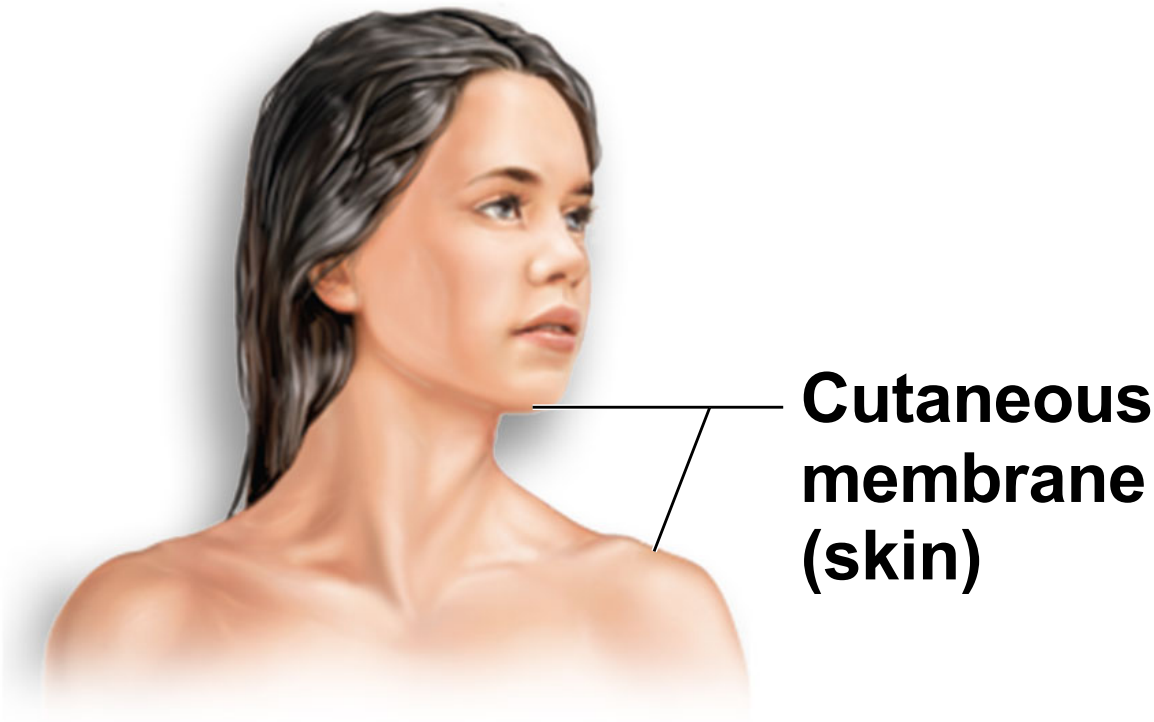
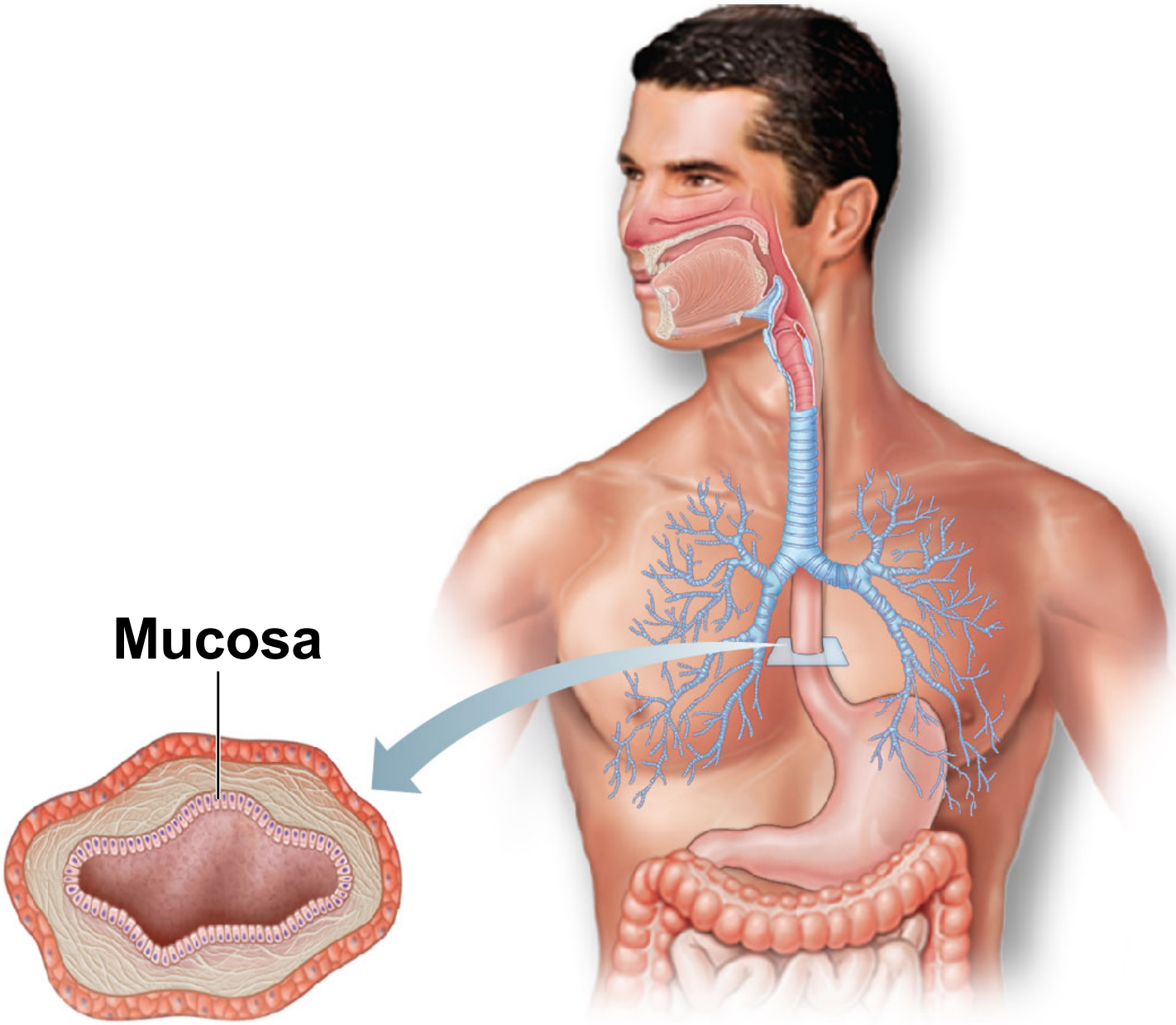
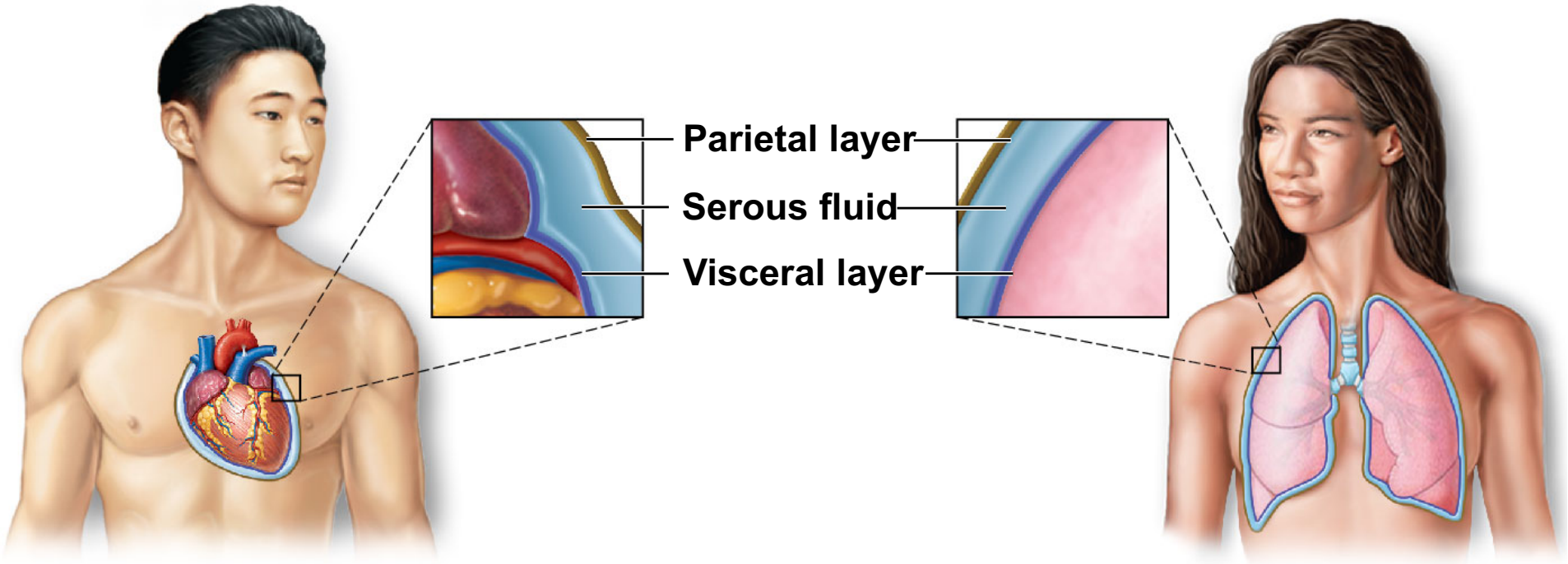


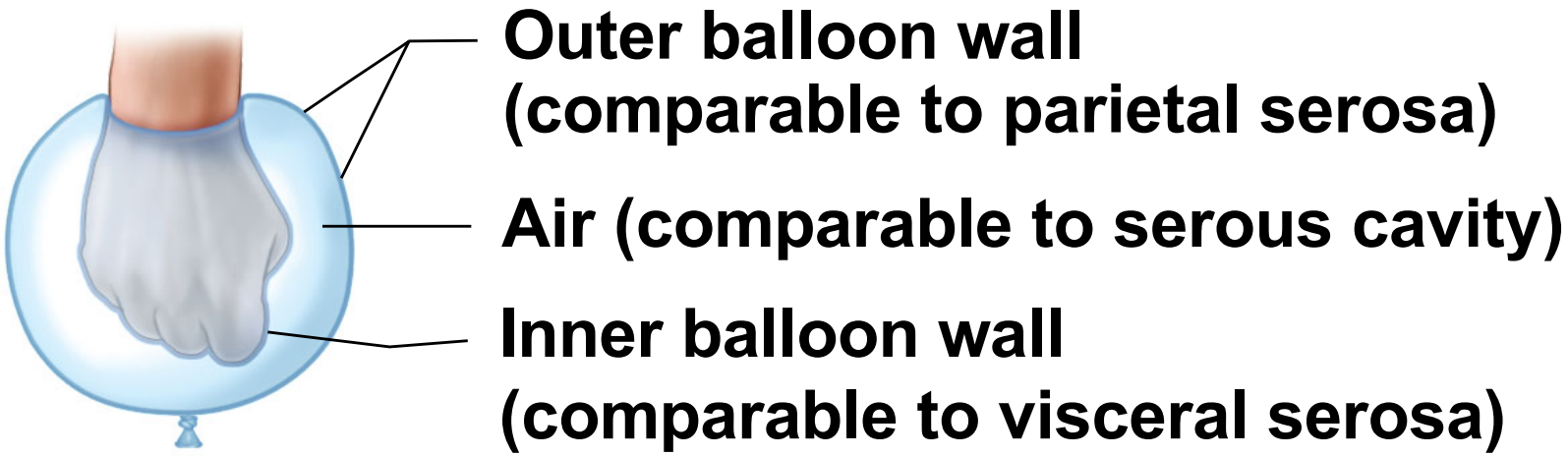
(a) Cutaneous membrane (the skin) covers the body surface.



(b) Mucous membranes line body cavities open to the exterior.



(c) Serous membranes line body cavities closed to exterior.



(d) A fist thrust into a limp balloon demonstrates the relationship between the parietal and visceral serous membrane layers.

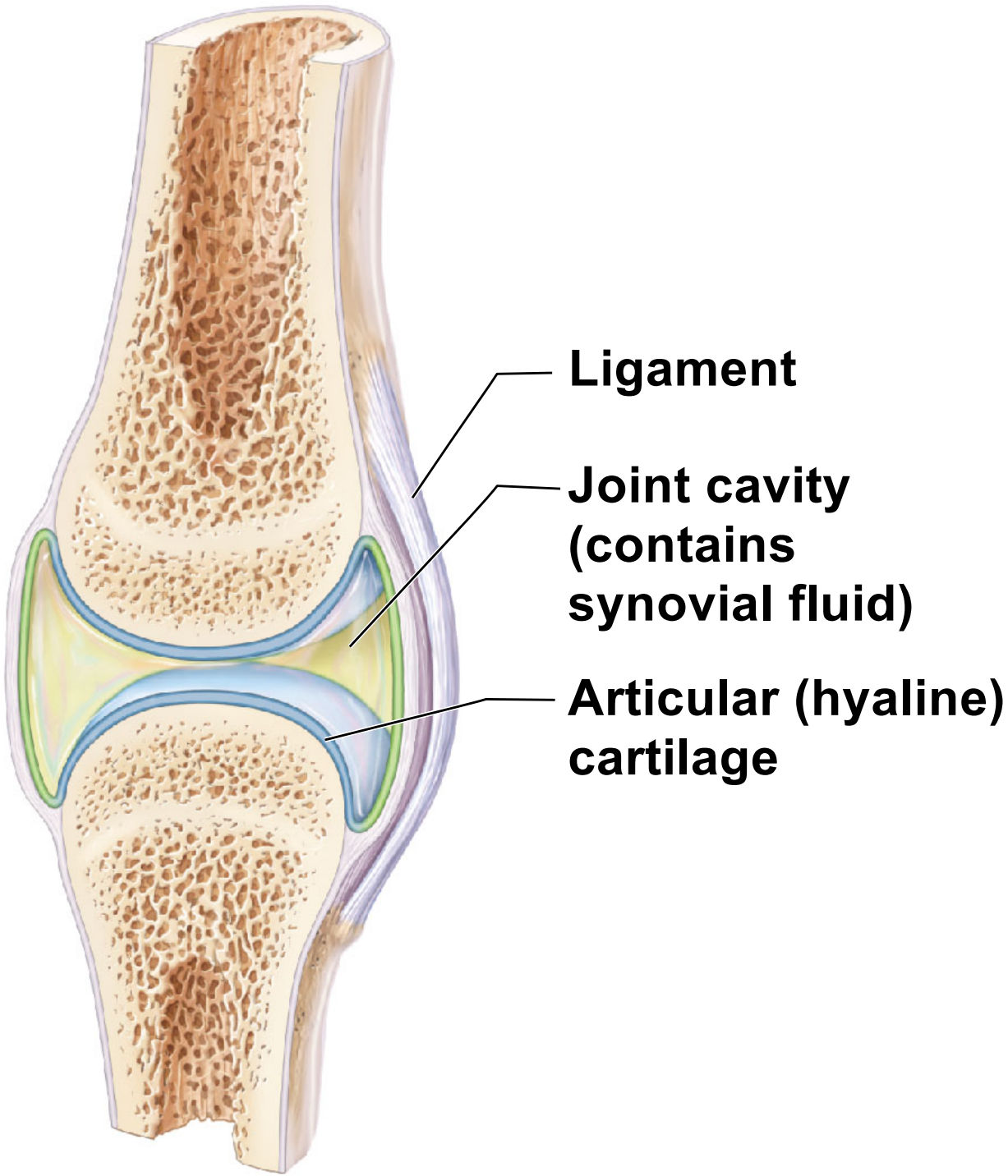
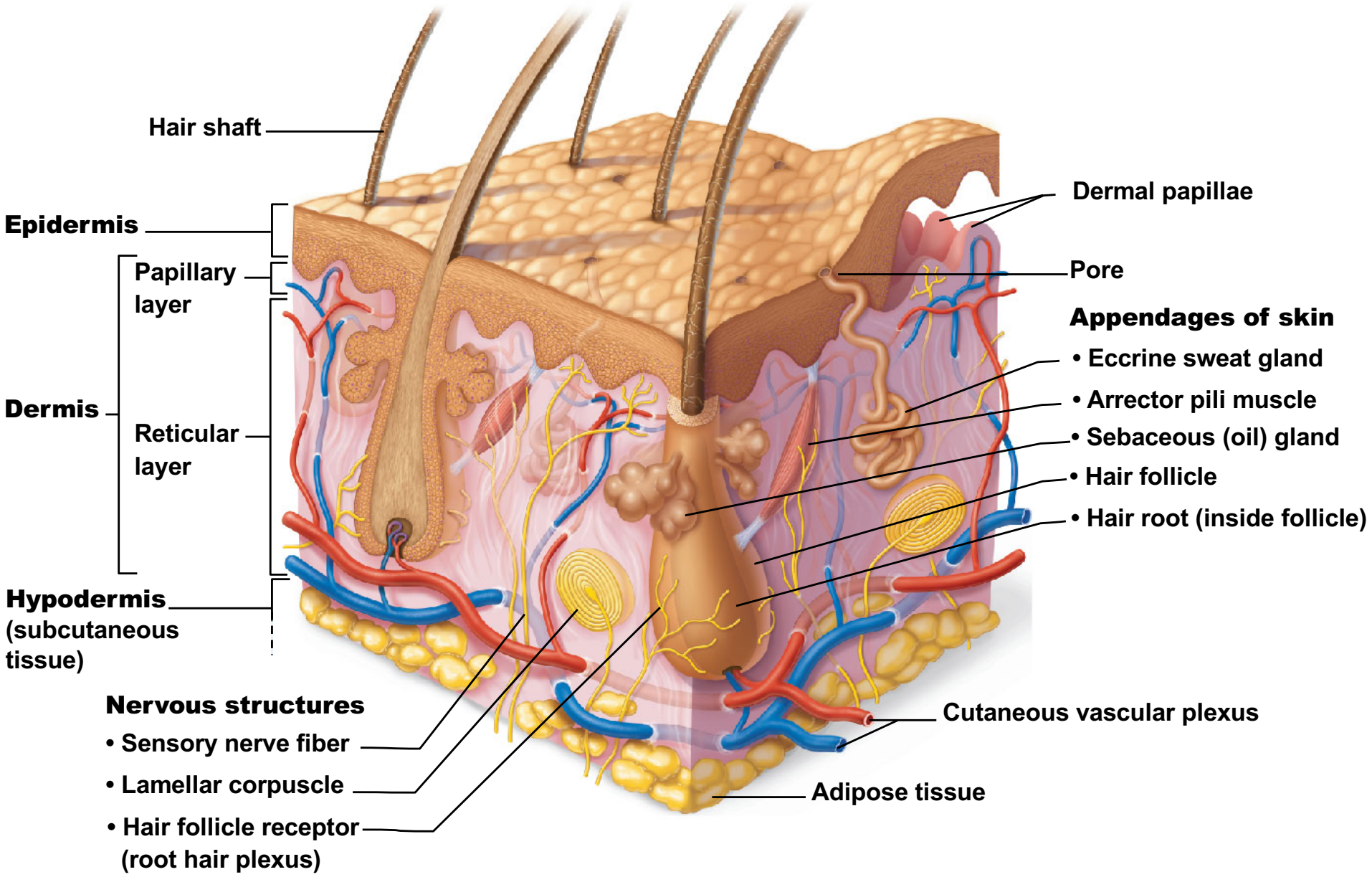


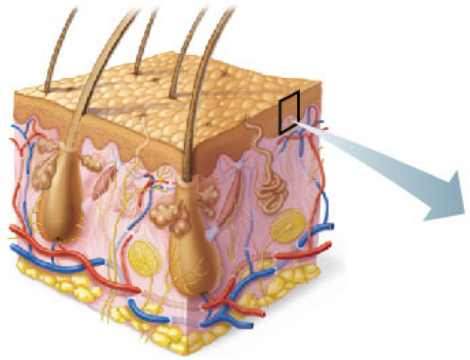
Table 4.1 Functions of the Integumentary System

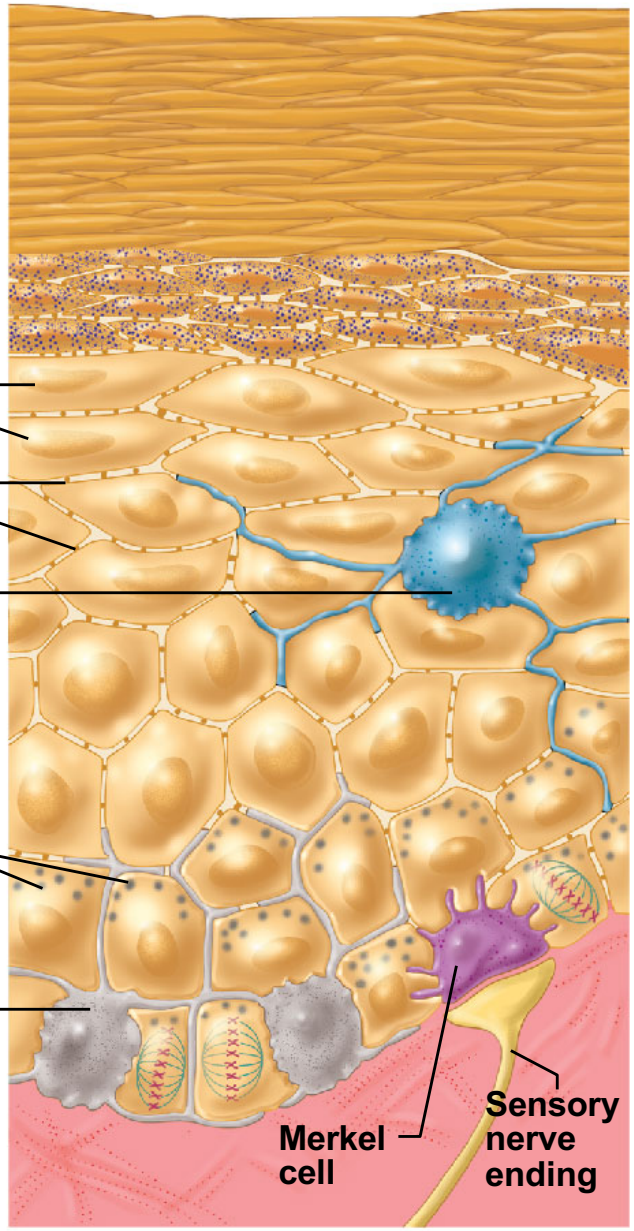
Functions	How accomplished
Protects deeper tissues from	
• Mechanical damage (bumps)	Physical barrier contains keratin, which toughens cells; fat cells to cushion blows; and both pressure and pain receptors, which alert the nervous system to possible damage.
• Chemical damage (acids and bases)	Has relatively impermeable keratinized cells; contains pain receptors, which alert the nervous system to possible damage.
• Microbe damage	Has an unbroken surface and "acid mantle" (skin secretions are acidic and thus inhibit microbes, such as bacteria). Phagocytes ingest foreign substances and pathogens, preventing them from penetrating into deeper body tissues.
• Ultraviolet (UV) radiation (damaging effects of sunlight or tanning beds)	Melanin produced by melanocytes offers protection from UV damage.
• Thermal (heat or cold) damage	Contains heat/cold/pain receptors.
• Desiccation (drying out)	Contains a water-resistant glycolipid and keratin.

Table 4.1 **Functions of the Integumentary System** (*continued*)

Functions	How accomplished
Aids in body heat loss or heat retention (controlled by the nervous system)	*Heat loss:* By activating sweat glands and by allowing blood to flush into skin capillary beds so that heat can radiate from the skin surface. *Heat retention:* By not allowing blood to flush into skin capillary beds.
Aids in excretion of urea and uric acid	Contained in perspiration produced by sweat glands.
Synthesizes vitamin D	Modified cholesterol molecules in skin converted to vitamin D in the presence of sunlight.







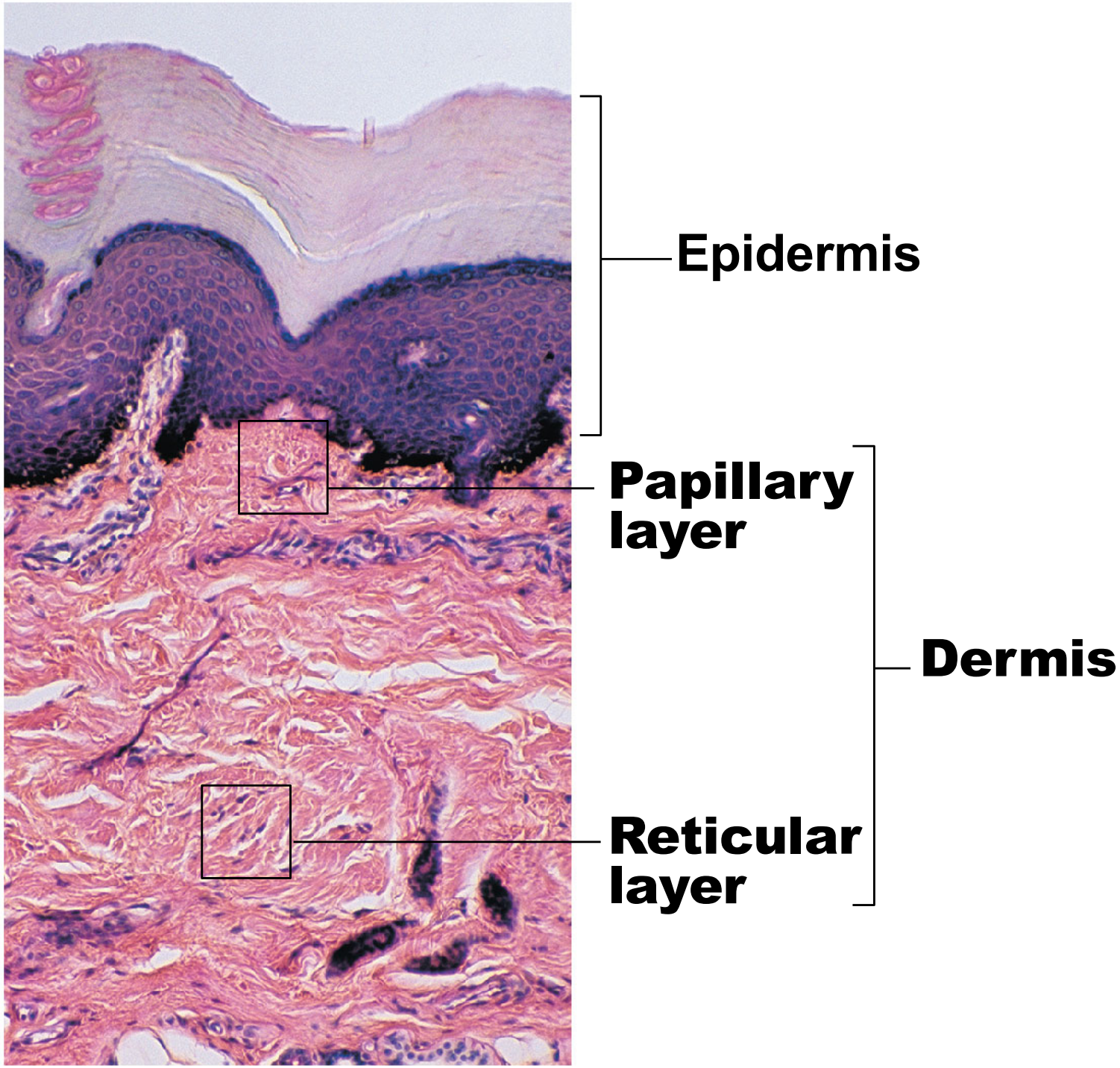
Stratum corneum. Cells are dead, flat membranous sacs filled with keratin. Glycolipids in extracellular space make skin water resistant.

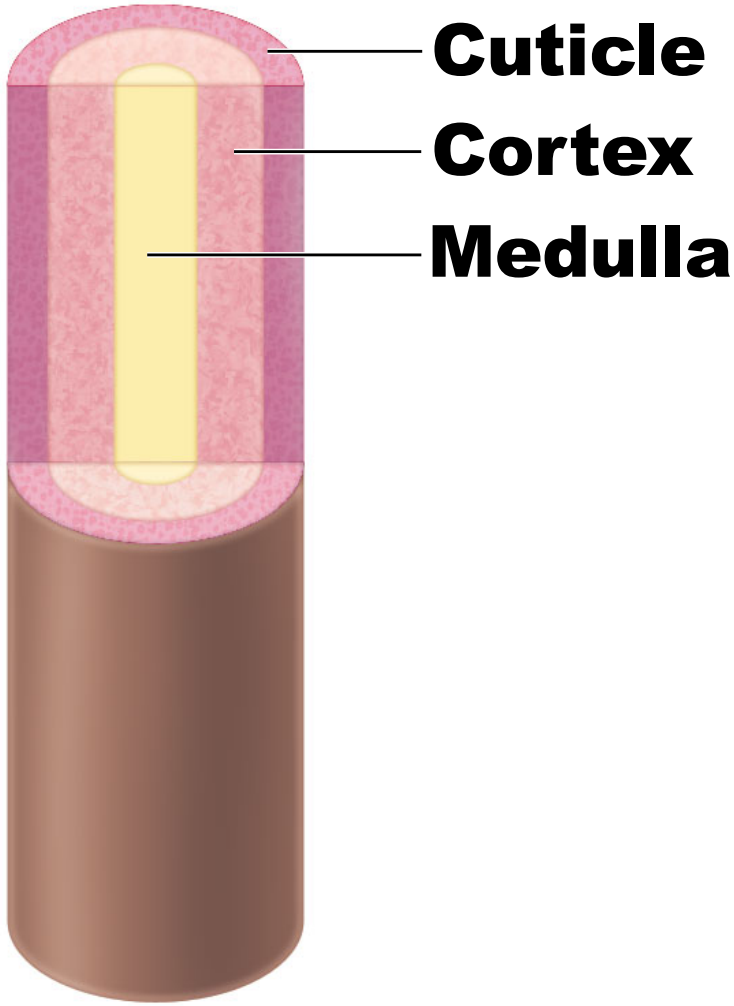
Stratum granulosum. Cells are flattened, organelles are deteriorating; cytoplasm full of granules.

Stratum spinosum. Cells contain thick bundles of intermediate filaments made of pre-keratin.

Stratum basale. Stem cells are actively dividing; some newly formed cells become part of the more superficial layers.

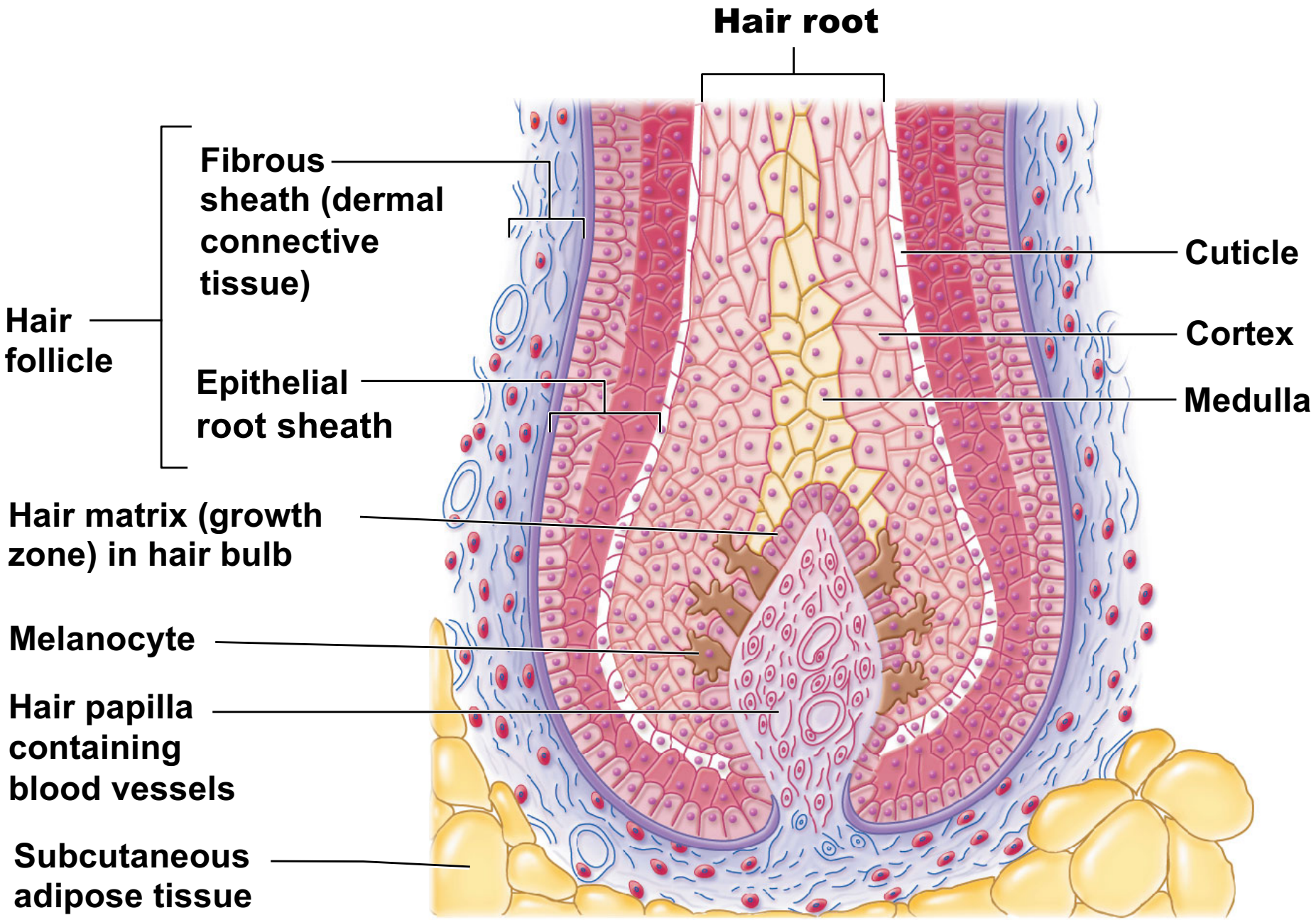
Dermis





(b) Hair

(c) Scanning electron micrograph of hair shaft emerging from follicle (435×)



(d) Cross section of hair bulb