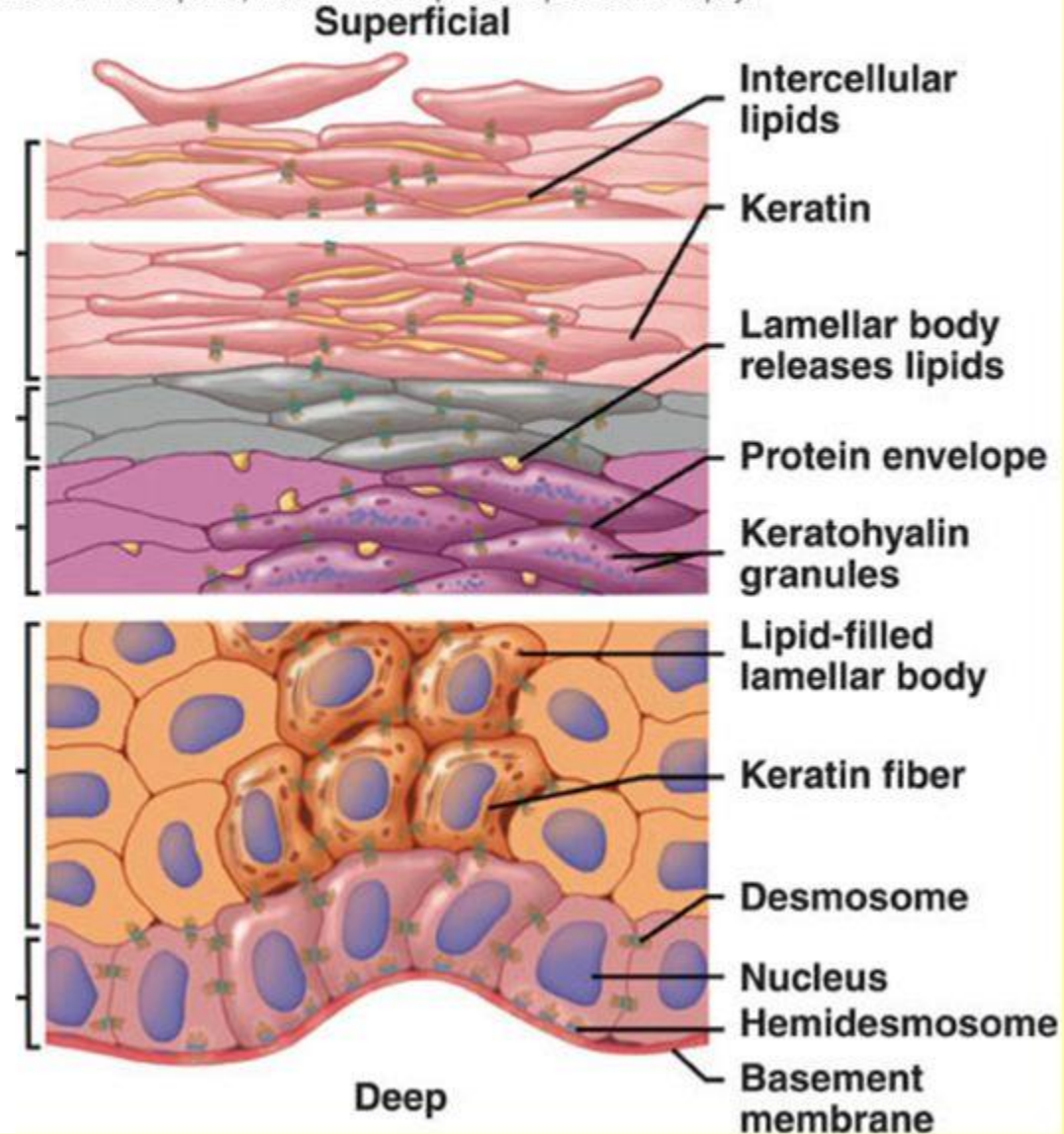


Langerhan's cells / Dendritic cells of the Skin



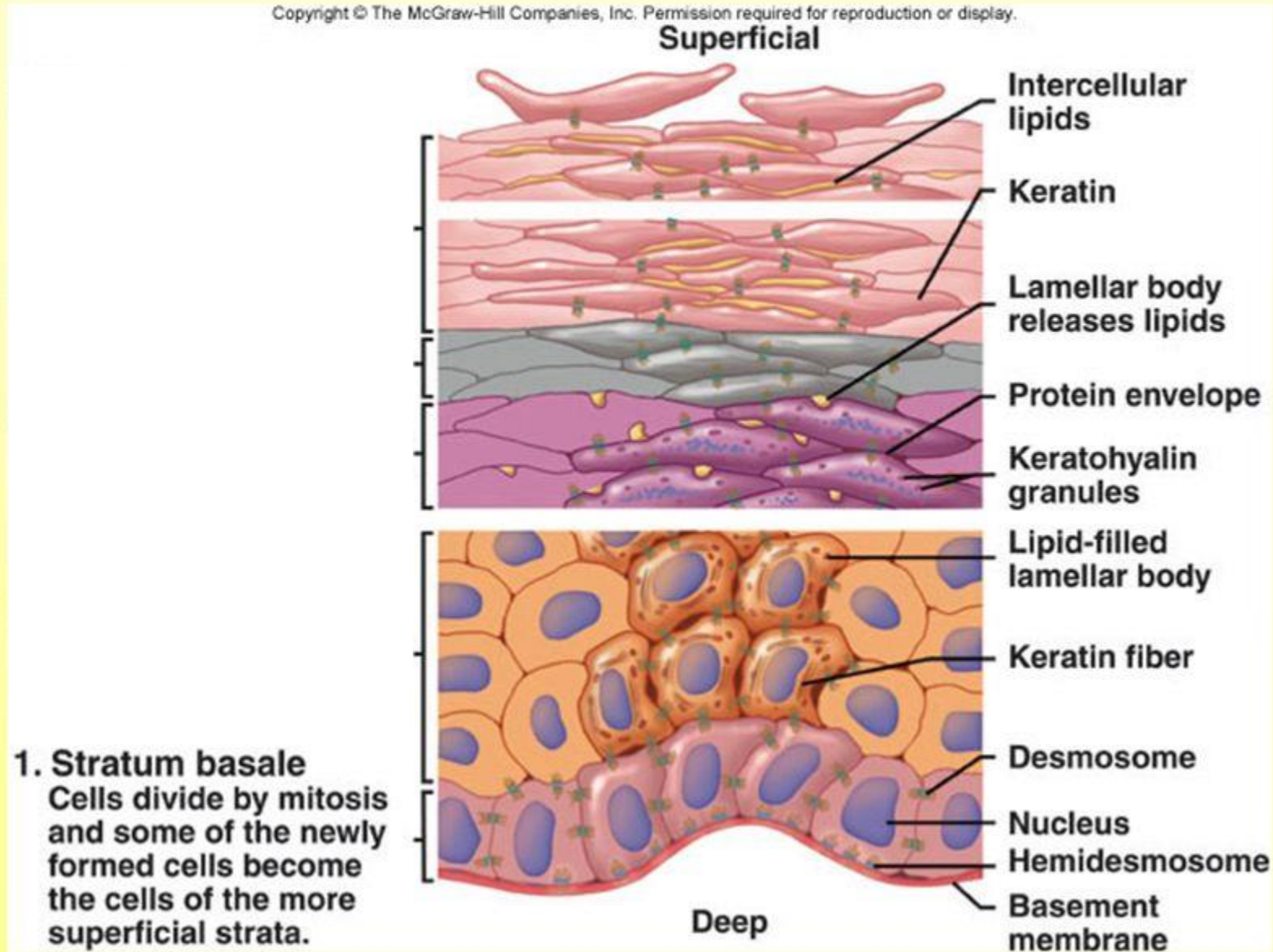
Epidermal Layers and Keratinization

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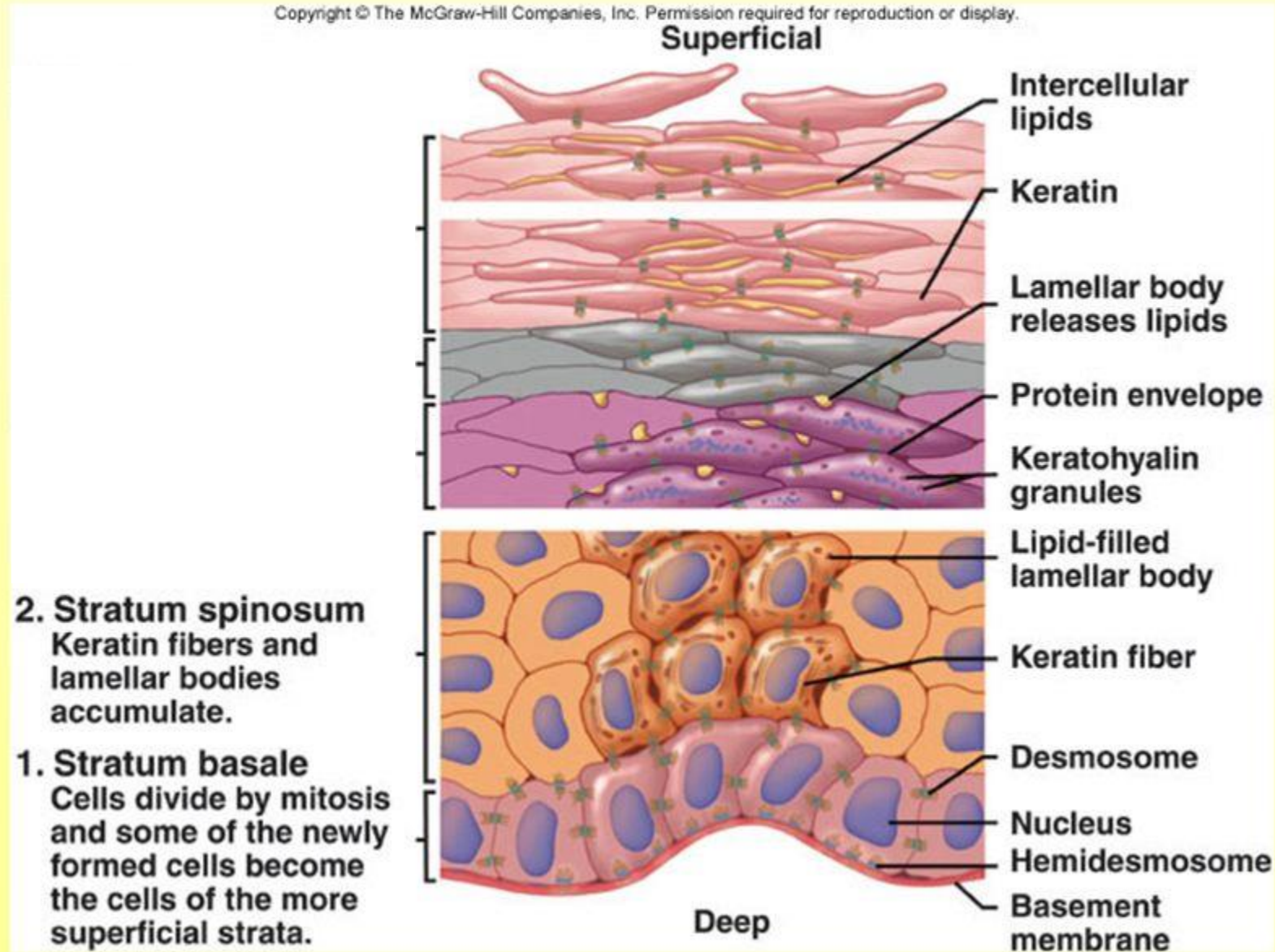
Epidermal Layers and Keratinization

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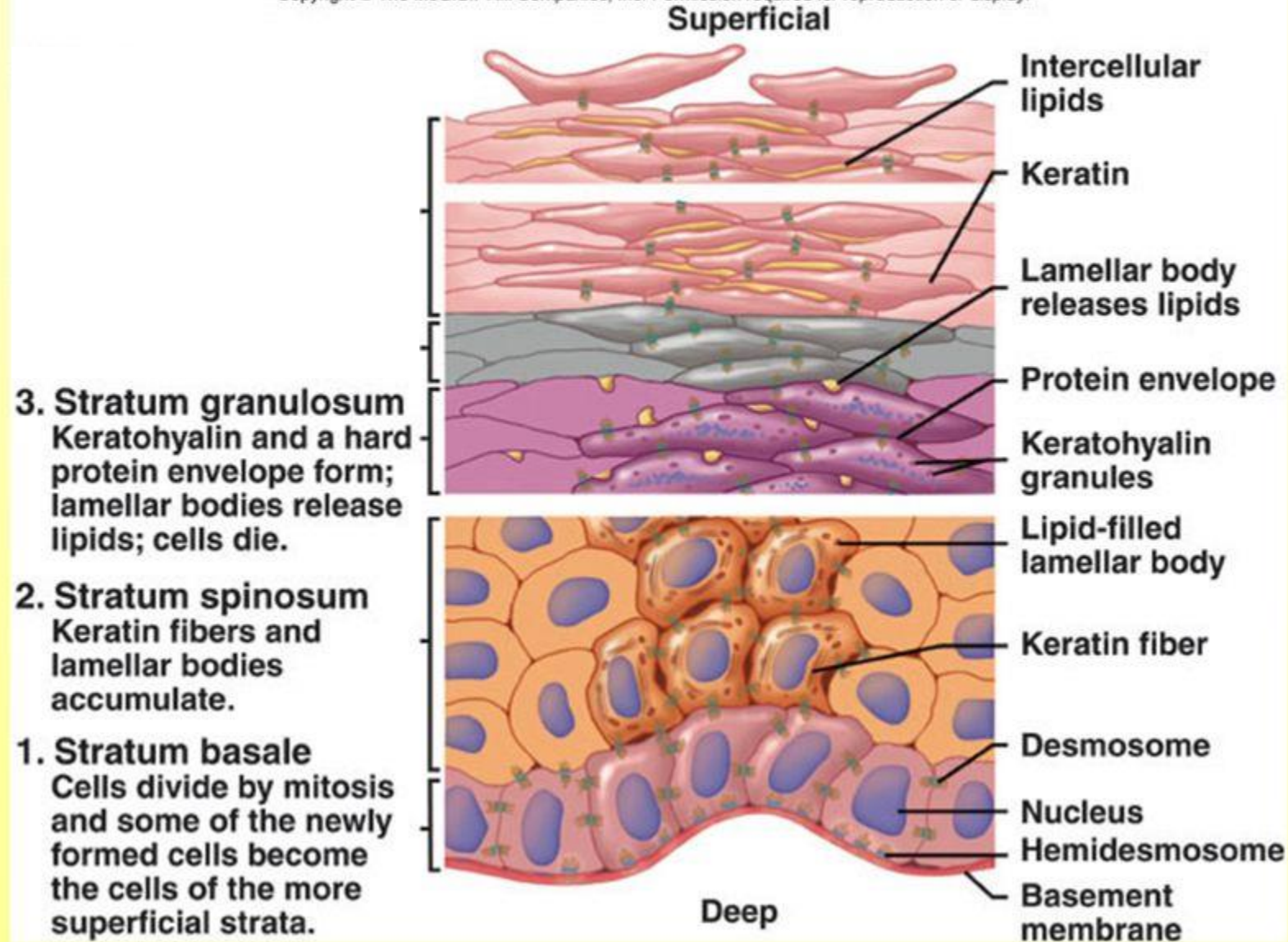
Epidermal Layers and Keratinization

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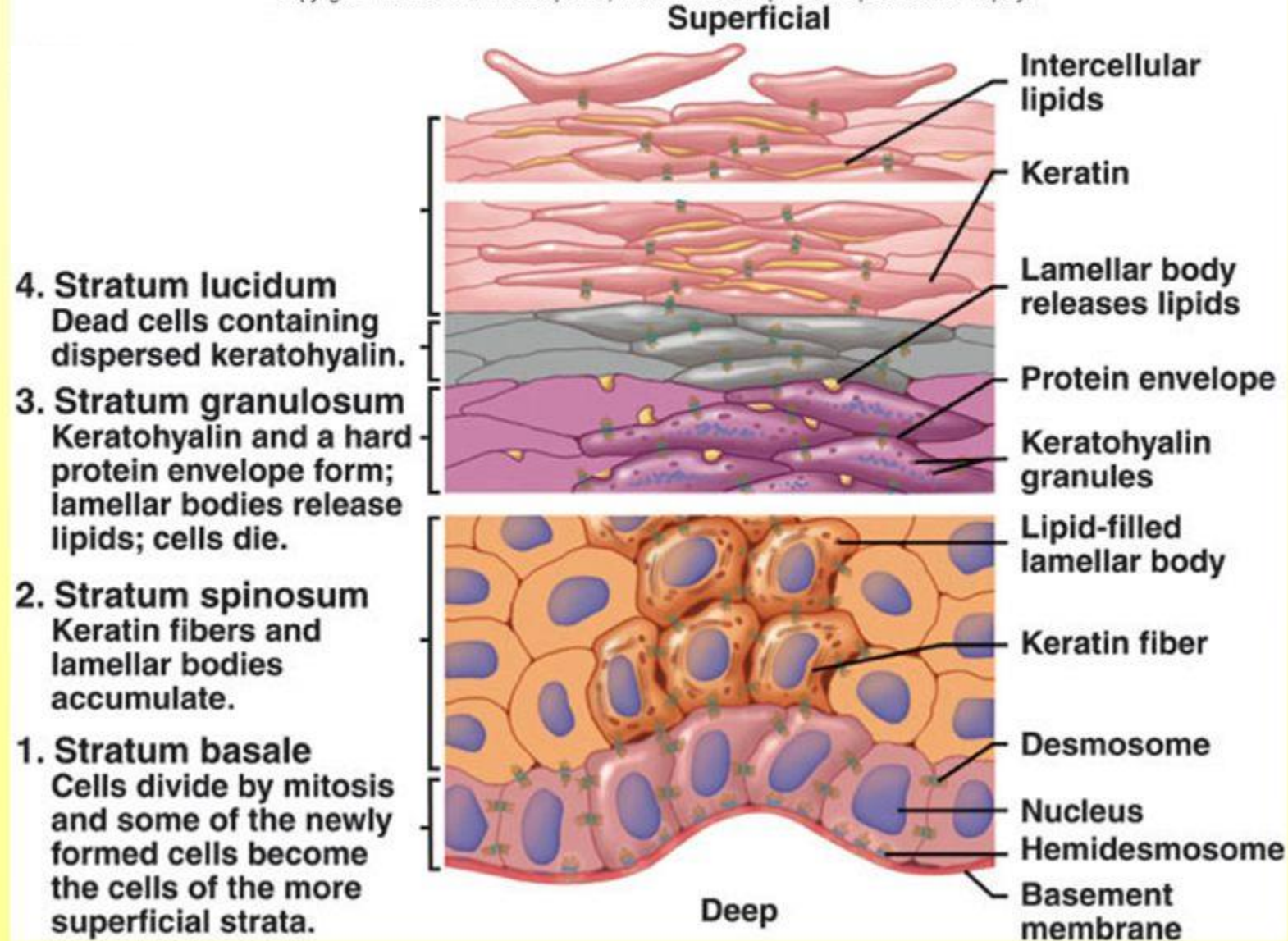
Epidermal Layers and Keratinization

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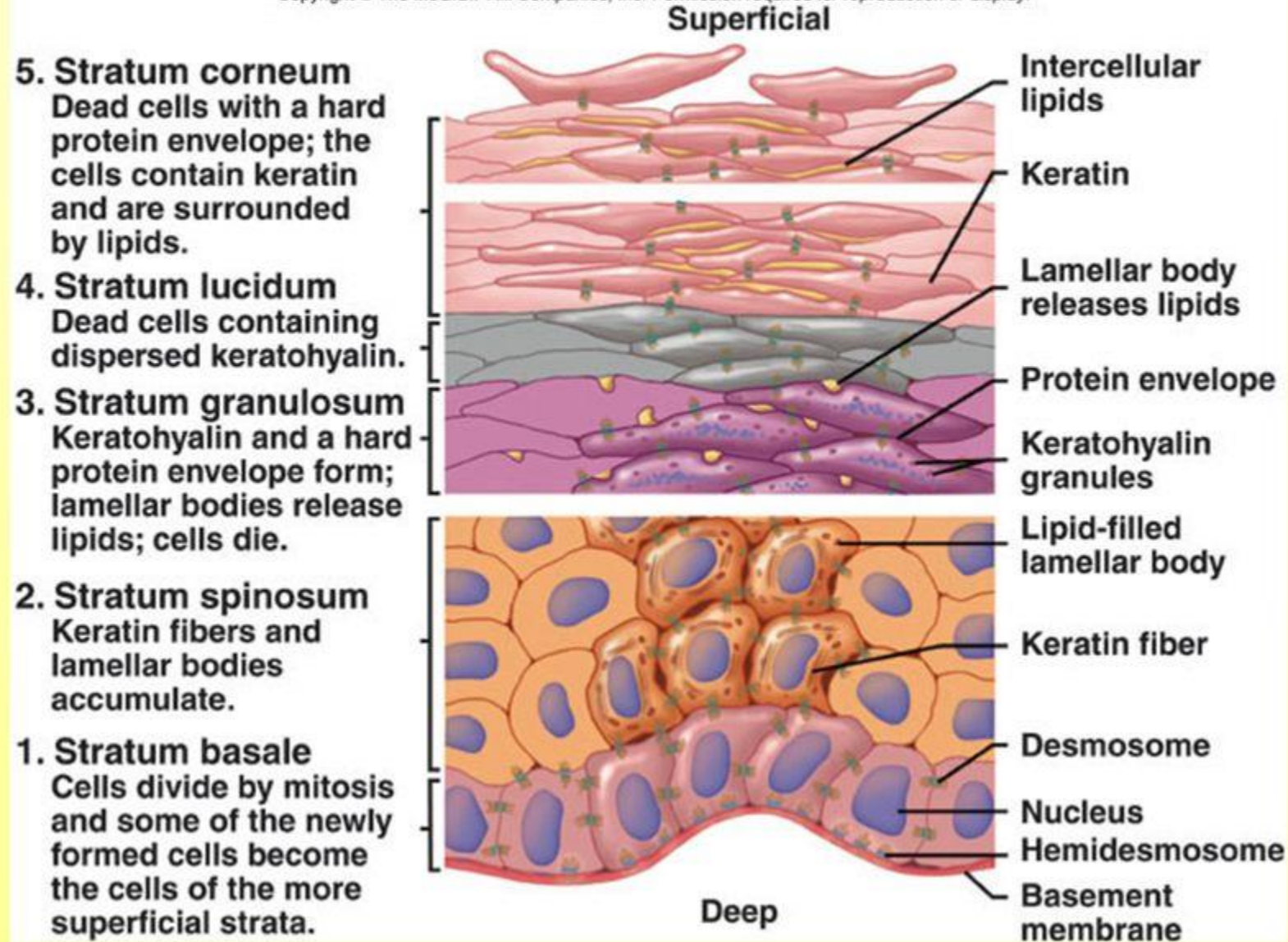
Epidermal Layers and Keratinization

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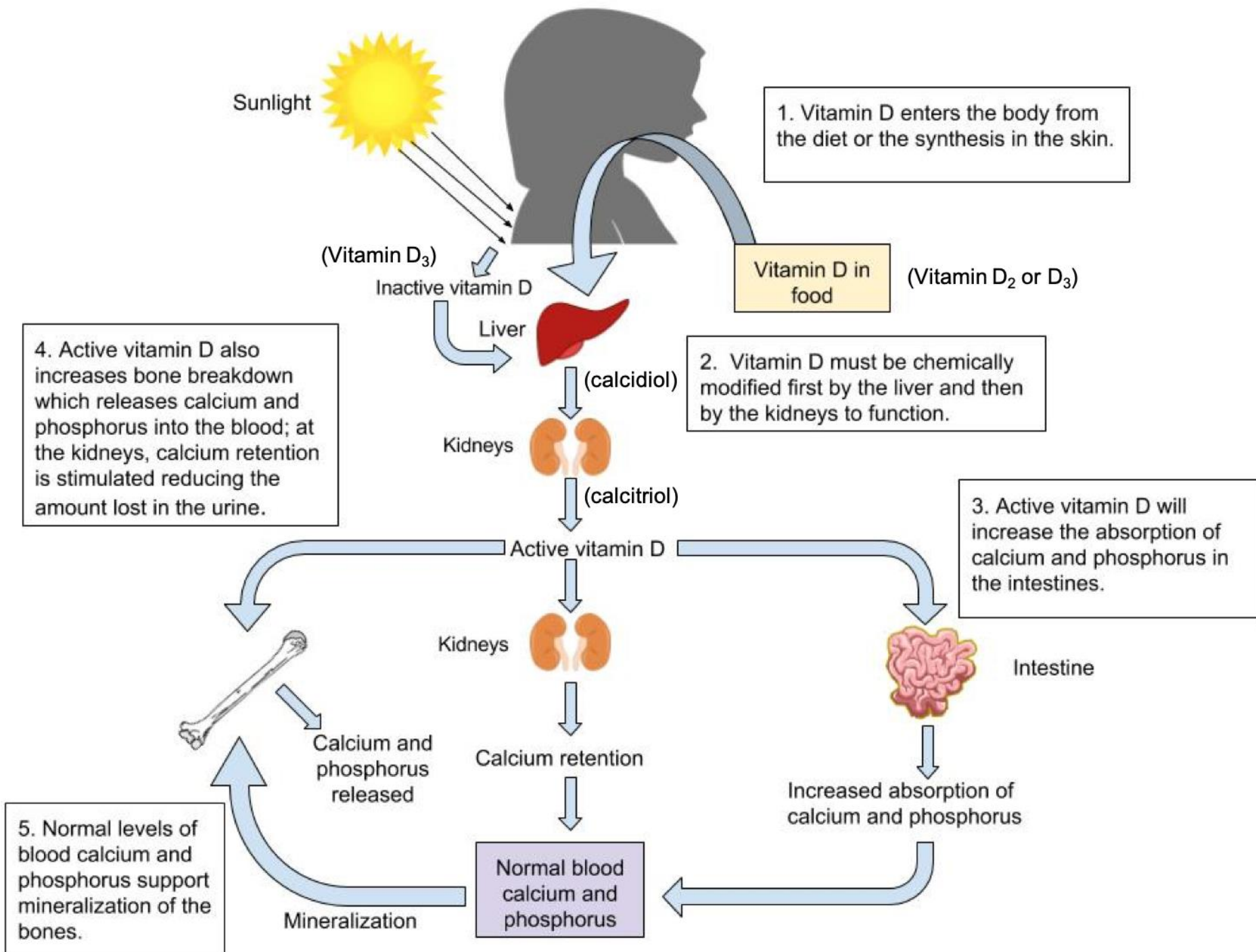


Epidermal Layers and Keratinization

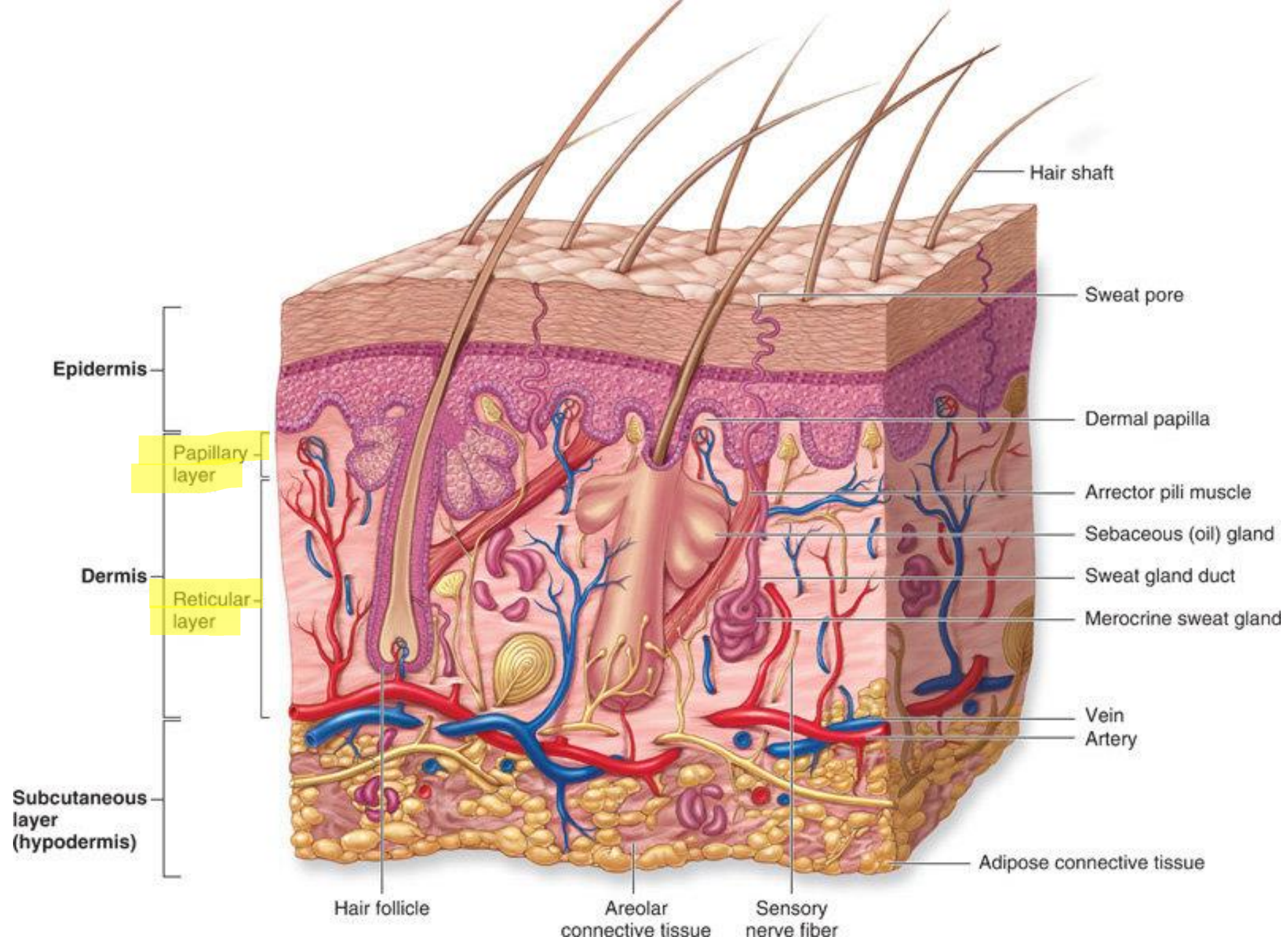
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How do we synthesize vitamin D?



Dermis: The Second Layer of the Skin



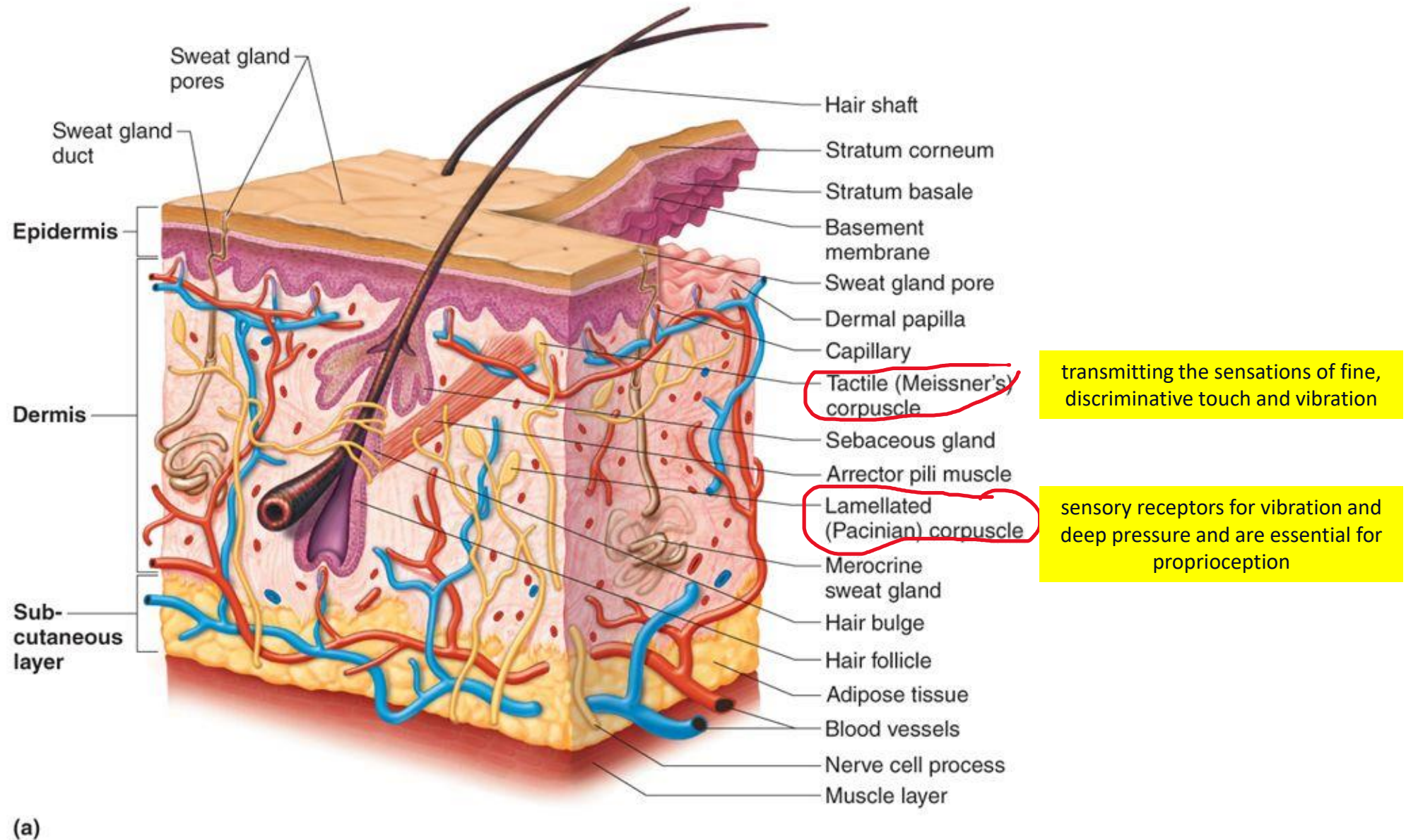
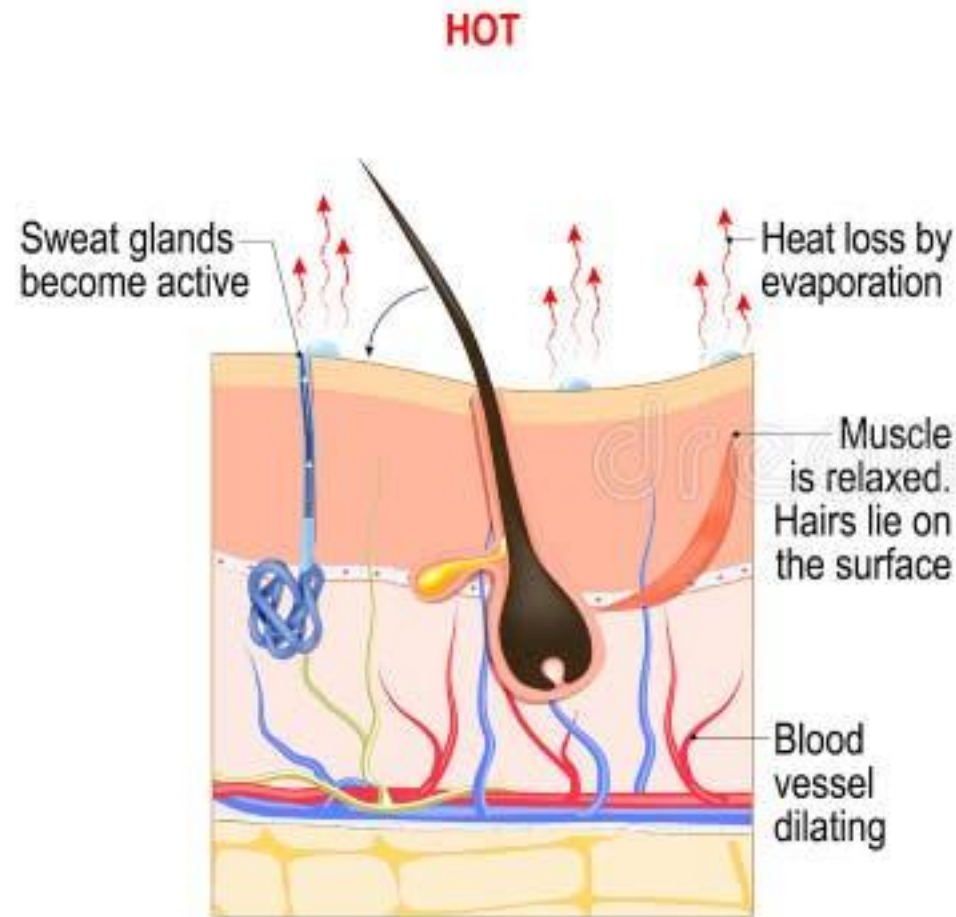
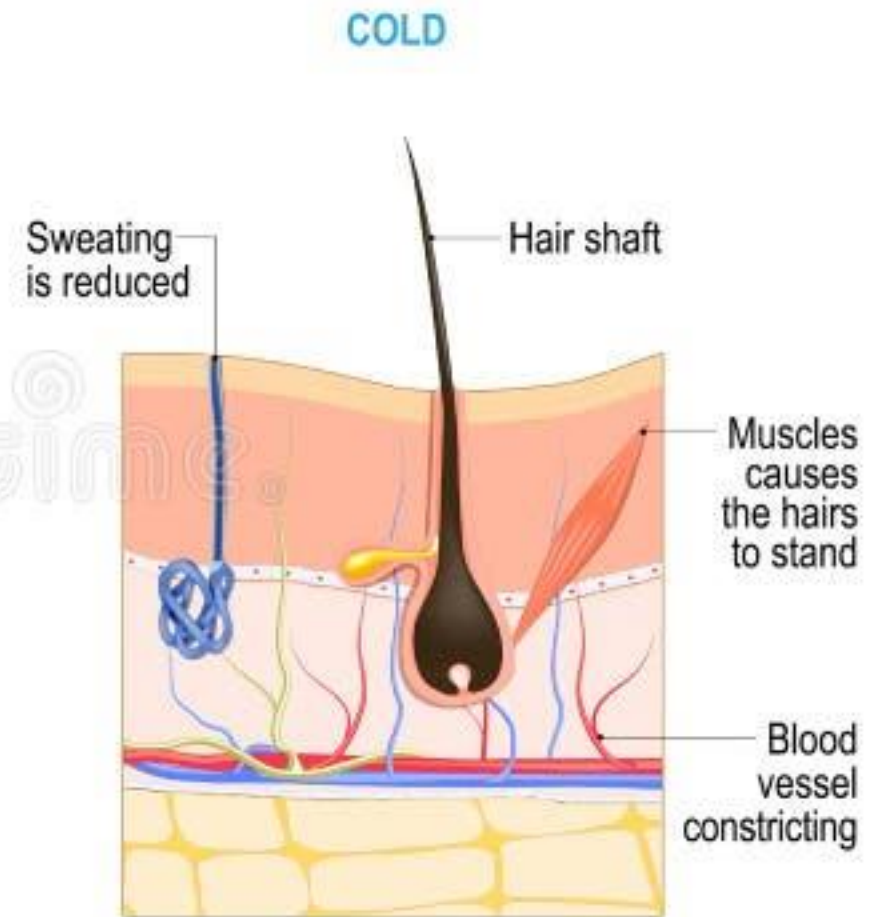


Fig 6.1a

Thermoregulation

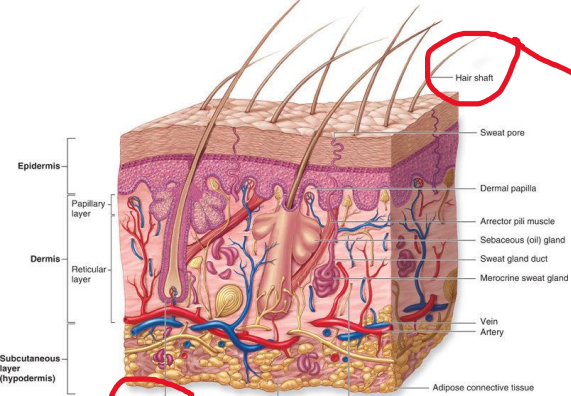


Sweat reaches the skin, and converted from a liquid to a vapor



Thickening of the fat layer. This is a long-term response to the cold environment

The Hair



Sebaceous gland

Arrector pili muscle

Medulla of hair shaft

Cortex of hair shaft

Inner root sheath

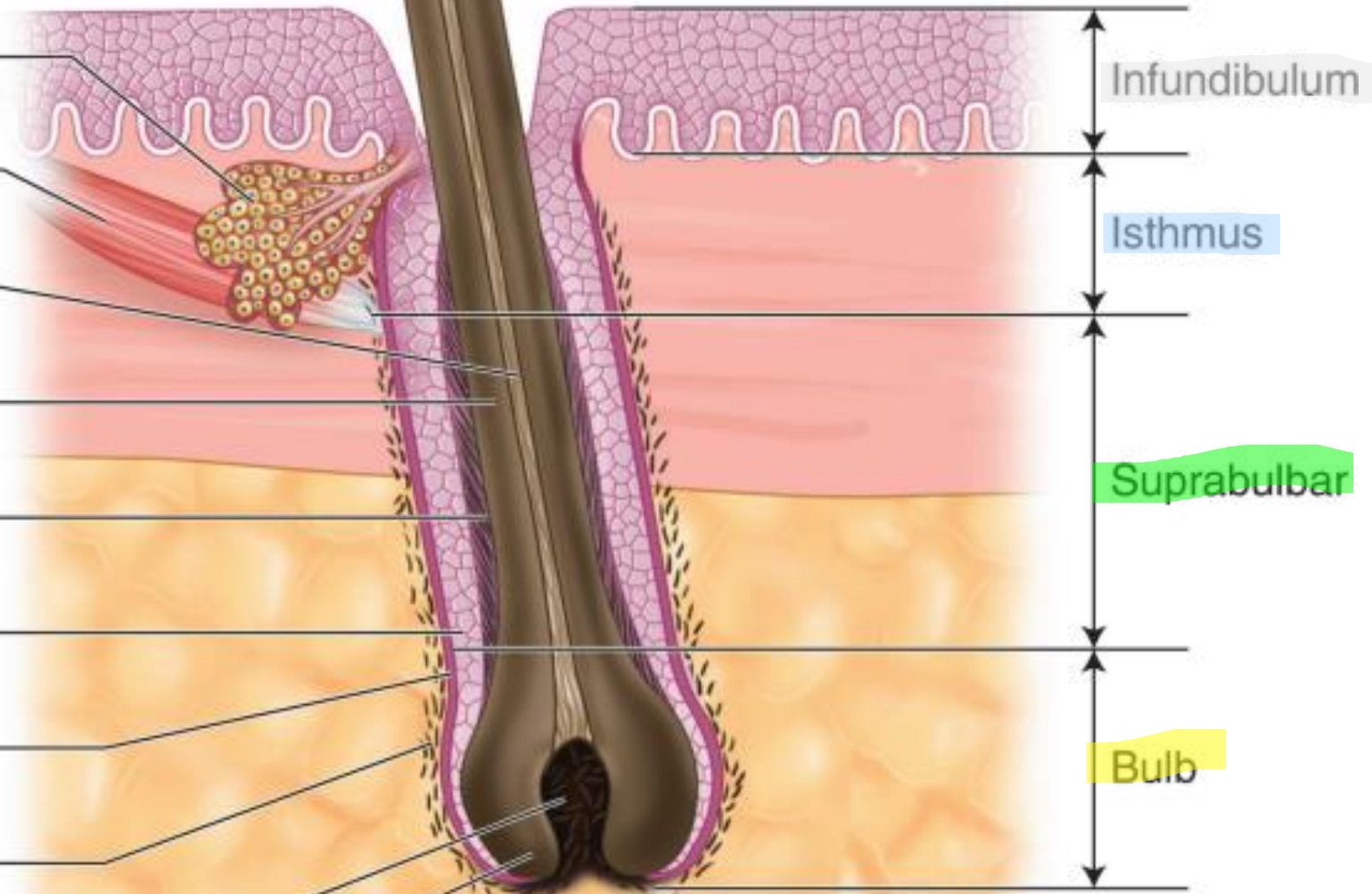
Outer root sheath

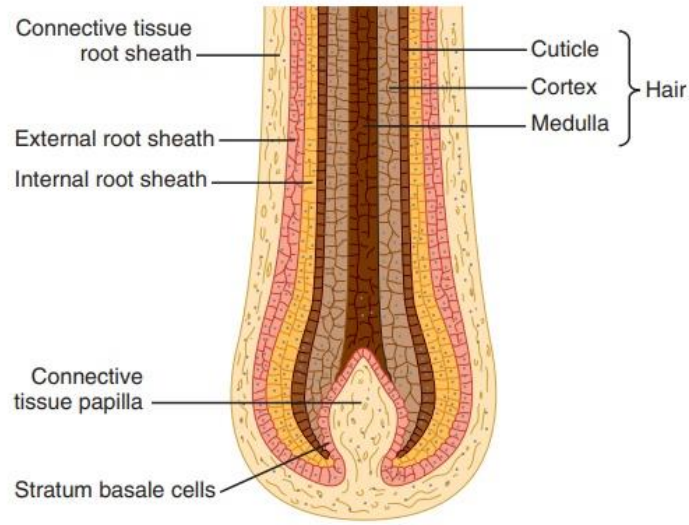
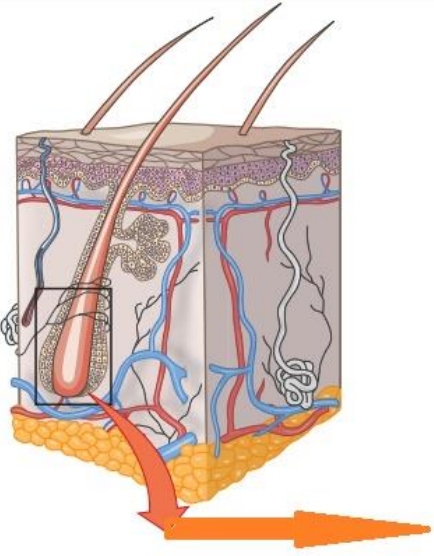
Vitreous or "glassy" layer

Fibrous root sheath

Dermal papilla

Hair matrix



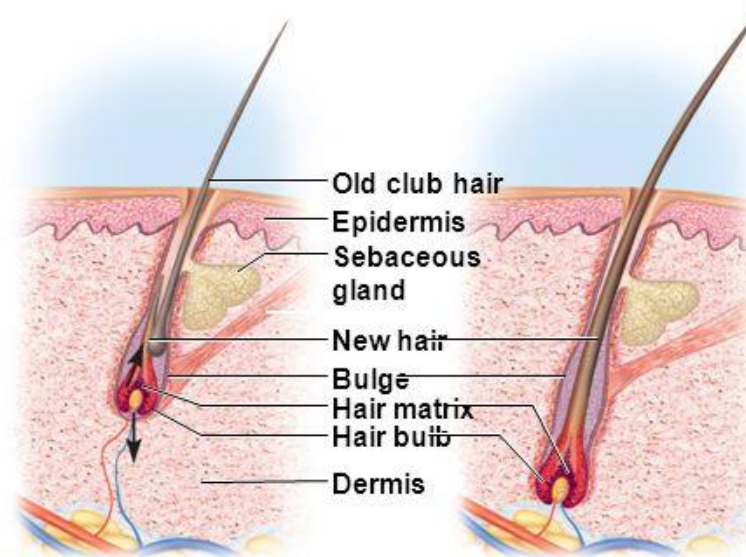


The hair shaft is formed of three layers:

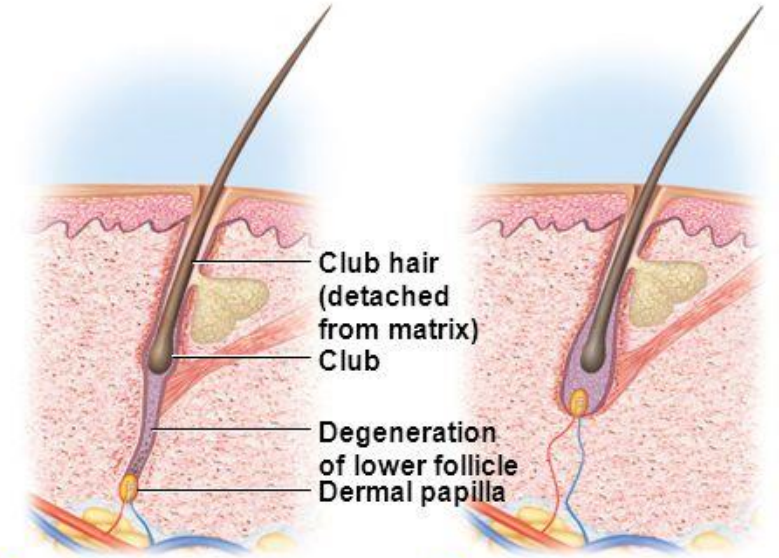
- The medulla – the deepest layer of the hair shaft, only seen in large and thick hairs.
- The cortex – the middle layer of the hair shaft which provides the strength, color and texture of a hair fiber.
- The cuticle – the outer layer of the hair shaft is thin and colorless.

FIGURE 6-6 A hair follicle.

Hair Cycle

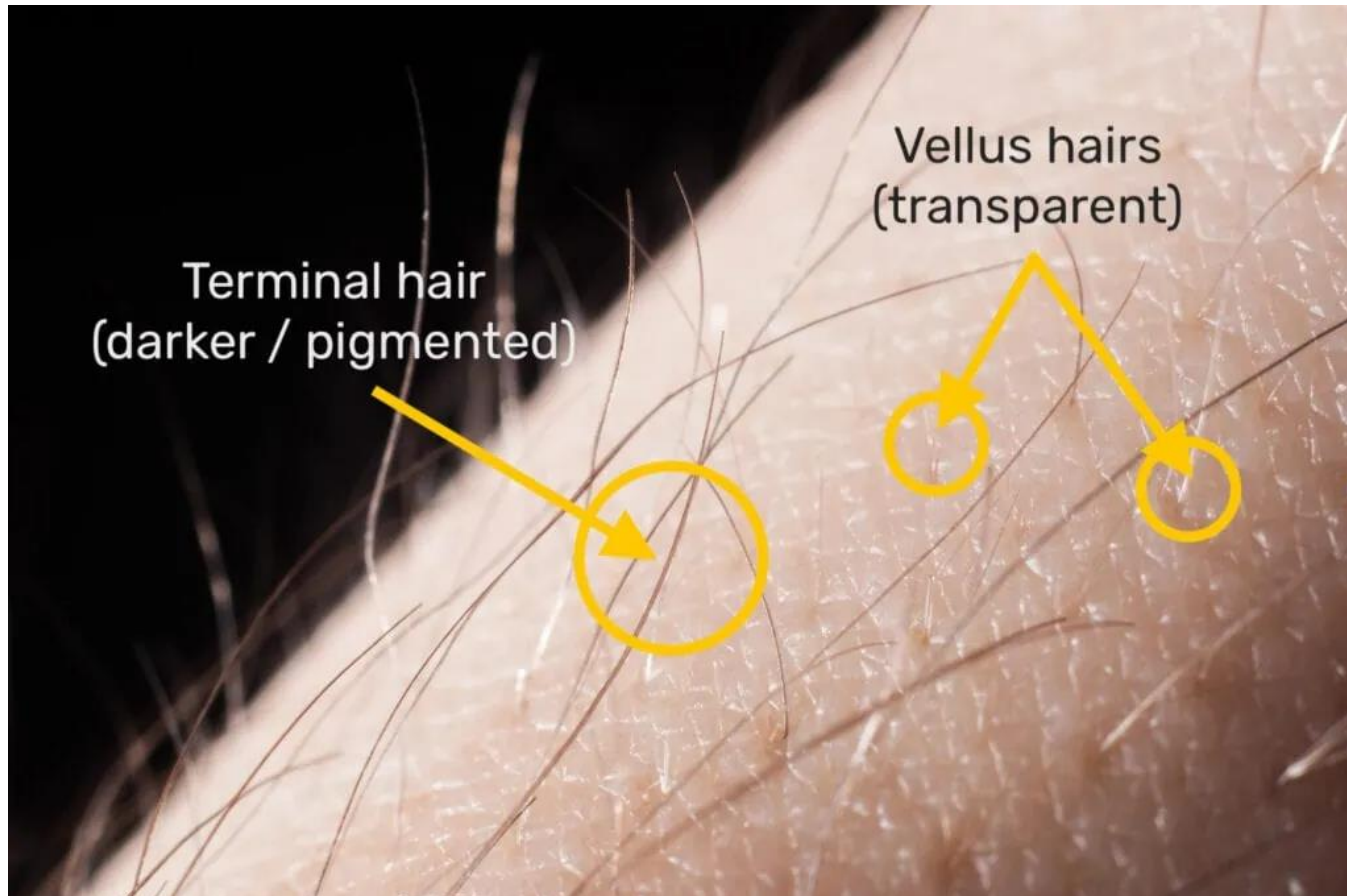


- ① Anagen (early)**
(Growing phase, 6–8 years)
Stem cells multiply and follicle grows deeper into dermis; hair matrix cells multiply and keratinize, causing hair to grow upward; old club hair may persist temporarily alongside newly growing hair.
- Anagen (mature)**



- ② Catagen**
(Degenerative phase, 2–3 weeks)
Hair growth ceases; hair bulb keratinizes and forms club hair; lower follicle degenerates.
- ③ Telogen**
(Resting phase, 1–3 months)
Dermal papilla has ascended to level of bulge; club hair falls out, usually in telogen or next anagen.

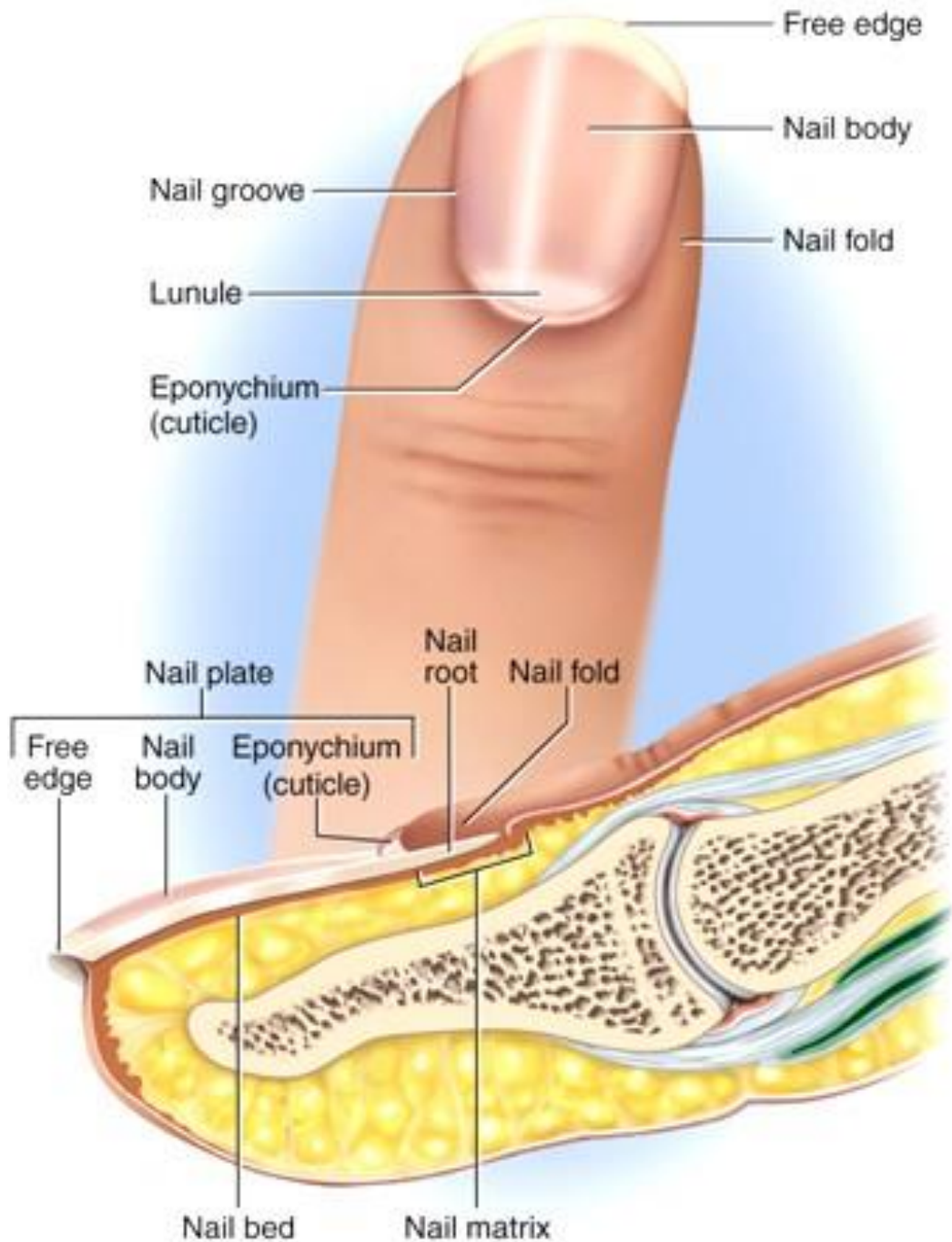
Follicles may produce either '**lanugo**' (fetal hair), '**vellus**' or '**terminal**' hairs. *Eyelashes, eyebrows, scalp hair and pubic hair* are all **terminal hairs** while **vellus** hair cover the *rest of the body* and is associated with 'goose-pimples' due to erector pili units.



Hair Color

- Due to pigment granules in the cells of the cortex
 1. **Brown or black hair** – rich in eumelanin
 2. **Red hair** – small amount of eumelanin but high concentration of pheomelanin
 3. **Blond hair** – intermediate amount of pheomelanin and very little eumelanin
 4. **Gray and white hair** – scarcity of melanin in the cortex and the presence of air in the medulla

The Nails



Nail plate – hard part of the nails

Free edge – overhangs the finger tip

Nail body – visible attached part of the nail

Nail root – extends proximally under overlying skin

Nail fold – surrounding skin rising a bit above the nail

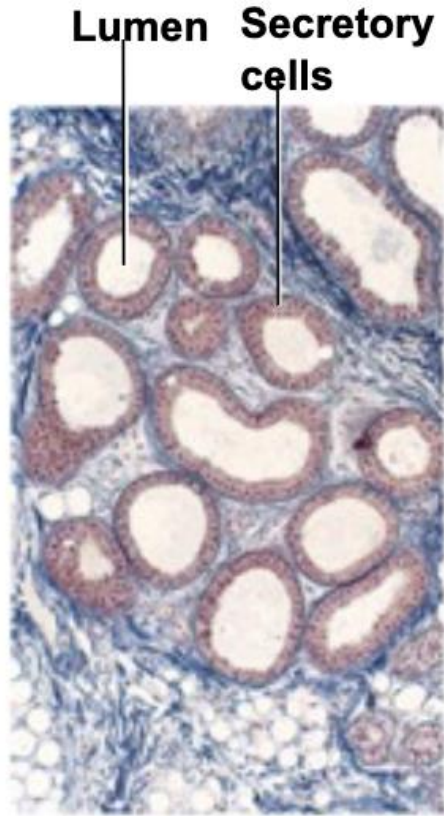
Nail groove – separate nail fold from nail plate

Nail bed – skin underlying the nail plate

Nail matrix – growth zone of thickened stratum basale at the proximal end of nail

Lunula – an opaque white crescent at the proximal end of nail

Eponychium (cuticle) – narrow zone of dead skin

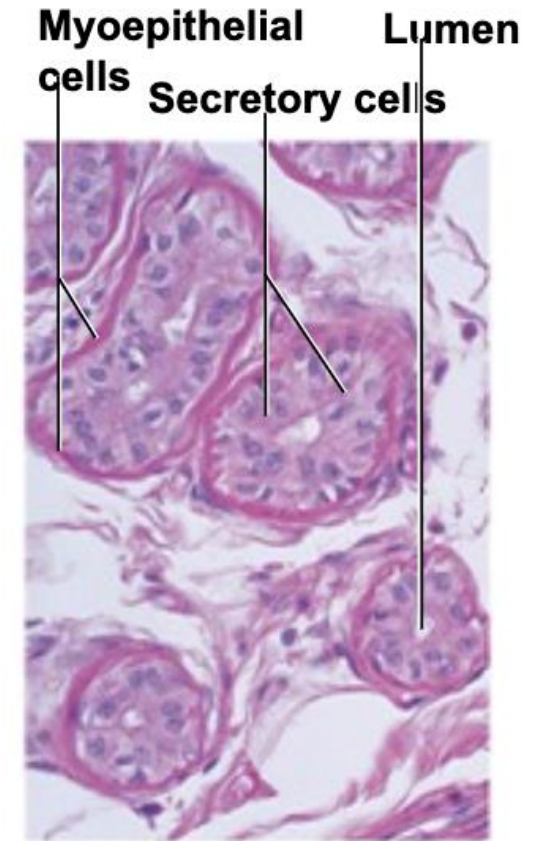


(a) Apocrine gland

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(c) Sebaceous gland



(b) Merocrine gland

Cutaneous Glands

Sweat glands (Sudoriferous)

- *Kinds of Sweat glands*

1. Merocrine (Eccrine)
2. Apocrine

Bromhidrosis – disagreeable body odor

Sweat – protein-free filtrate of the blood plasma contains potassium ions, urea, lactic acid, ammonia, and some sodium chloride ; drugs
- creates the acid mantle (pH of 4-6)

Insensible perspiration – 500 ml per day

Diaphoresis – sweating with wetness of the skin

Other glands

- **Sebaceous glands**

- produces *sebum*

- flask shaped with short ducts opening into hair follicle

- holocrine gland

- **Ceruminous glands**

- found only in external ear canal

- produces *cerumen*

- keeps eardrum pliable, waterproofs the canal, kills bacteria

Additional Information

First-degree



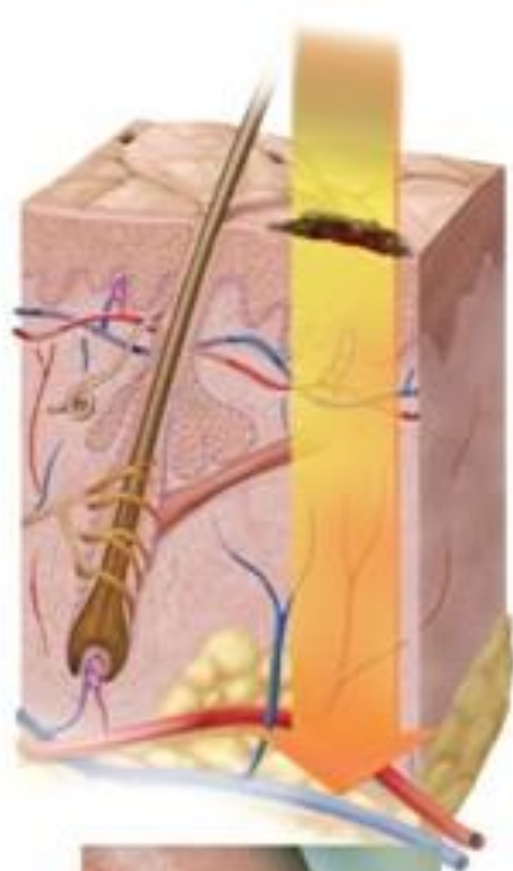
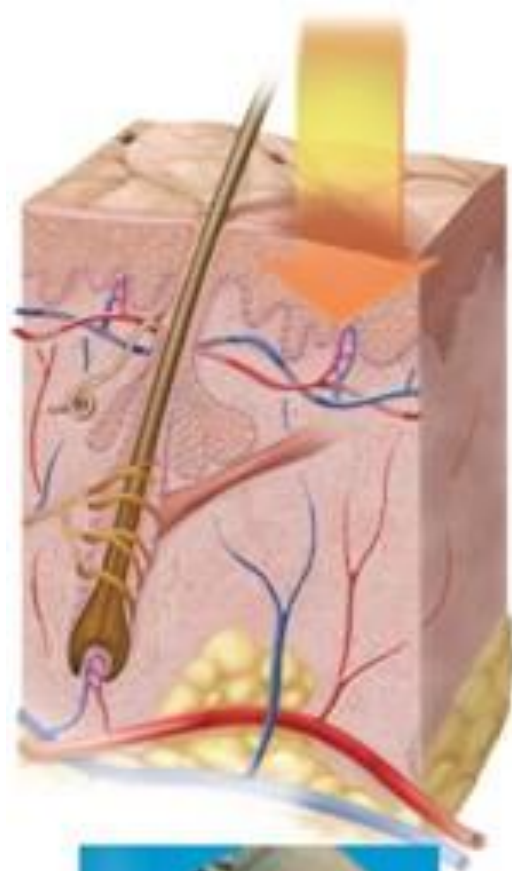
Second-degree



Third-degree

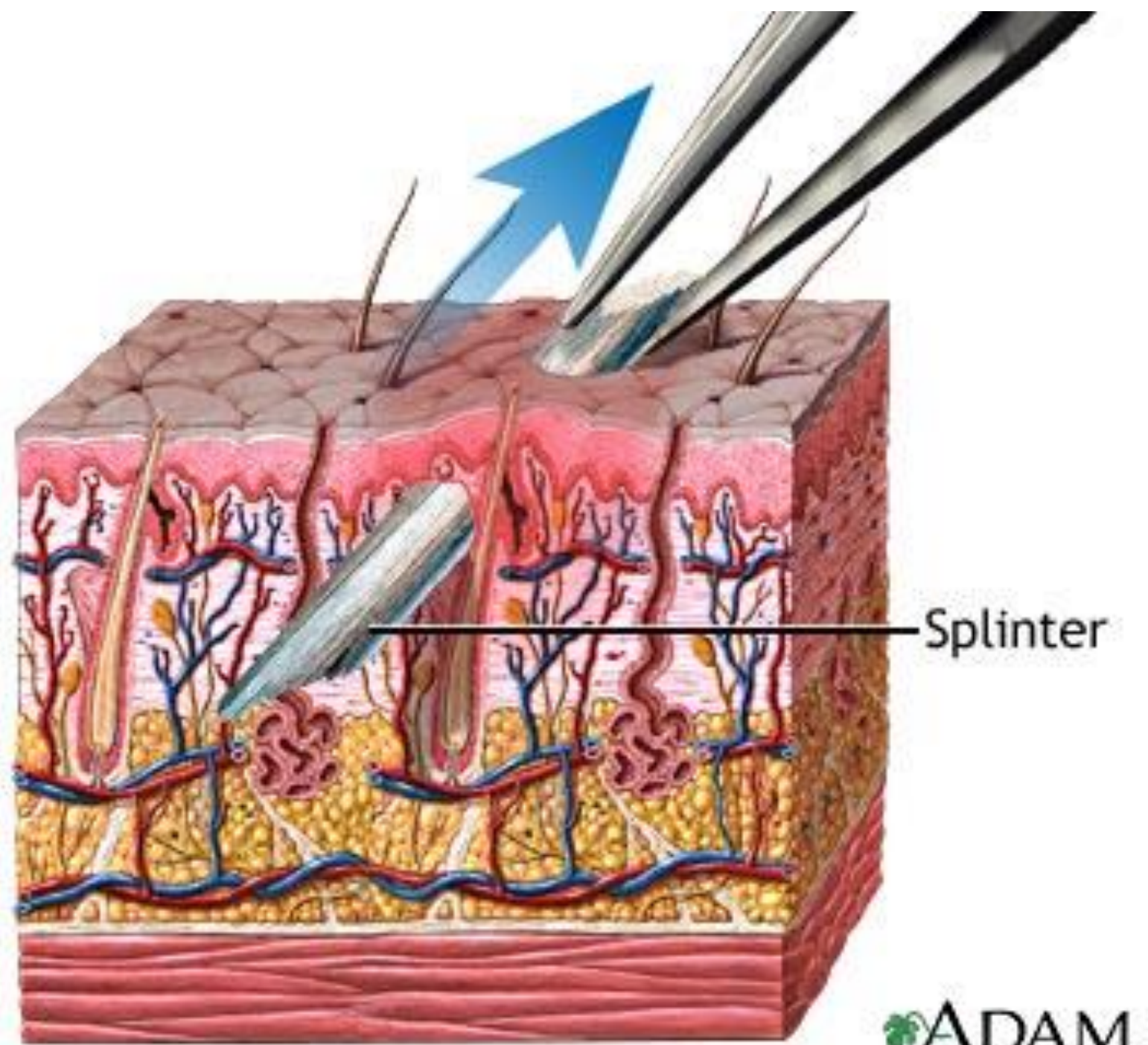


1. Dermis 2. Epidermis 3. Subcutaneous tissue



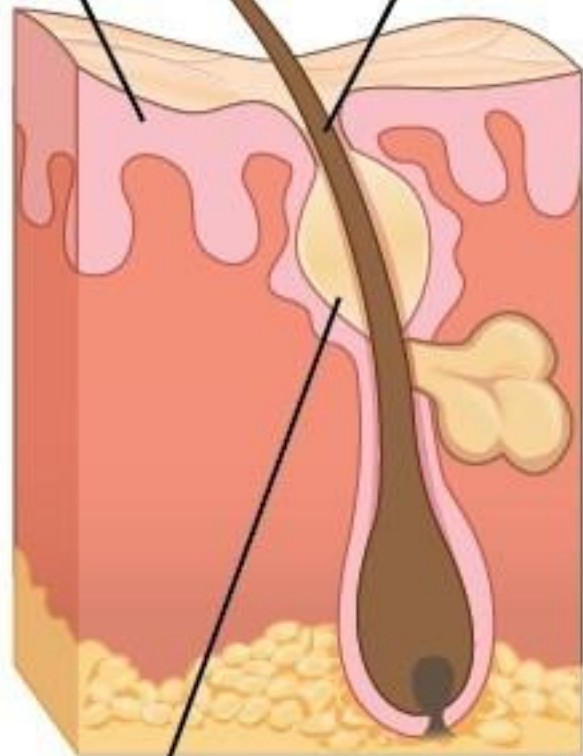
Burns

- **first-degree burns** – partial thickness burn - involve only the epidermis
 - redness, slight edema, and pain
 - heal in a few days
 - most sunburns
- **second-degree burns** – partial thickness burn - involve the epidermis and part of the dermis
 - leaves part of the dermis intact
 - red, tan, or white
 - two weeks to several months to heal and may leave scars
 - blistered and very painful
- **third-degree burn** – full thickness burn – the epidermis and all of the dermis, and often some deeper tissues (muscles or bones) are destroyed
 - often require skin grafts
 - needs fluid replacement and infection control



Epidermis

Plugged follicle



Accumulation of shed
keratin and sebum

Mild inflammation

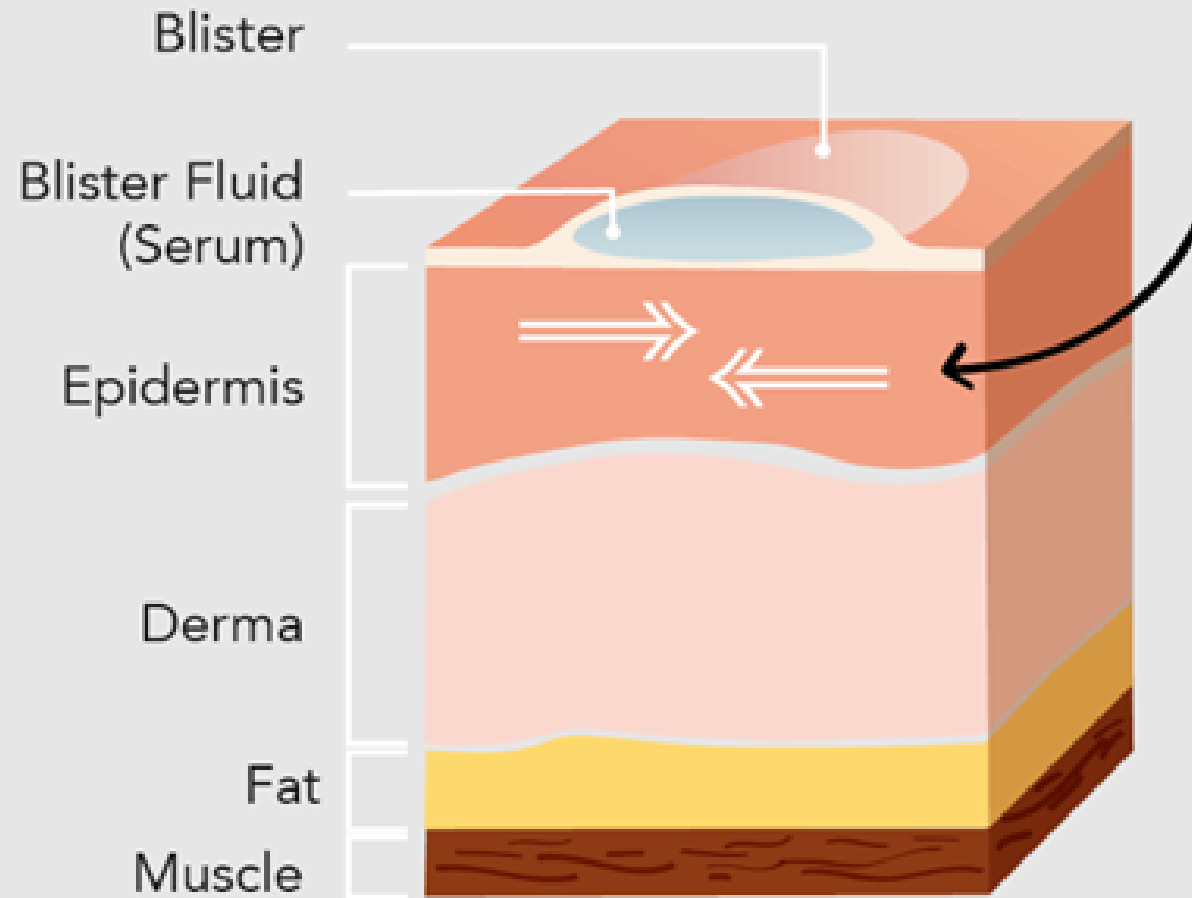
Sebaceous
gland



Bacteria proliferate

Marked inflammation





Friction,
or hydrostatic
pressure causes
accumulation
of fluid (serum)
which results
in a blister

Skin with blister