VIVEKANANDA COLLEGE

THAKURPUKUR

KOLKATA-700063

NAAC ACCREDITED 'A' GRADE

Topic: INTEGUMENT

Course Title: COMPARATIVE ANATOMY OF VERTEBRATES

Paper: CC8 (ZOOA-CC4-8-TH)

Unit: 1

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Name of the Teacher: Dr. Shaoli Majumder

Name of the Department: Zoology

• It is the outer covering of the body of vertebrates; commonly referred to as SKIN

•makes up about 16% of the total body weight

•Forms the interface between organisms and the external environment.

•Includes the mucous membrane lining of the mouth, eyelids, nostrils and the openings of rectum and urogenital organs.

•It consists of two layers:

–An outer EPIDERMIS (epithelial tissue only)

–Inner DERMIS (connective tissue, nerve & muscle)

–Between the epidermis and dermis lies the BASEMENT MEMBRANE (basal lamina and reticular lamina)

–Under the dermis lies a subcutaneous tissue or HYPODERMIS (very loose connective and adipose tissue)

- Varies in different regions of the body, in different individuals, different ages and different groups of vertebrates

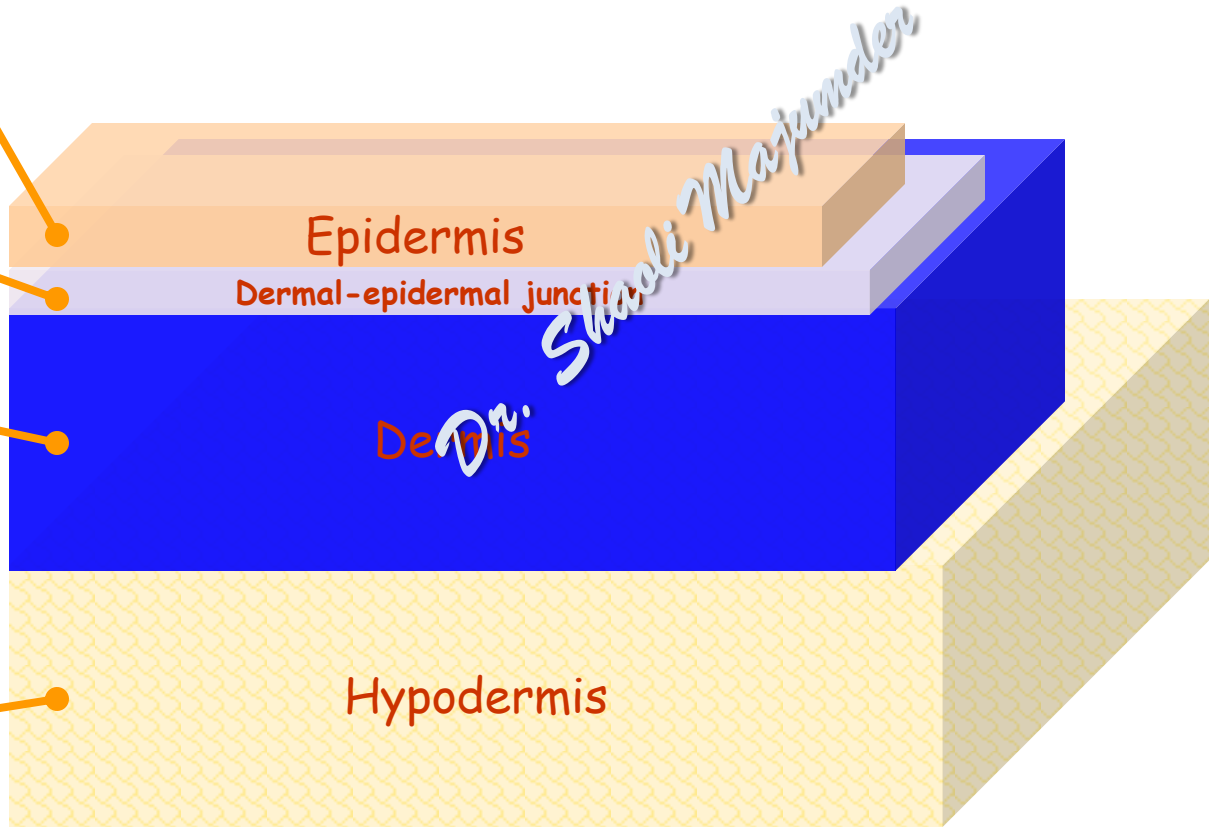
Structure of skin

Epithelial tissue
- stratified squamous (keratinized)

Basement membrane
- glue-like layer

Connective tissue
- dense, fibrous connective tissue
- blood vessel, nerves, etc.

Areolar & adipose tissue
- superficial fascia
- subcutaneous tissue



Functions of the Skin

- FIRST LINE OF DEFENSE against environmental hazards
- Protection of underlying tissues and organs against impact, abrasion, fluid loss and chemical attacks.
- Excretion of salts, water, wastes.
- Temperature regulation via adipocytes which insulate to keep warmer, or evaporative (sweating) for cooling.
- Synthesis of D3 (cholcalciferol)
- Stores lipids in adipocytes
- Detects touch, pressure, pain, temperature, and relays to the neural system.

Embryonic Origin and Development

- Epidermis – arises from ectoderm
- Dermis origin varies…

  Dermatome – principal origin, from the outer wall of dermomyotome of somites.

Integument of Amphibians

-specialized as a respiratory surface (Cutaneous respiration)

Epidermis -divided into four layers:

1. stratum basale
2. stratum spinosum
3. stratum granulosum
4. stratum corneum- thin, capillary beds reach into the lower part allowing cutaneous respiration

2. Dermis

-thinner

-composed of fibrous connective tissue divided into 2 layers:

1. stratum spongiosum
2. stratum compactum

-chromatophores are located in the dermis but sometimes found in the epidermis

-mucous and granular poison glands are located in the dermis

GLANDS

Generally, the skin of frogs and salamanders includes two types of multicellular glands; both are located in the dermis and open to the surface through connecting ducts :

- Mucous glands - large numbers of simple saccular mucous glands tend to be smaller, the bulblike enlargements of which lie in the vascular stratum spongiosum of the dermis. Each gland is made up of a little cluster of cells that release their product into a common duct.

- Poison glands – The poison glands (granular glands) tend to be larger than mucous glands and often contain stored secretions within the lumen of each gland. They are more abundant on the dorsal side of the body and hind legs. The warts of the toad and the parotid glands are actually masses of poison gland. Secretions of poison glands tend to be distasteful or even toxic to predators.

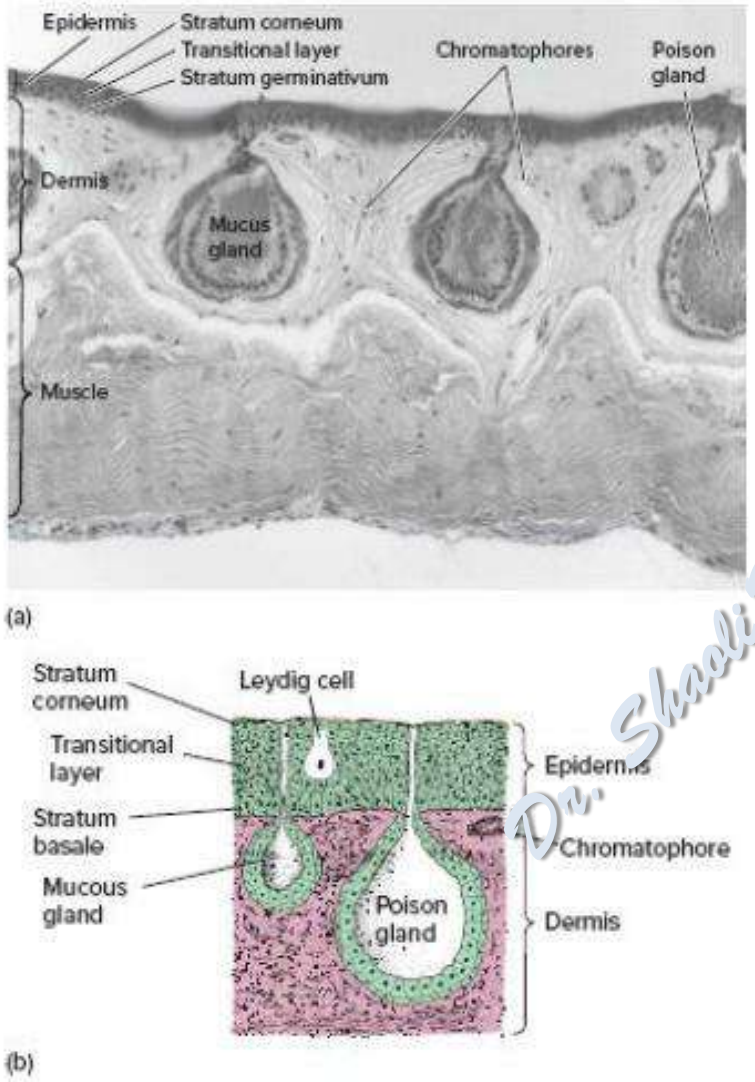


FIGURE 6.13 Amphibian skin. (a) Section through an adult frog skin. A basal stratum basale and a thin, superficial stratum corneum are present. The transitional layer between them includes a stratum spinosum and a stratum granulosum. (b) Diagrammatic view of amphibian skin showing mucous and poison glands that empty their secretions through short ducts to the surface of the epidermis.

Skin glands in Aves:

1. Uropygial glands

-secretes lipid and protein products used in preening to make the feathers water repellent

2. Salt glands

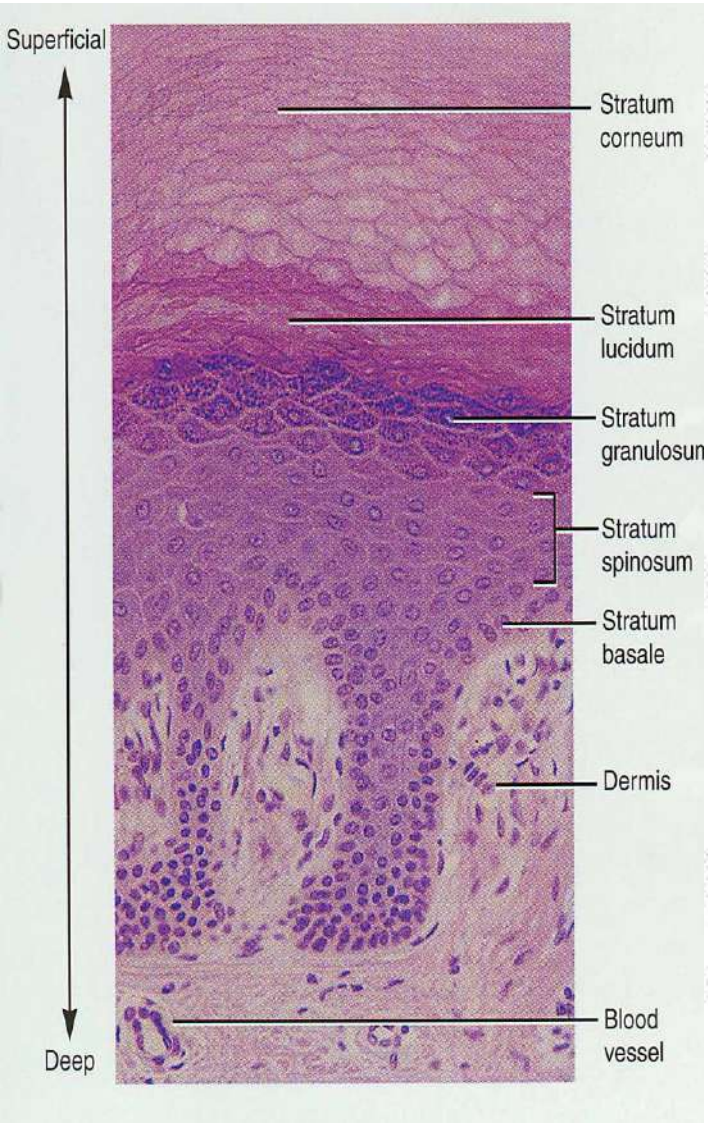
-excrete excess salt in marine birds

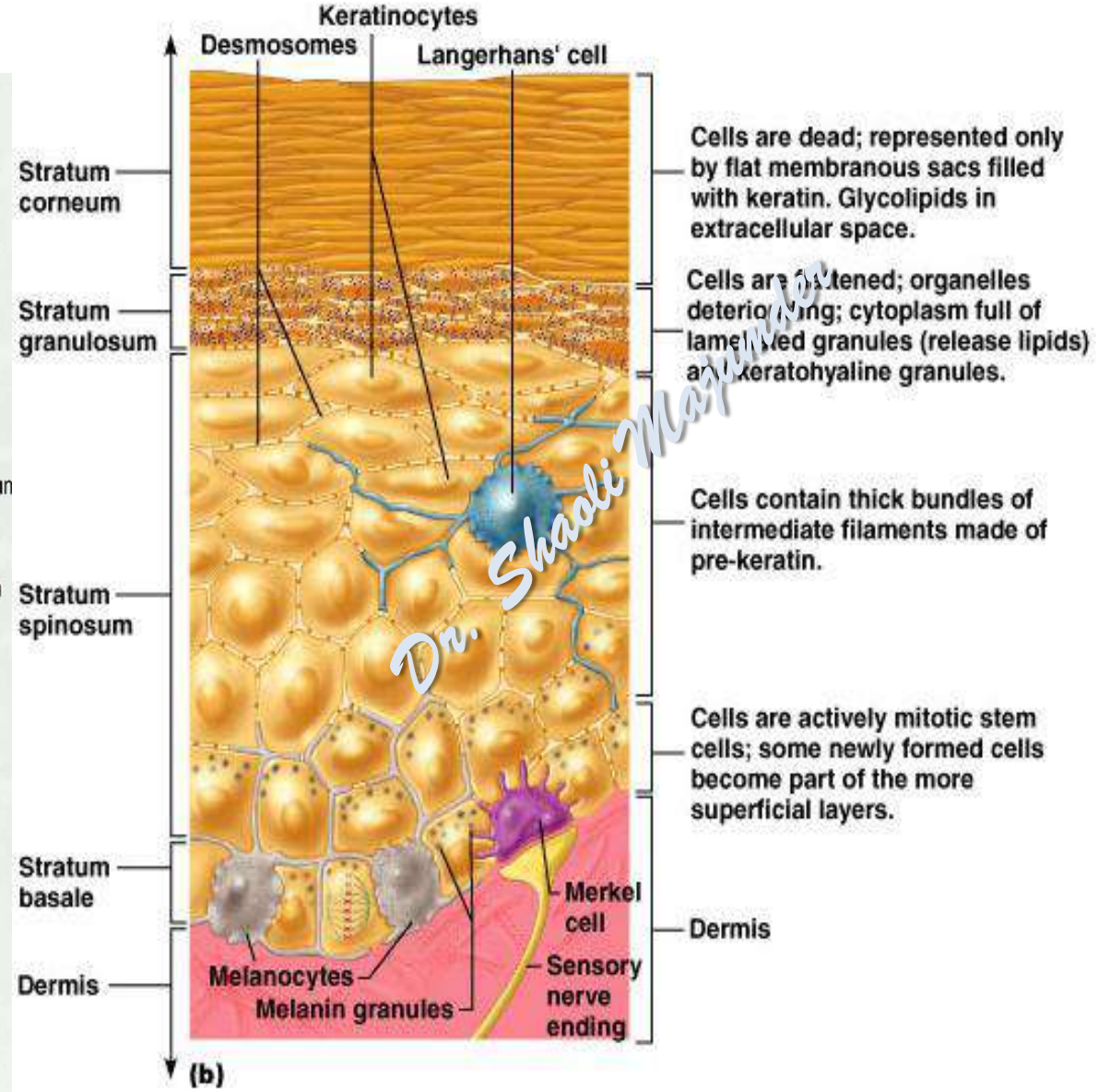
Integument of Mammals

Dr. Shashi Majumder

Epidermis

- Keratinized stratified squamous epithelium; no blood vessel
- Four types of cells
  - Keratinocytes – 90%, produce keratin (tough fibrous protein)
  - Melanocytes - 8%, 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, Specialized Cells are Merkel cells, Melanocytes
  - Stratum spinosum – spiny layer; Eight to ten layers of keratinocytes bound by desmosomes, contain dendritic (Langerhans) cells, tonofilaments (bundles of protein) resist tension
  - Stratum granulosum – 3-5 layers of flattened keratinocytes; Create tightly interlocked layer of keratin surrounded by keratohyalin
  - Stratum lucidum (only on palms and soles)- 3-5 layers of clear, flat, dead cells
  - Stratum corneum – horny layer (cells dead, many layers thick)





Keratinization

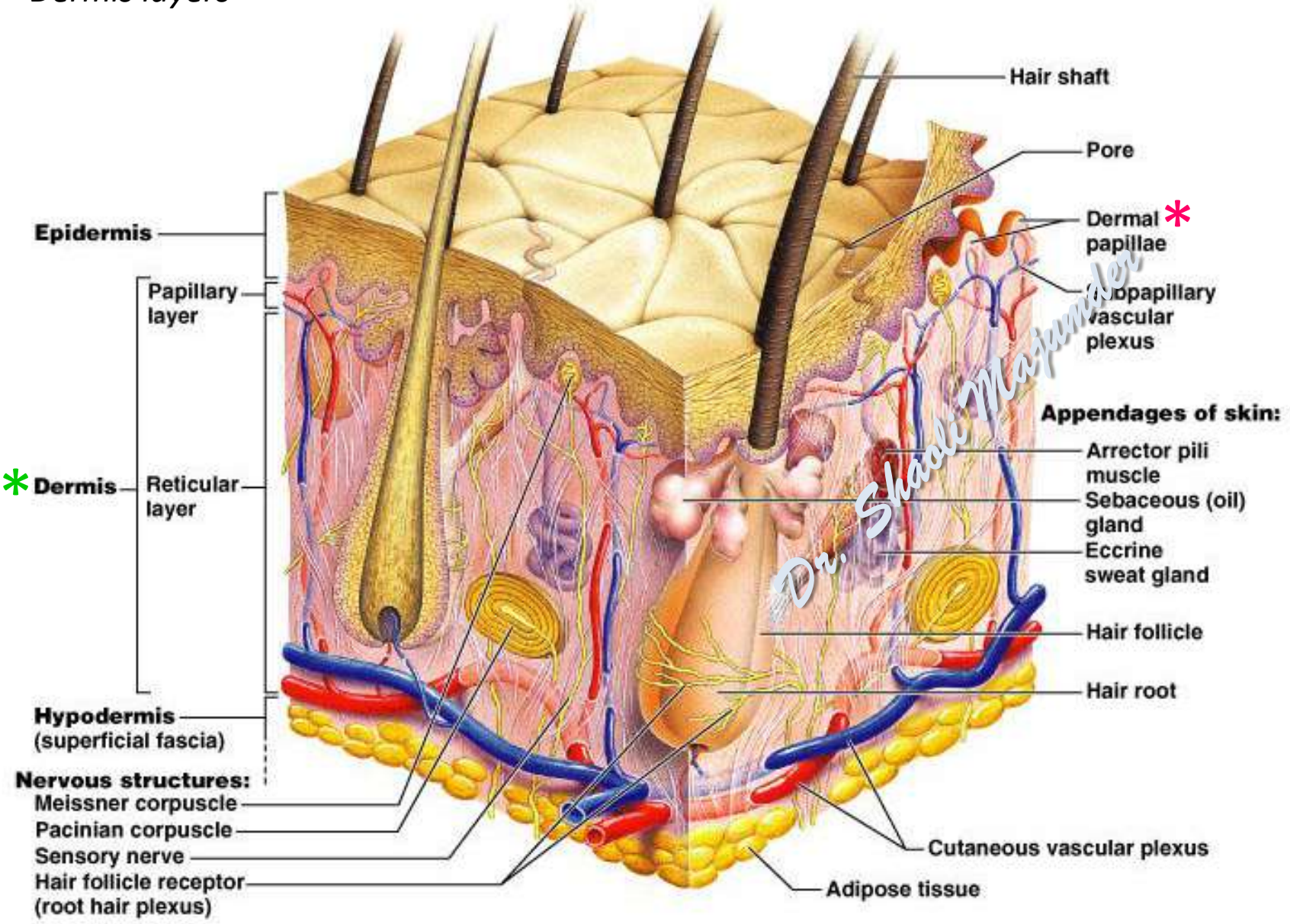
- Stem cells divide to produce keratinocytes
- As keratinocytes are pushed up towards the surface they fill with keratin
- 4 week journey unless outer layers removed in abrasion. Dead cells can remain an additional 2 weeks before shedding.
- Hormone EGF (epidermal growth factor) can speed up process
- <u>Psoriasis = chronic skin disorder</u>
  - cells shed in 7 to 10 days as flaky silvery scales
  - abnormal keratin produced

Dermis

- The dermis lies below the epidermis and contains a number of structures including blood vessels, nerves, hair follicles, smooth muscle, glands and lymphatic tissue.
- Fiber types: collagen, elastin, reticular
- Cells: fibroblasts, macrophages, mast cells, WBCs
- Provides tensile strength, and physiologic support for the interfacing epidermis
- Critical role in temperature regulation (the vessels)
- Has an ancient and persistent potential to form bone
- Major regions of dermis
  - papillary region – superficial; areolar connective tissue; includes dermal papillae; contains Meissner's corpuscles (touch) & free nerve endings (pain and temperature)
  - reticular region –deeper; "reticulum" (network) of collagen and reticular fibers; Packed with oil glands, sweat gland ducts, fat & hair follicles; Provides strength, extensibility & elasticity to skin

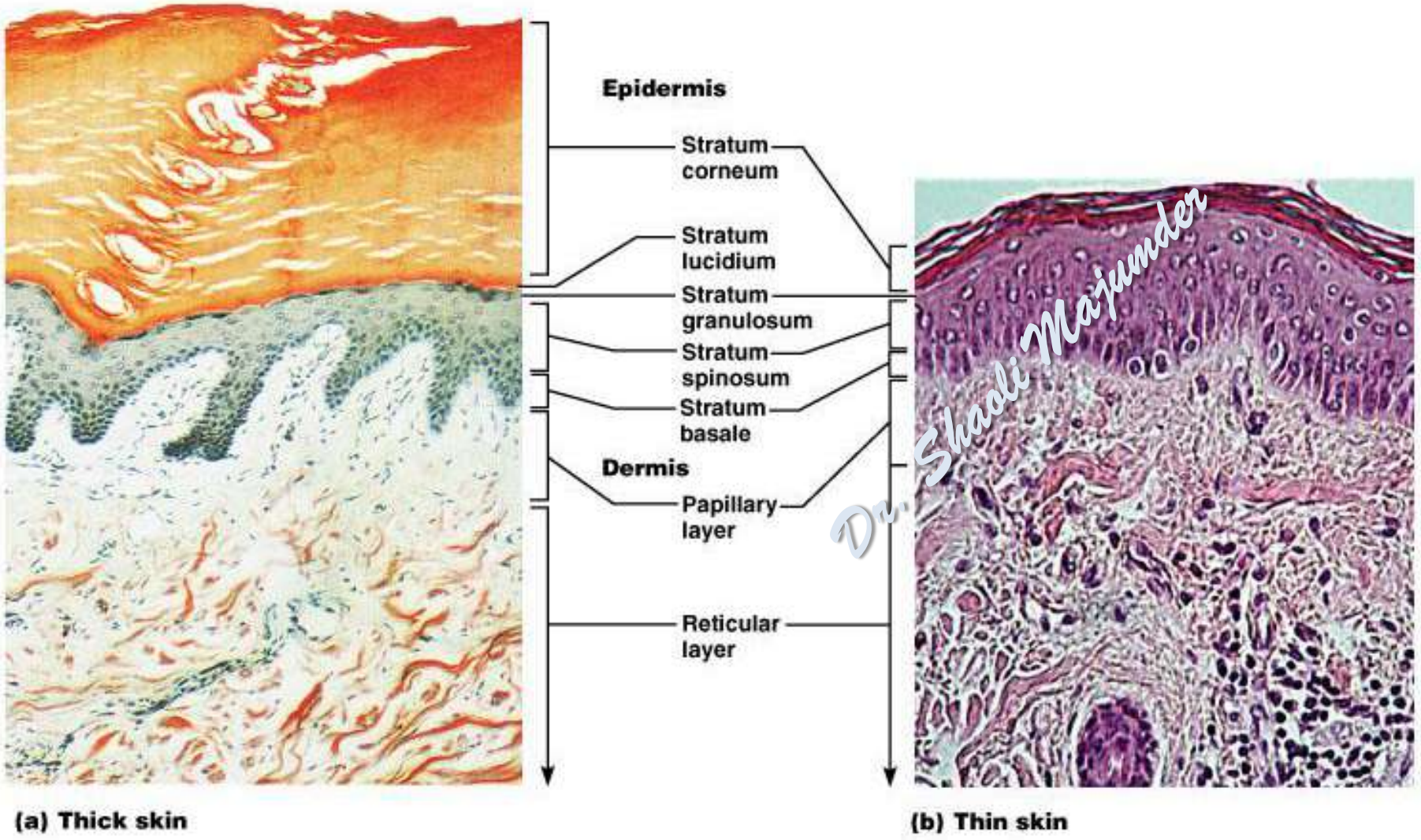
* *Dermis layers*

* *Dermal papillae*



Epidermis and dermis of (a) thick skin and (b) thin skin

(which one makes the difference?)



Basement membrane

•underlying support where epithelial cells are rested; It demarcates the underlying connective tissue from epithelium.

•Made up of 2 layers

- ➢Basal Lamina - Membrane proteins of the epithelial cells are anchored in the basal lamina. The major 2 glycoproteins - LAMININ and Type IV COLLAGEN; acts as a selectively permeable filter between epidermis and dermis connective tissue.
- ➢Reticular Lamina - Reticular fibers embedded in ground substance that connect the basal lamina with the underlying CT.

Hypodermis

- "Hypodermis" (Gk) = below the skin
- "Subcutaneous" (Latin) = below the skin
- Also called "superficial fascia"

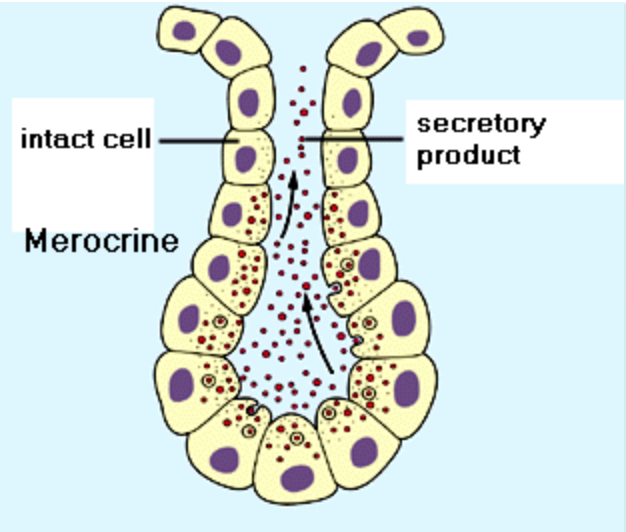
  "fascia" (Latin) =band; in anatomy: sheet of connective tissue
- Fatty tissue which stores fat and anchors skin (areolar tissue and adipose cells)
- Different patterns of accumulation (male, female)

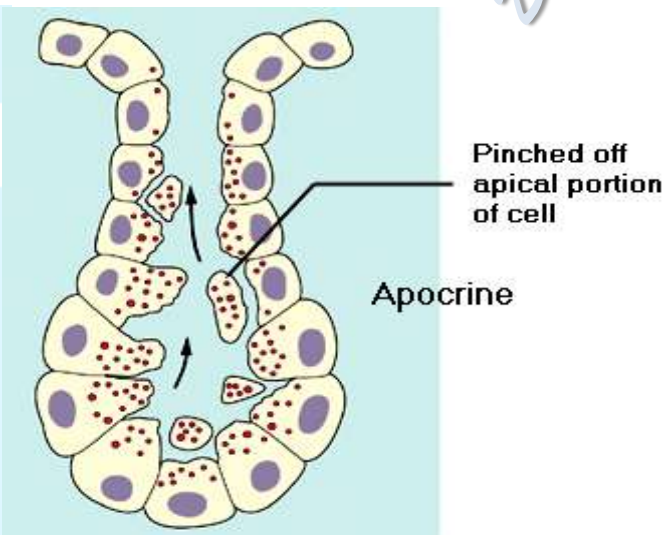
Types of Glands as to Method of Secretion

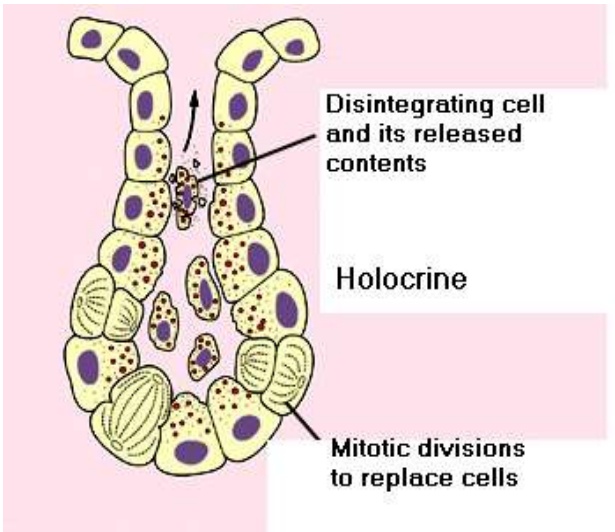
1. Merocrine glands- true glands; not destroyed during secretion; Sweat gland

2. Apocrine glands- part of the cell is destroyed that go with the secretion; the apical portions of cells are pinched off and lost during the secretory process. This results in a secretory product that contains a variety of molecular components including those of the membrane. Mammary glands

3. Holocrine glands - involves death of the cell & a new cell is produced to replace it; The secretory cell is released and as it breaks apart, the contents of the cell become the secretory product. Sebaceous or oil gland.

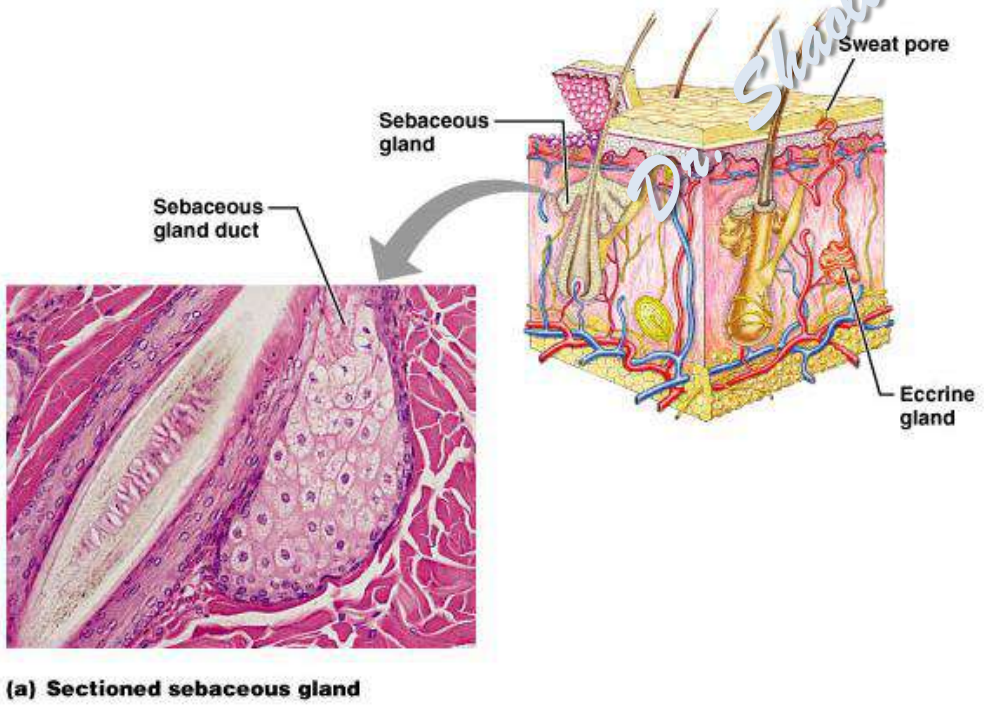






Sebaceous (oil) glands

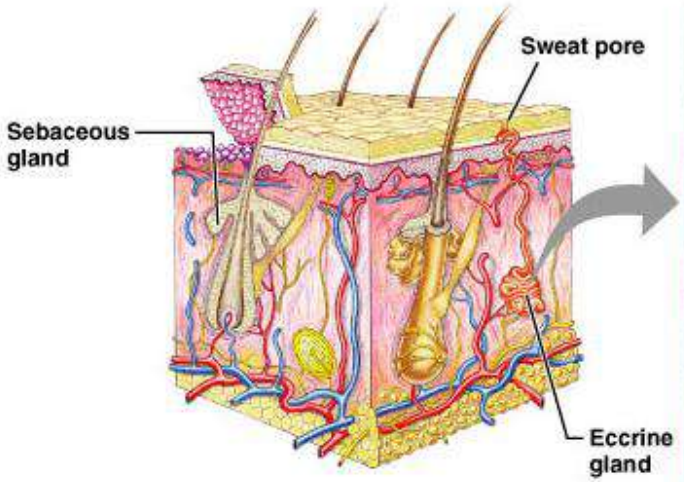
- Entire body except palms and soles
- Most open onto hair shafts
- Produce *sebum* by holocrine secretion; sebum is the combination of cholesterol, proteins, fats & salts; keeps hair and skin soft & pliable, inhibits growth of bacteria & fungi (ringworm). The sebaceous glands forces lipids into the hair follicle and onto the skin creating a seal.



(a) Sectioned sebaceous gland

Sweat glands

- Entire skin surface, abundant in armpit and pubic region; absent in nipples and part of external genitalia
- regulate body temperature with perspiration
- 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 follices
  - The organic molecules in it decompose with time - odor
- Modified apocrine glands
  - Ceruminous – secrete earwax
  - Mammary – secrete milk

Ceruminous glands

- Modified in ear canal
- Cerumin sweat glands produce waxy secretion contains secretions of oil and wax glands
- Helps form barrier for entrance of foreign bodies
- Impacted cerumen may reduce hearing

Mammary Glands

produce milk – found in both sexes, but rudimentary until puberty. With estrogen they develop, with testosterone they are inhibited.