



The Integumentary System

Integument is skin

Skin and its appendages
make up the integumentary
system

A fatty layer (hypodermis)
lies deep to it

Two distinct regions

Epidermis



Functions of skin

Protection

Cushions and insulates and is waterproof

Protects from chemicals, heat, cold, bacteria

Screens UV

Synthesizes vitamin D with UV

Regulates body heat

Prevents unnecessary water loss

Sensory reception (nerve endings)

Epidermis

Keratinized stratified squamous epithelium

Four types of cells

Keratinocytes - deepest, produce keratin (tough fibrous protein)

Melanocytes - make dark skin pigment melanin

Merkel cells - associated with sensory nerve endings

Langerhans cells - macrophage-like dendritic cells

Layers (from deep to superficial)

Stratum basale or germinativum - single row of cells attached to dermis; youngest cells

Stratum spinosum - spinyess is artifactual; tonofilaments (bundles of protein) resist tension

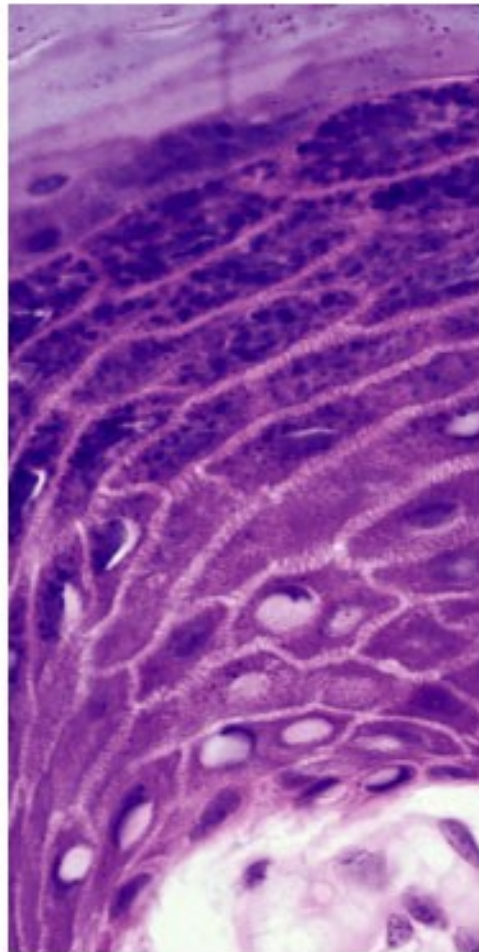
Stratum granulosum - layers of flattened keratinocytes producing keratin (hair and nails made of it also)

Stratum lucidum (only on palms and soles)

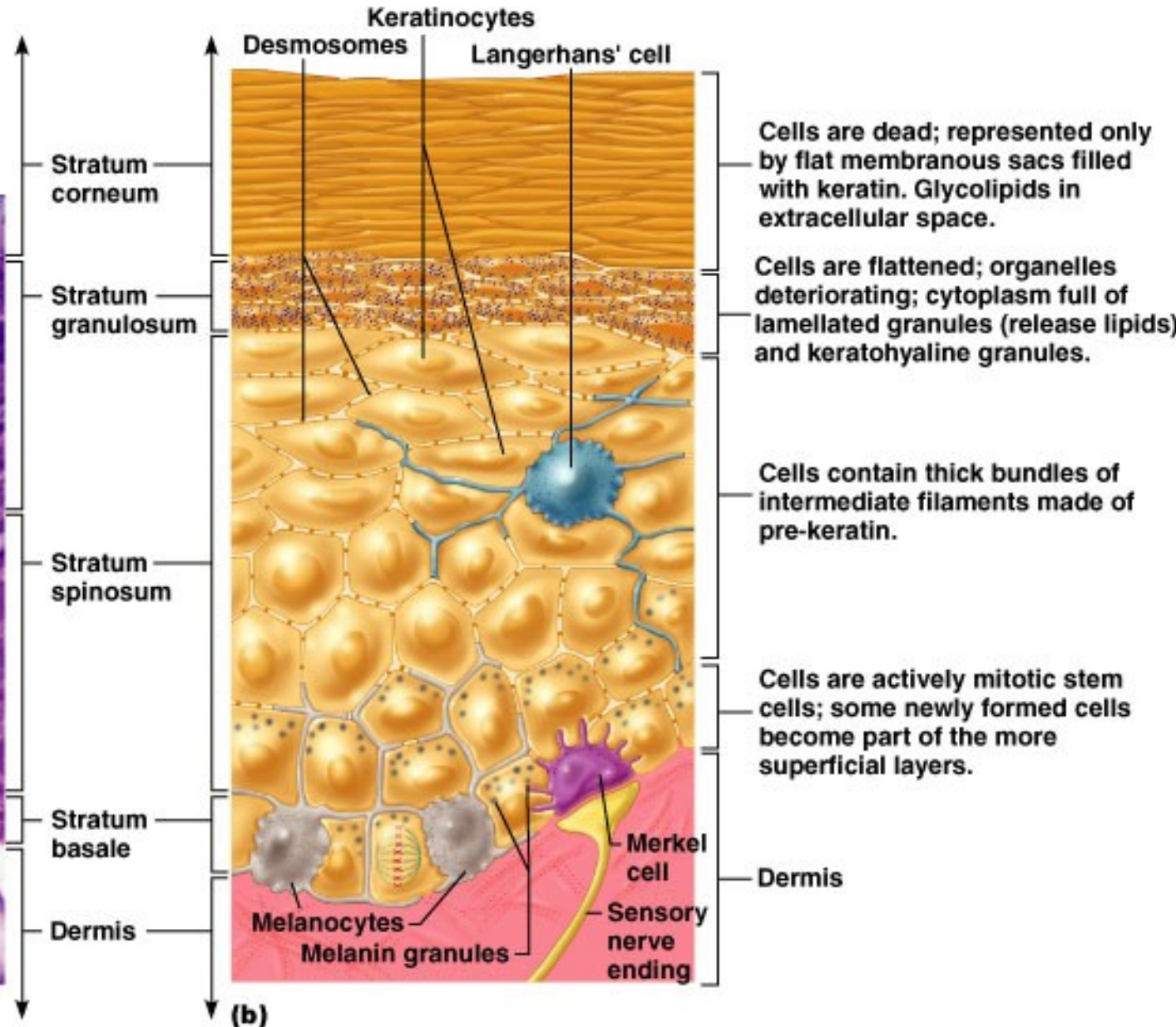
Stratum corneum - horny layer (cells dead, many layers thick)

(see figure on next slide)

Epithelium: layers (on left) and cell types (on right)



(a)





Remember...

Four basic types of tissue

Epithelium – epidermis just discussed

Connective tissue - dermis

Muscle tissue

Nervous tissue



Dermis

Strong, flexible connective tissue: your “hide”

Cells: fibroblasts, macrophages, mast cells, WBCs

Fiber types: collagen, elastic, reticular

Rich supply of nerves and vessels

Critical role in temperature regulation (the vessels)

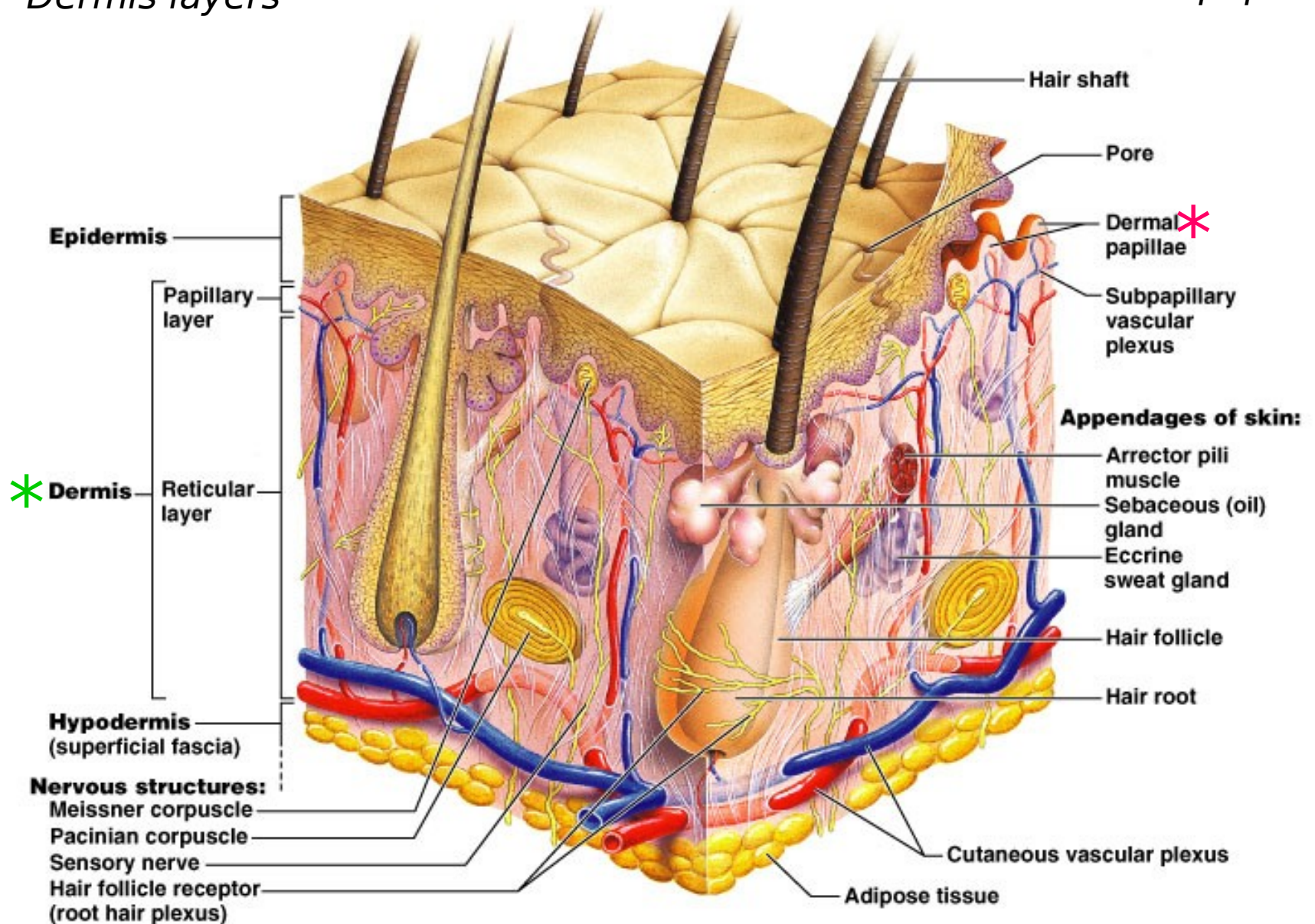
Two layers (see next slides)

Papillary – areolar connective tissue; includes dermal papillae

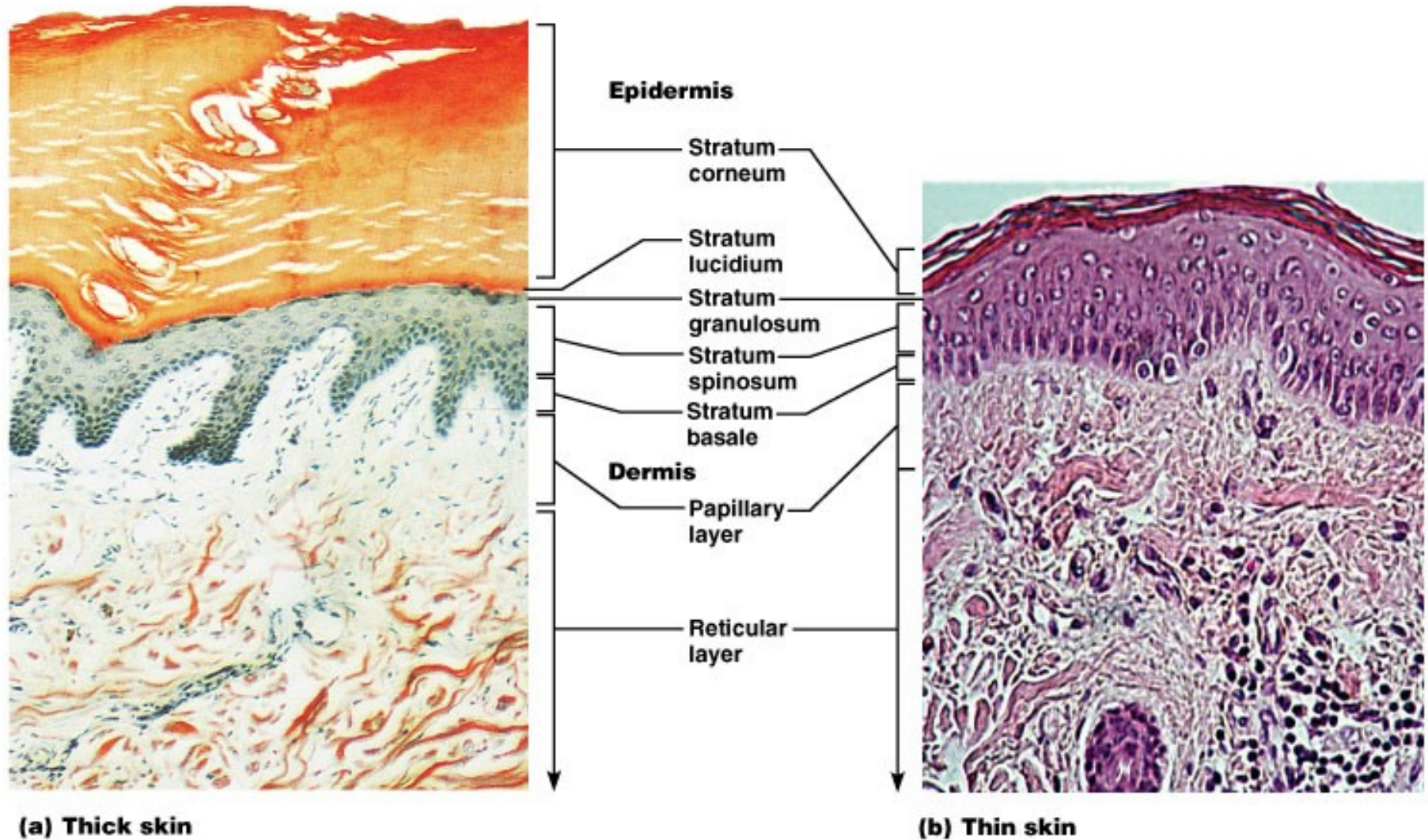
Reticular – “reticulum” (network) of collagen and reticular fibers

* *Dermis layers*

* *Dermal papillae*



Epidermis and dermis of (a) thick skin and (b) thin skin *(which one makes the difference?)*





Hypodermis

“Hypodermis” (Gk) = below the skin

“Subcutaneous” (Latin) = below the skin

Also called “superficial fascia”

“fascia” (Latin) = band; in anatomy: sheet of connective tissue

Fatty tissue which stores fat



Skin color

Three skin pigments

Melanin: the most important

Carotene: from carrots and yellow vegies

Hemoglobin: the pink of light skin

Melanin in granules passes from melanocytes (same number in all races) to keratinocytes in stratum basale

Digested by lysosomes

Variations in color

Protection from UV light vs vitamin D?



Skin appendages

Derived from epidermis but
extend into dermis

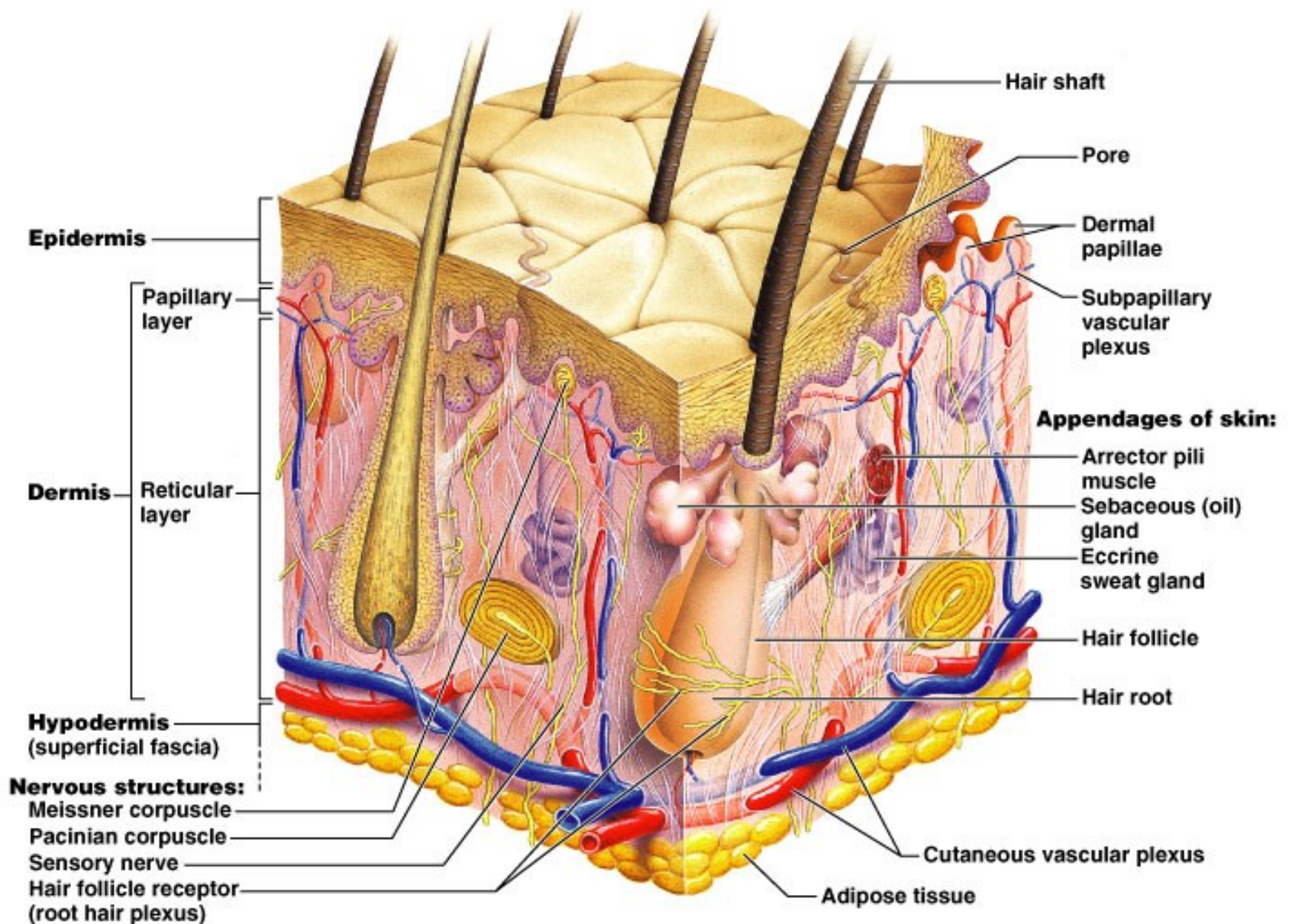
Include

Hair and hair follicles

Sebaceous (oil) glands

Sweat (sudoriferous) glands

Nails

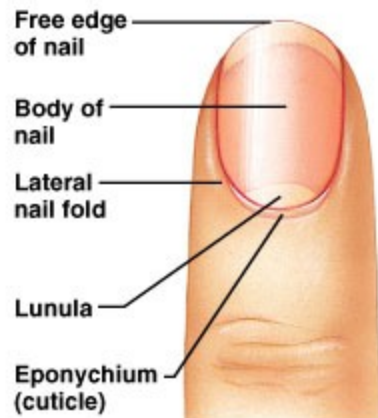


Nails

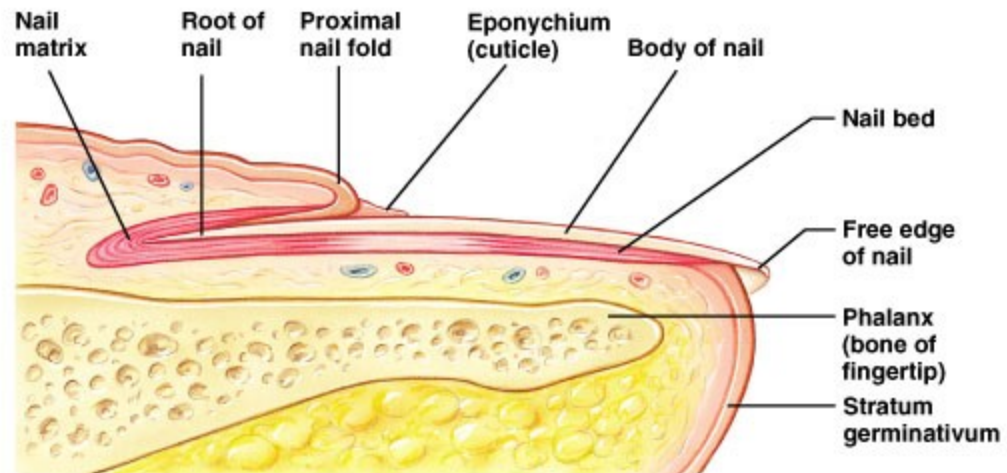
Of hard keratin

Corresponds to hooves and
claws

G



(a)

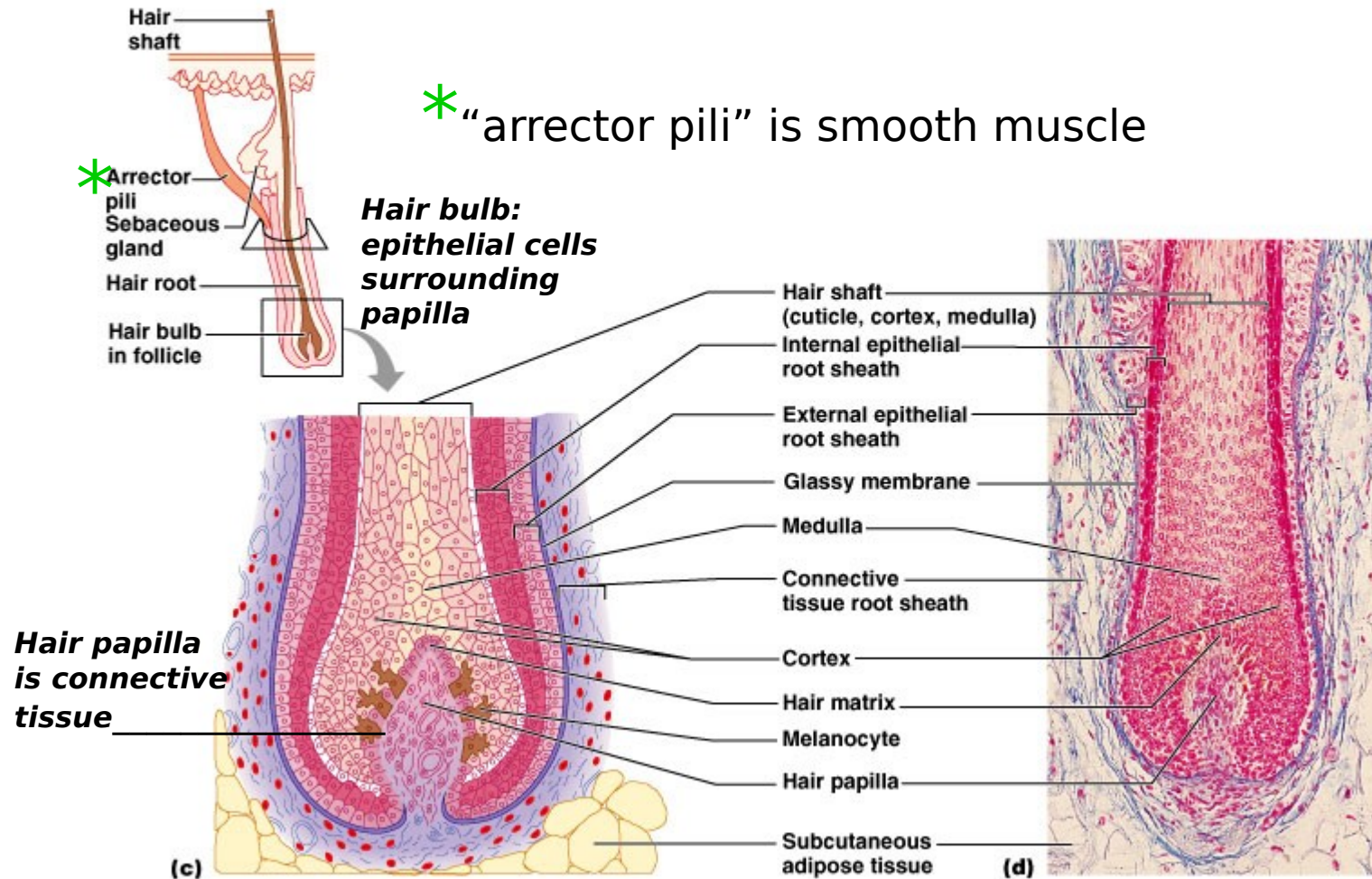


(b)

Hair and hair follicles: complex

Derived from epidermis and dermis

Everywhere but palms, soles, nipples, parts of genitalia





Functions of hair

Warmth – less in man than other mammals

Sense light touch of the skin

Protection - scalp

Parts

Root imbedded in skin

Shaft projecting above skin surface

Make up of hair – hard keratin

Three concentric layers

Medulla (core)

Cortex (surrounds medulla)

Cuticle (single layers, overlapping)



Types of hair

Vellus: fine, short hairs

Intermediate hairs

Terminal: longer, courser hair

Hair growth: averages 2 mm/week

Active: growing

Resting phase then shed

Hair loss

Thinning - age related

Male pattern baldness

Hair color

Amount of melanin for black or brown; distinct form of melanin for red

White: decreased melanin and air bubbles in the medulla

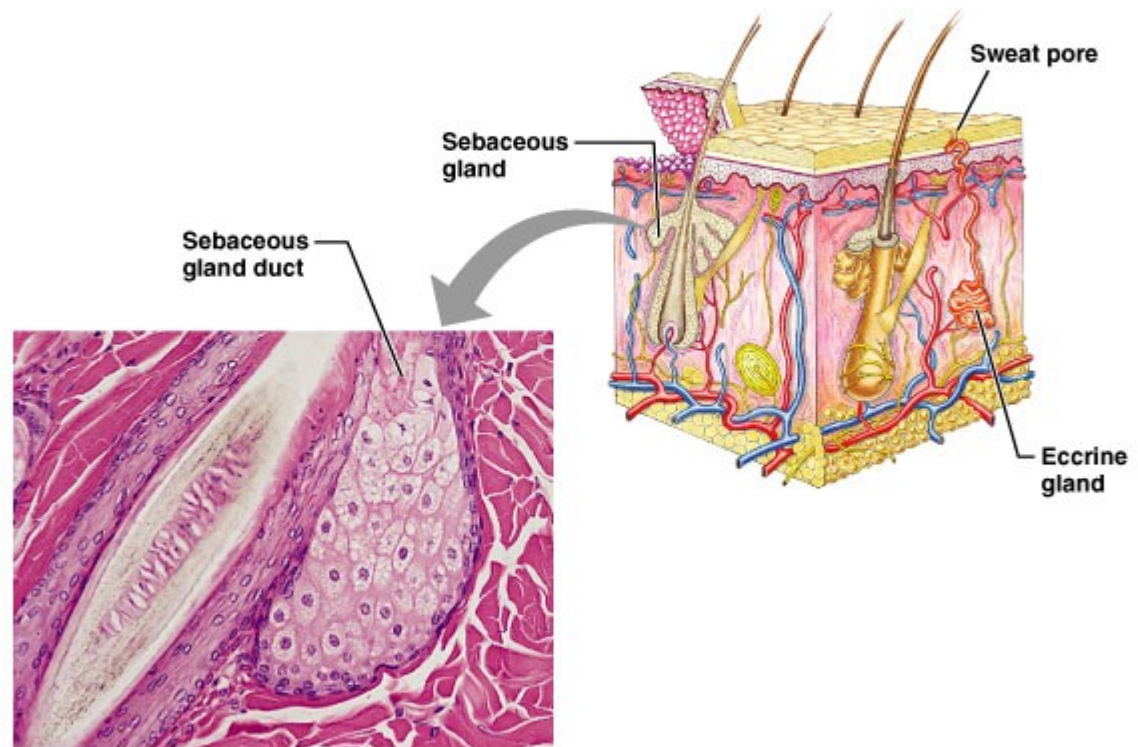
Genetically determined though influenced by hormones and environment

Sebaceous (oil) glands

Entire body except palms and soles

Produce *sebum* by holocrine secretion

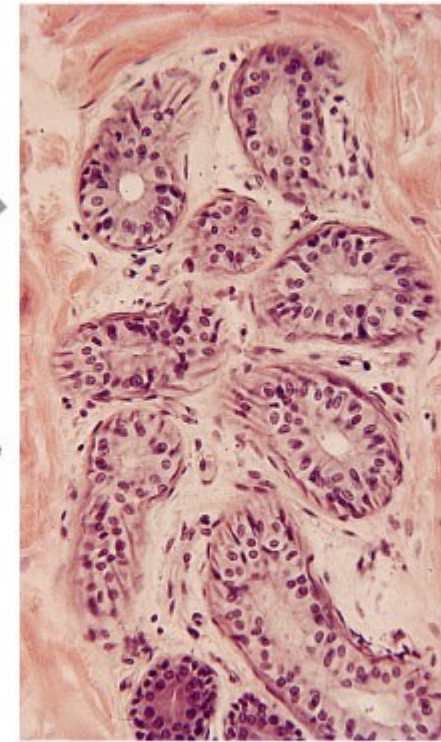
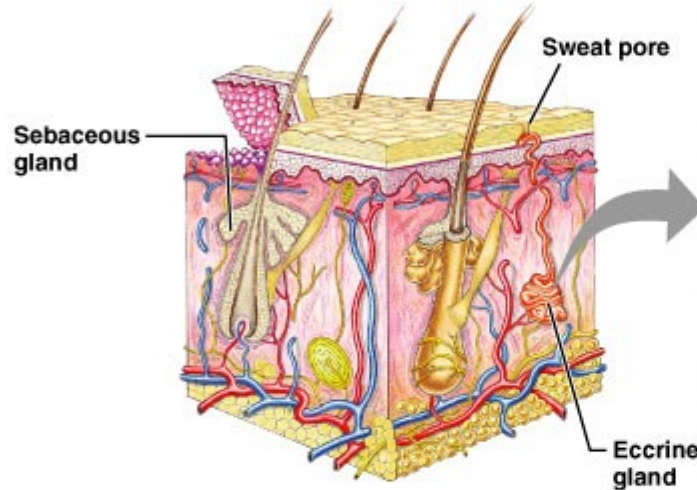
Oils and lubricates



(a) Sectioned sebaceous gland

Sweat glands

Entire skin surface
except nipples and
part of external
genitalia
Prevent
overheating
500 cc to 12 l/day!
(is mostly water)
Humans most
efficient (only
mammals have)
Produced in
response to stress
as well as heat



(b) Sectioned eccrine gland



Types of sweat glands

Eccrine or merocrine

Most numerous

True sweat: 99% water, some salts, traces of waste

Open through pores

Apocrine

Axillary, anal and genital areas only

Ducts open into hair follicles

The organic molecules in it decompose with time -
odor

Modified apocrine glands

Ceruminous – secrete earwax

Mammary – secrete milk



Disorders of the integumentary system

Burns

Threat to life

Catastrophic loss of body fluids

Dehydration and fatal circulatory shock

Infection

Types

First degree - epidermis: redness (e.g. sunburn)

Second degree - epidermis and upper dermis: blister

Third degree - full thickness

Infections

Skin cancer

Burns

First-degree
(epidermis only; redness)



(b)

Second-degree
(epidermis and dermis,
with blistering)



(c)

Third-degree
(full thickness, destroying
epidermis, dermis, often
part of hypodermis)



(d)



Tumors of the skin

Benign, e.g. warts

Cancer – associated with UV exposure (also skin aging)

Aktinic keratosis - premalignant

Basal cell - cells of stratum basale

Squamous cell - keratinocytes

Melanoma – melanocytes: most dangerous; recognition:

A - **A**symmetry

B - **B**order irregularity

C - **C**olors

D - **D**iameter larger than 6 mm