



INTEGUMENTARY SYSTEM OF CHORDATE

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COMPARATIVE ANATOMY OF CHORDATES II

BIO 404

Semester 2

Week 2

Date 8/2/2024

Outline

- ❖ **Comparative anatomy.**
- ❖ **Integument system**
- ❖ **Function of skin**
- ❖ **Integument of vertebrate**
- ❖ **Fish skin**
- ❖ **Amphibian skin**
- ❖ **Reptile skin**
- ❖ **Bird skin**
- ❖ **Mammals' skin**
- ❖ **Skin derivative**
- ❖ **Types of epidermal glands**



Objectives

You should be able to explain and describe the following;

- Integumentary system components
- Function of the system
- Integumentary system in vertebrate
- Skin Components
- The skin of different vertebrate classes, fish skin, amphibian skin, bird skin, reptile skin, and mammals.
- Skin derivatives
- Dermal and epidermal derivatives



Chordate characteristics



1- Notochord:-

In vertebrate replaced by vertebral column, in other cases may be persist or lost

2- Nerve Cord:

Single, hollow cord dorsal to the notochord modified in vertebrates into the central nervous system.

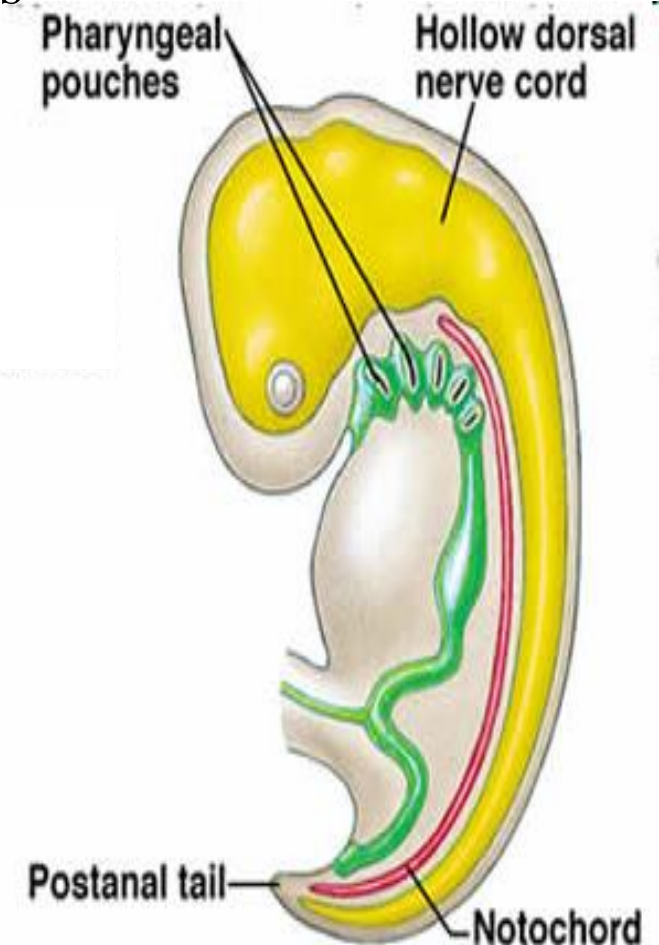
3-Gill pouch:

Lost in the Most chordates and Become functional gill in fish and amphibian larvae

4- Post anal tail:-

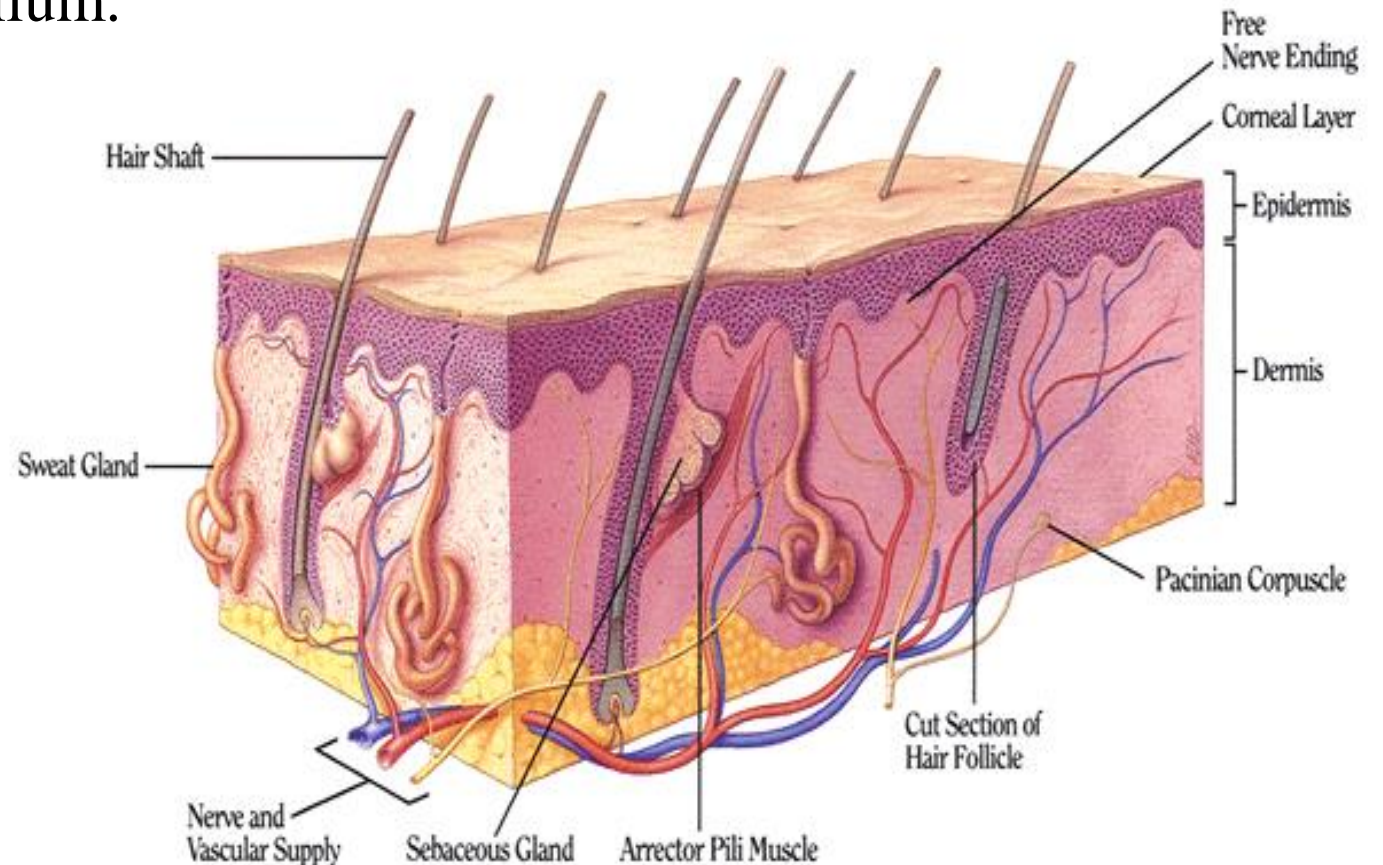
Beyond the anus so called Post-anal region

5- Endostyle



Integumentary System

- The outer layer of skin that protects the body.
- **Skin** consist of 2 layers
 1. **Epidermis** derived from ectoderm, and it consists of a keratinized stratified squamous epithelium.
 2. **Dermis** derived from mesoderm, it consists of dense connective tissue



Function of Skin

- Protect against infection, dehydration & temperature
- Help excrete waste materials
- Receptor for touch, pressure, pain, heat, and cold
- Maintenance of the body form
- Protect the body against sunburns by secreting melanin
- Store water, fat, glucose, and vitamin D
- Generate vitamin D through exposure to ultraviolet light
- Formation of new cells from stratum germinativum

Integument of vertebrate

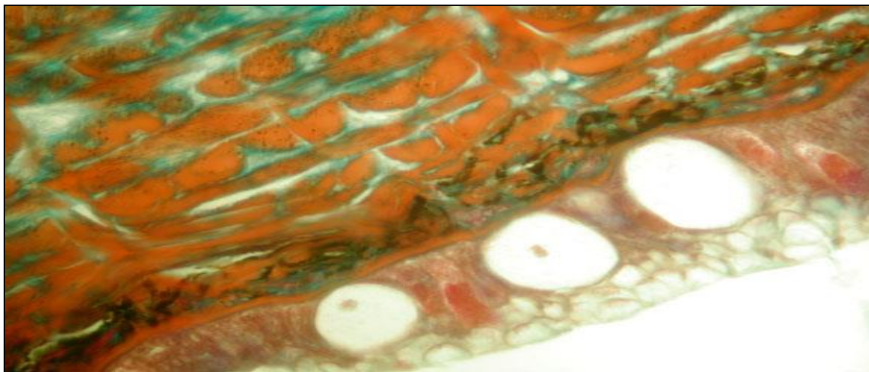


- Amphioxus; **an epidermis** consisting of one layer of columnar or cuboidal epithelial cells and scattered mucous cells, covered by a thin cuticle, and has a thin dermis of soft connective tissue



Amphioxus (protochordata)
The simplest form of chordate

- Lamprey skin surface is smooth with no scales. The epidermis consists of several layers that actively secrete a thin cuticle.



Hagfish has a thin epidermis with unicellular mucous glands (at bottom of image), thick dermis with connective tissues (green) & smooth muscle (red)



Hagfish (Agnatha); tiny slime gland openings in skin

Fish Skin

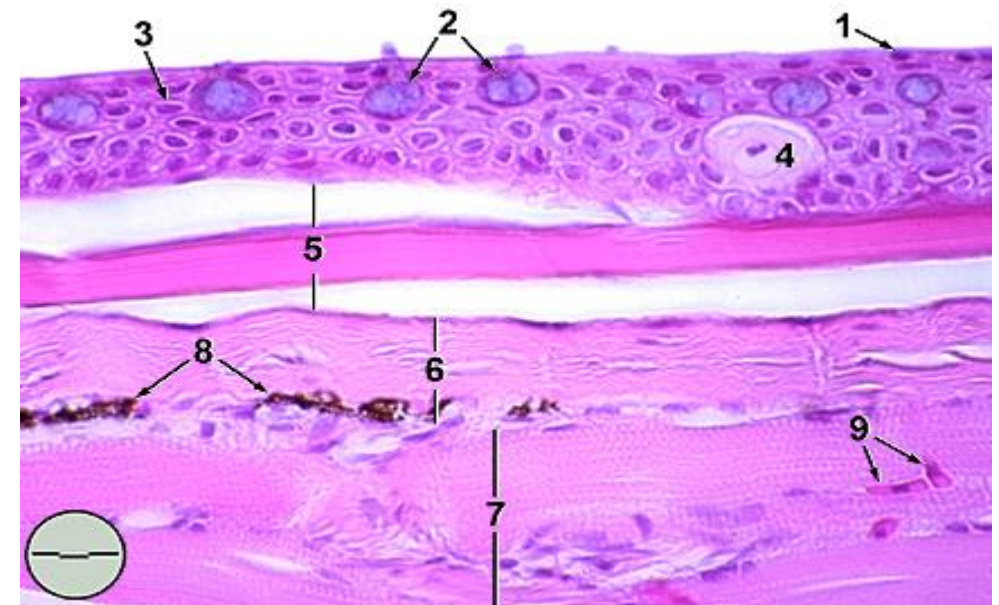
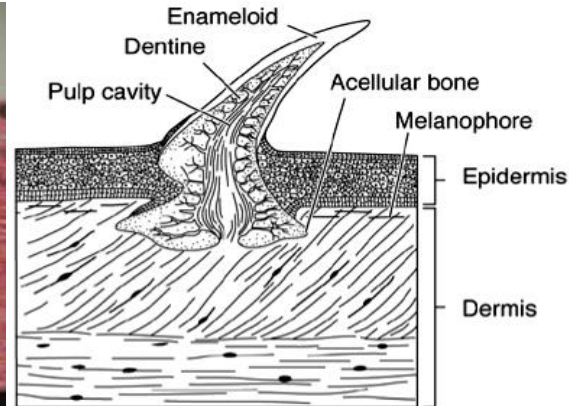
- Have many unicellular glands like goblet cells (secretes mucus)
- Chromatophores



Dogfish (**Chondrichthyes**)



Shark Skin section

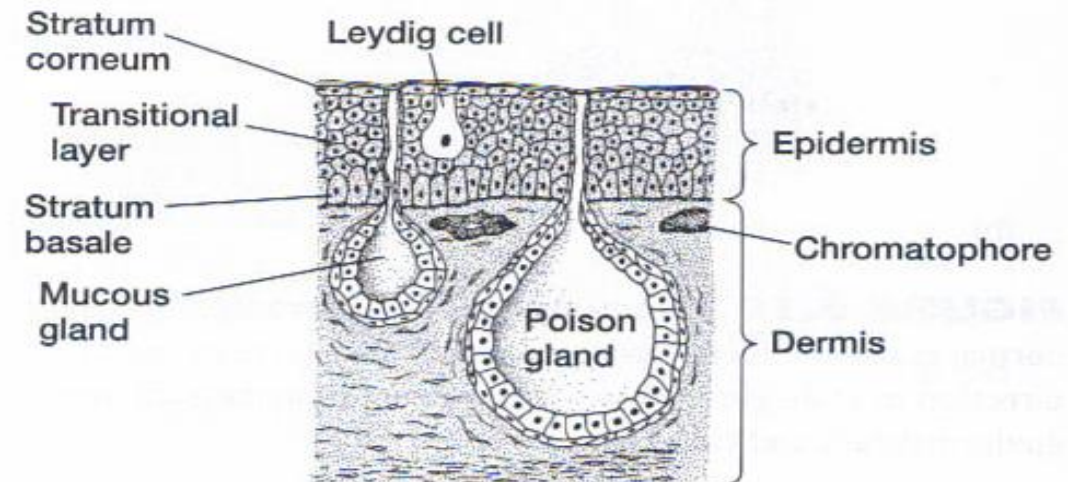
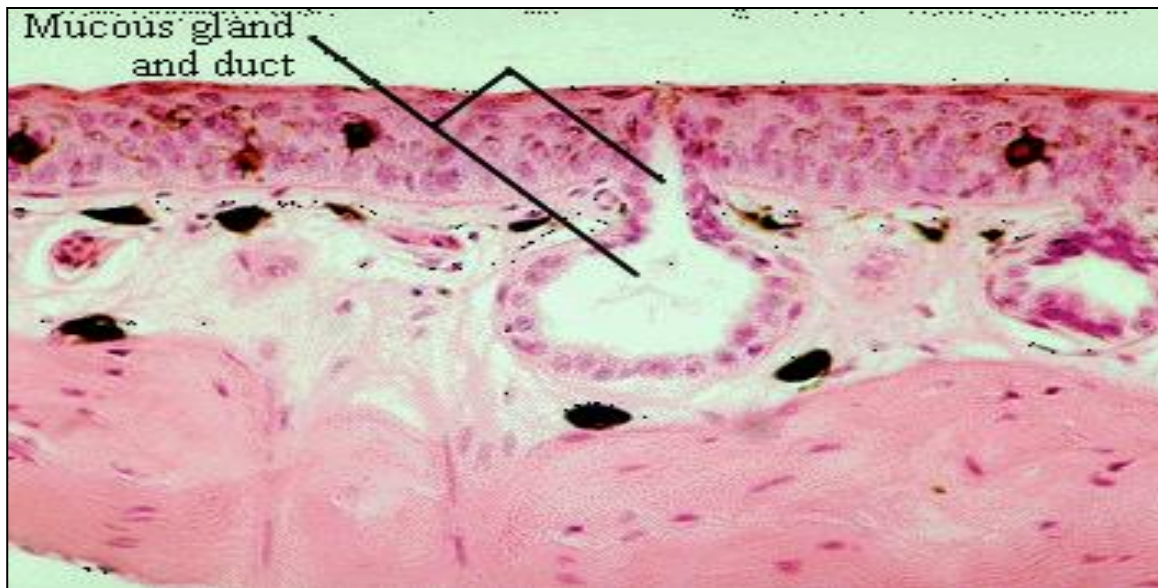


Bonny Fish Skin at high power:

1, 3 epidermis, 2- mucous gland, 4-club gland, 5-elasmoid scale, 6 – dermis, 7 muscle tissue, 8 chromatophore.

Amphibian Skin

- Skin is delicate and permeable, allowing oxygen and water to pass through its pores.
- No dermal scales, exception: caecilian as their dermal scales are composed of a basal plate with layers of collagen
- Moist skin contain
 - Epidermal glands (mucous and poison)
 - Chromatophore pigment cells



Slide shows Amphibian skin, with mucous and poison glands.

Amphibian Skin

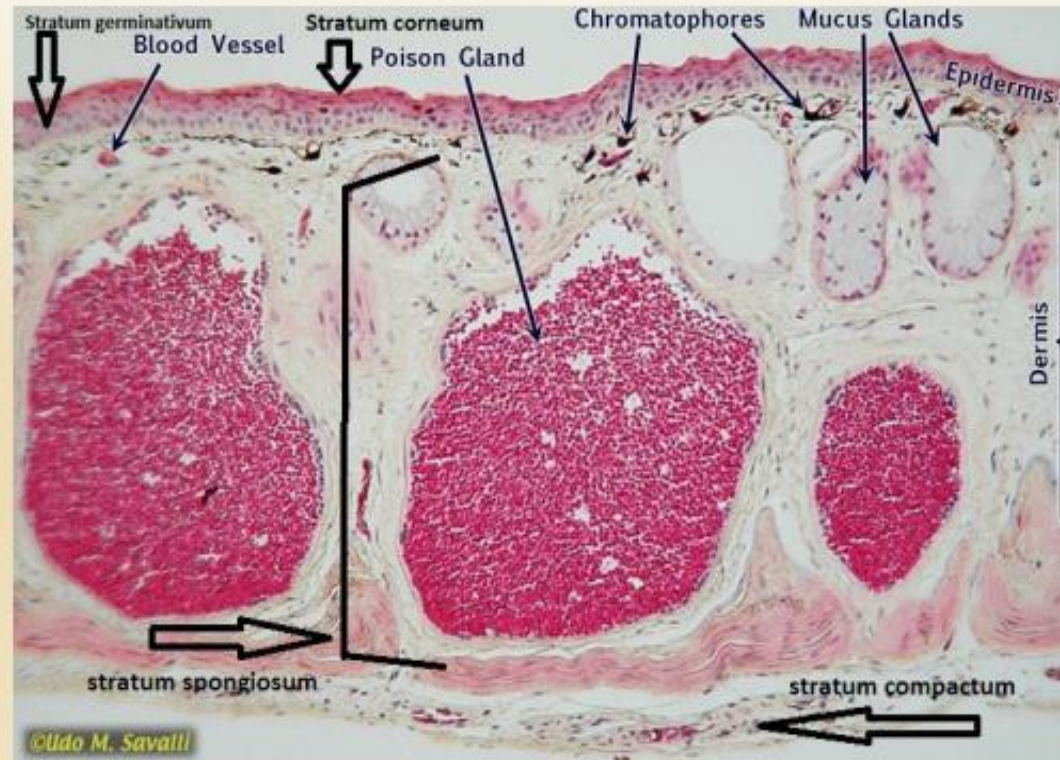
- Layers similar to reptiles, mammals/birds. Epidermis much thinner in amphibians and highly glandular compared to other taxa

Mucous glands

- Generally more abundant
 - predominantly dorsal
- Prevalence may be related to habitat differences
- Secrete mucopolysaccharides

Granular glands

- Generally larger
- More localized
 - Localization related to life history traits
- Produce toxins (generally protein and alkaloid-based) in response to stimuli



Reptile Skin

- Thick modified stratum corneum
- Few glands (dry skin)
- Epidermal scales and dermal plate (osteoderms)
 - Osteoderms beneath some epidermal scales

-Alligator and snakes have Gastralia dermal bones found in the ventral body wall of crocodilian



Reptile Skin

- Turtles have highly developed dermal scales, form a rigid dermal skeleton that is attached to the true skeleton.
- Turtle have shell of dermal bone, dorsal called Carapace (shell) and ventral called Plastron
- Turtles have epidermal scutes (large epidermal scales)
- Snakes have scutes on belly
- Spikes and spines are epidermal



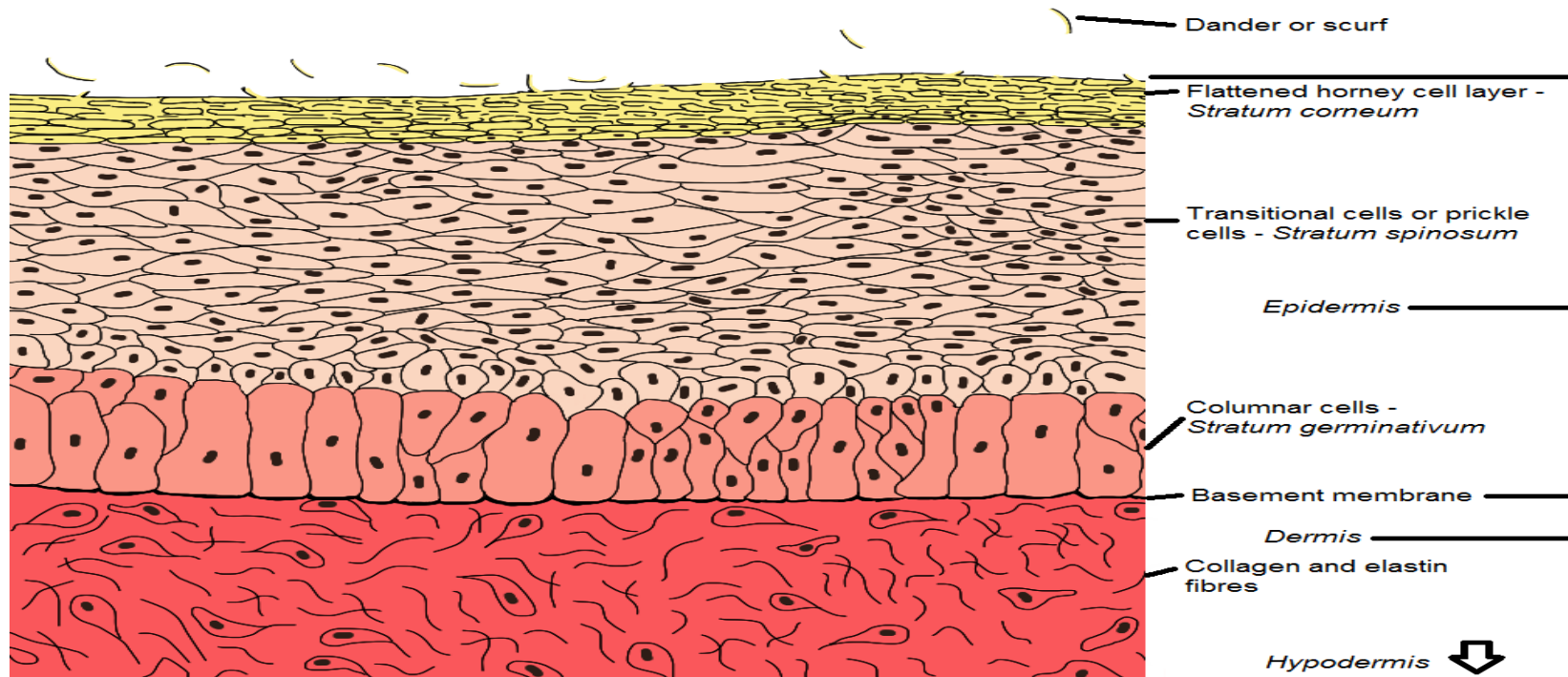
Snake belly scutes



White bony plate of turtle with scutes removed.

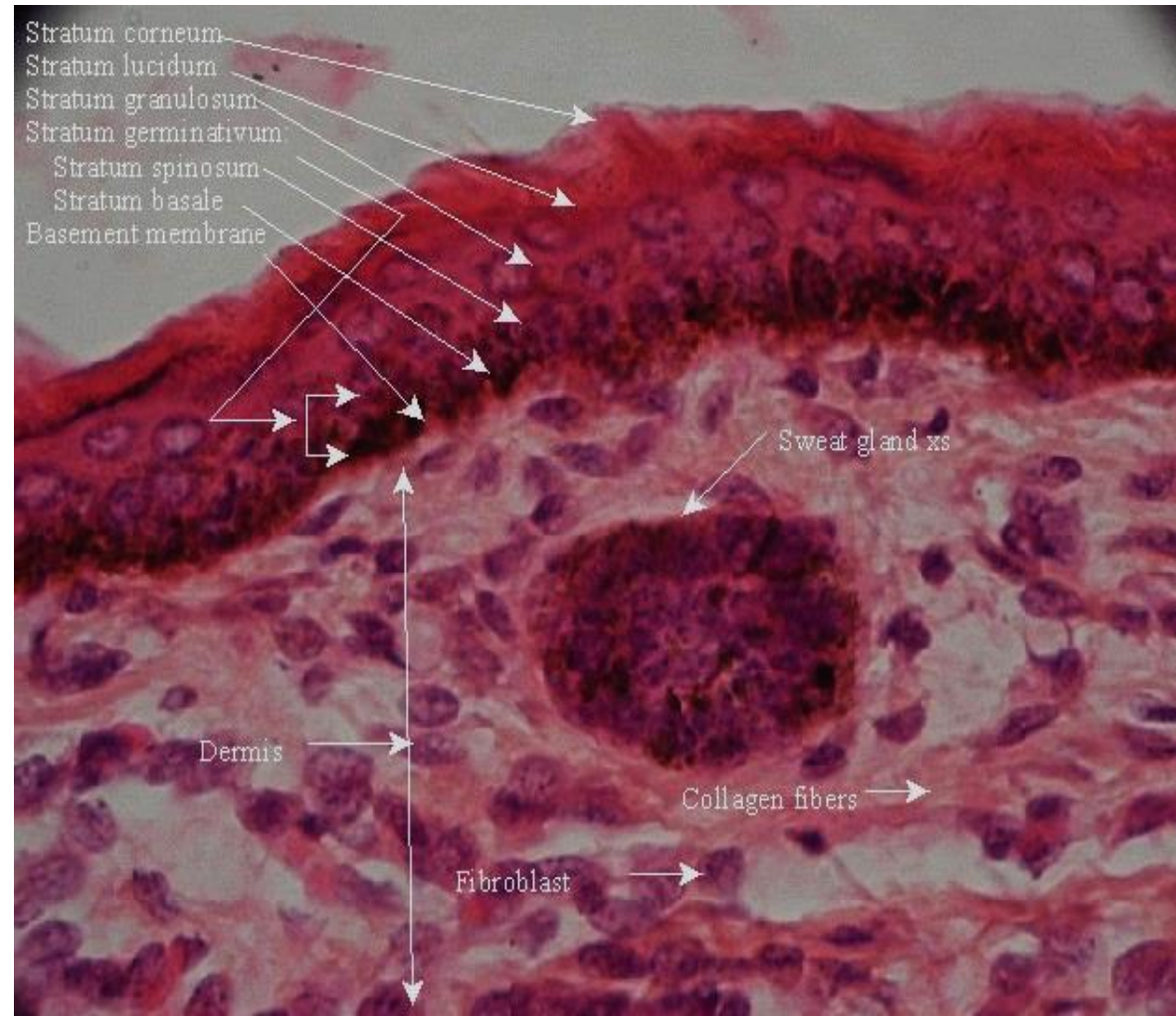
Skin of Birds

- Thin and delicate skin
- Few epidermal scales Legs and beak
- Dermal scales are absent
- Claws- diversified
- Few glands Uropygial gland- preening gland



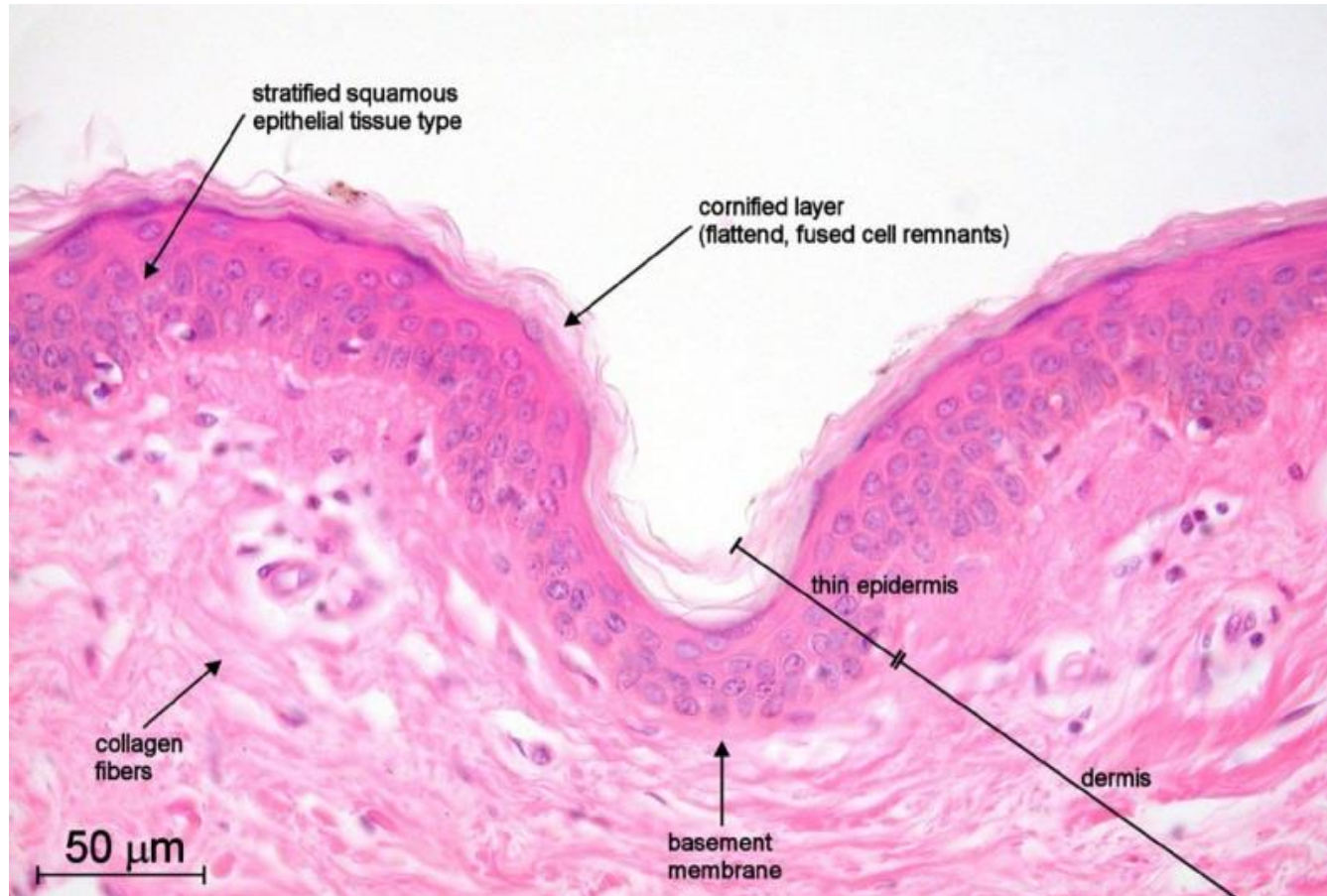
Integumentary System of mammals

- The epidermis subdivided into the following *strata* or layers
- Stratum corneum
- Stratum lucidum
- Stratum granulosum
- Stratum germinativum
- Stratum spinosum
- Stratum basale
- Stratum germinativum
also called stratum basale)

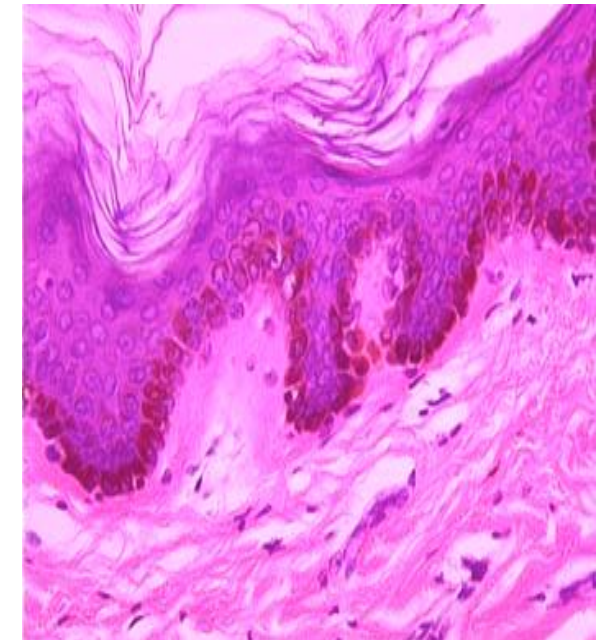


Skin of Mammals

- Modifications of stratum corneum are Hair, claws, nails, hooves and vibrissae
- Vibrissae are specialized hairs, tactile in function

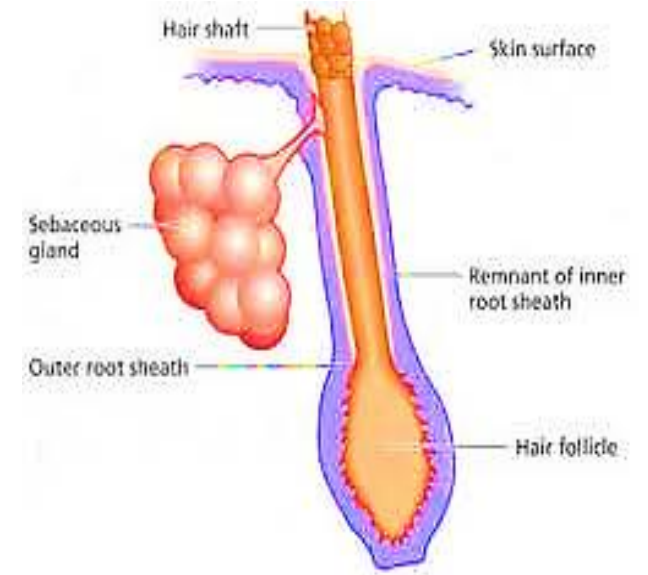


Vibrissae of harbor seal.



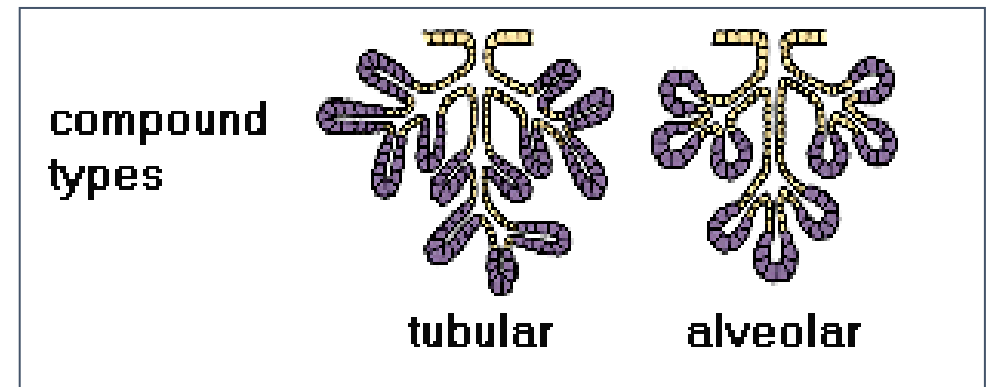
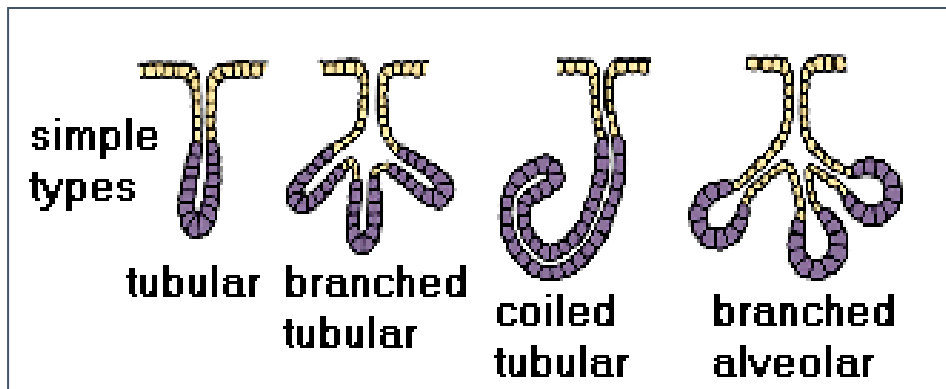
Skin derivatives

- The skin derivatives are numerous and are either epidermal or dermal in origin
- **Epidermal derivatives**
Formed from epidermis and derivatives of Malpighian layer
(stratum basale & stratum spinosum)
- Includes,
- **Glands**
- Horny teeth & beaks,
- epidermal scales and scutes,
- feathers,
- Claws, hoofs, and nail,
- horn, hair and its modification.



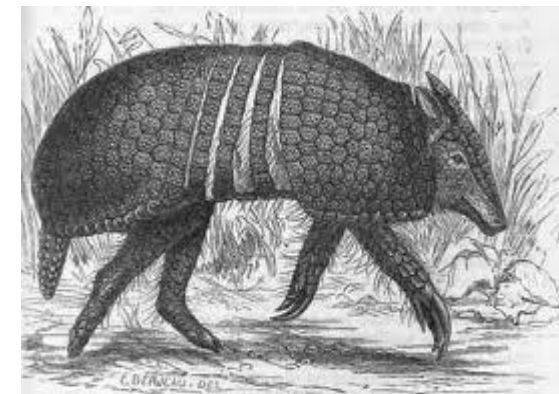
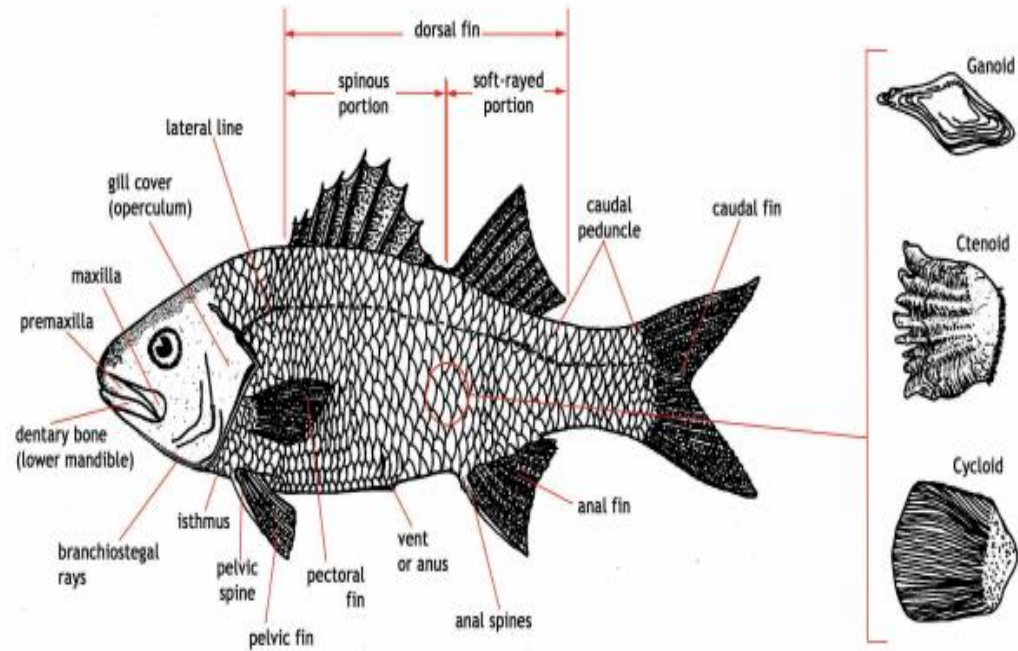
Integumentary Gland Type

- **Simple tubular**
 - Intestinal glands
- **Simple coiled tubular**
 - Sweat glands
- **Simple branched tubular**
 - Female plethodontid-spermatheca
- **Simple alveolar (acinar)**
 - Mucous glands
- **Compound tubular**
 - Mammary glands of monotremes
- **Compound branched alveolar**
 - Mammary glands of placentals



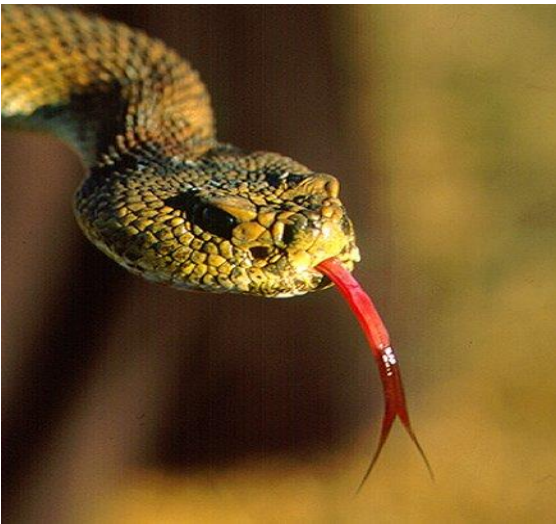
Skin derivatives

- **Dermal derivatives**
 - derived from dermis and comprise
- Dermal Pigments cell(chromatophore)
- Bony or dermal scale
- Plate (shields)
- Fin ray
- Antler

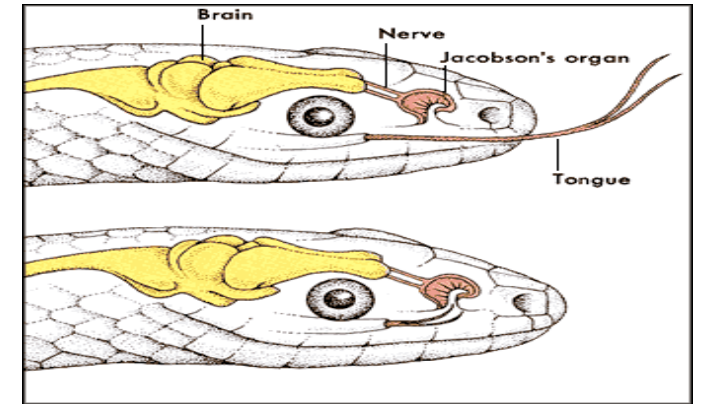


Types of epidermal gland

- Scent gland
- Mucous glands
- Poison glands
- Femoral glands
- Sweat glands,
- Sebaceous gland
- Wax gland
- Mammary glands



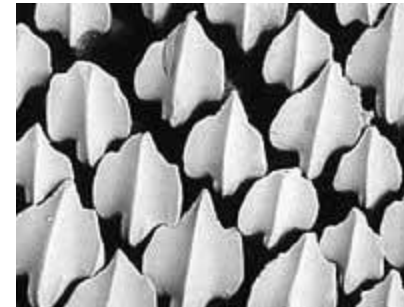
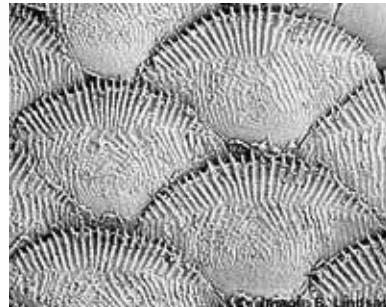
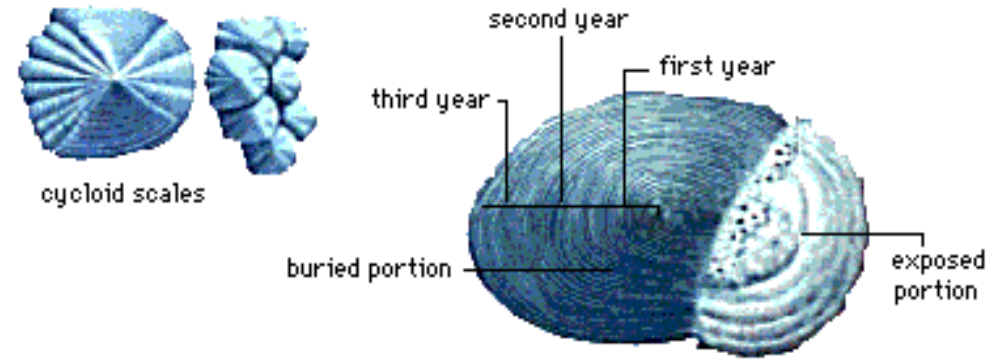
- Scent glands lizards, turtles and snakes
(Snakes use forked tongue to pick up scent
(Jacobson's organ))



- Femoral pores
Occur ventrally, waxy excretion
- Musk gland
 - Scent glands
 - Along carapace in turtles
 - Under lower jaw in crocodiles
 - Musk deer

Dermal Scales of Fish

- Fish have no epidermal scales
 - Scales are dermal
- Modern fish
 - Cycloid and ctenoid scales
 - Placoid and ganoid scales



Cycloid,

ctenoid,

placoid,

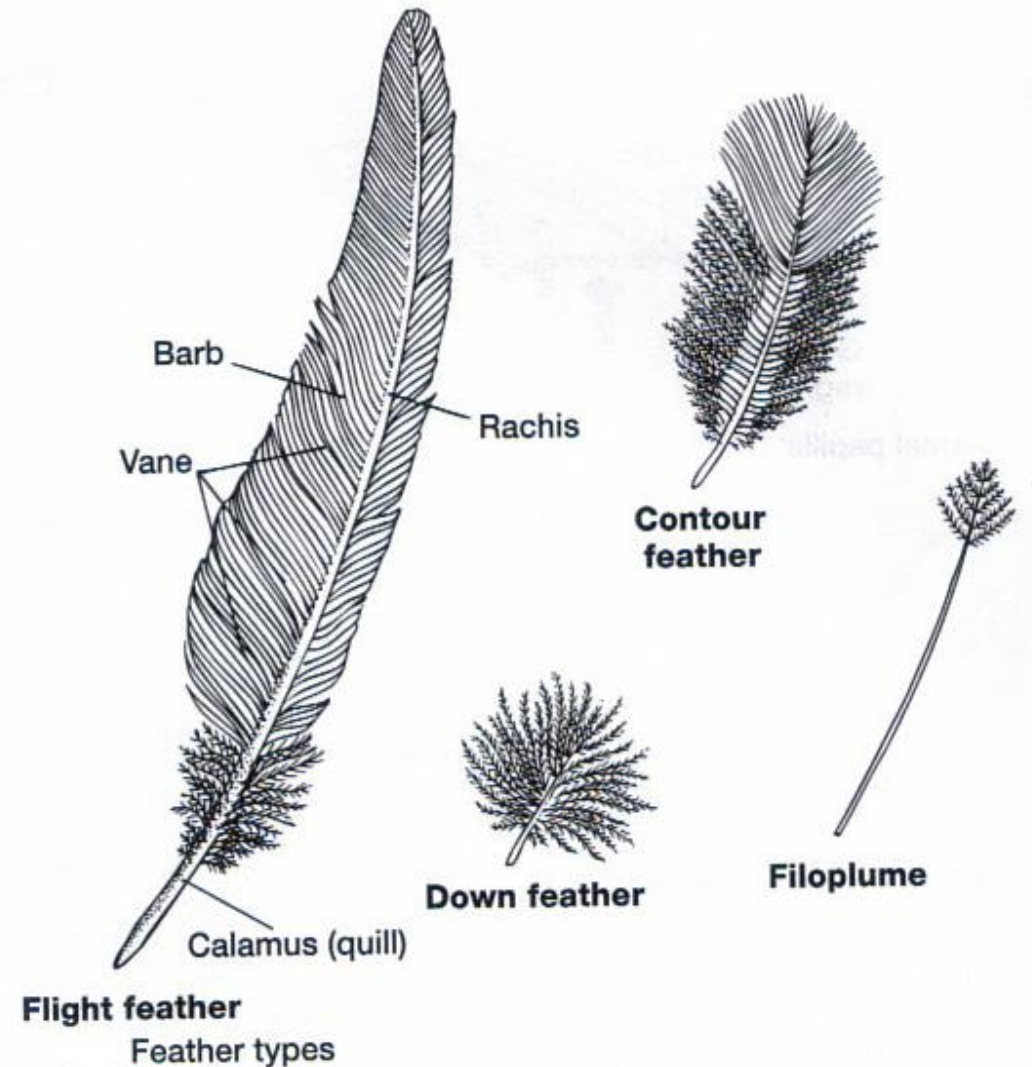
ganoid

Feathers



There are 3 types

- **Contour** (plumae); flight feather provides wing shape
- **Down** (plumulae); beneath contour feather, covering the young birds.
- **Filoplume**; always situated beside other feathers.



Filoplumes

- Filoplumes always situated beside other feathers.
- They are simple, hair like structures that grow in circles around the base of down feathers.
- Made up of a thin rachis with a few short barbs or barbules at the tip.



Down

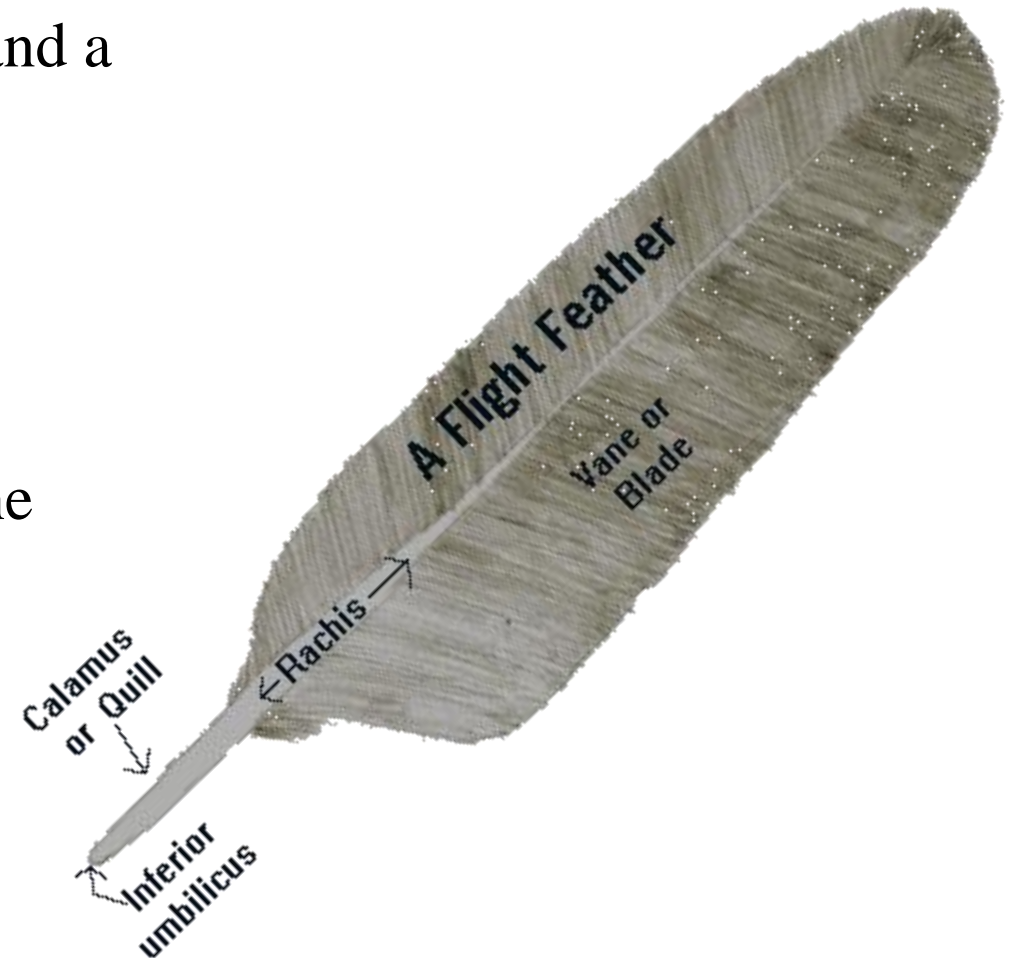
- Each is composed of a basal, short, hollow quill, embedded in the integument, and numerous barbs which arise from the free end of the quill.
- The barbs bear tiny barbules along their edges.



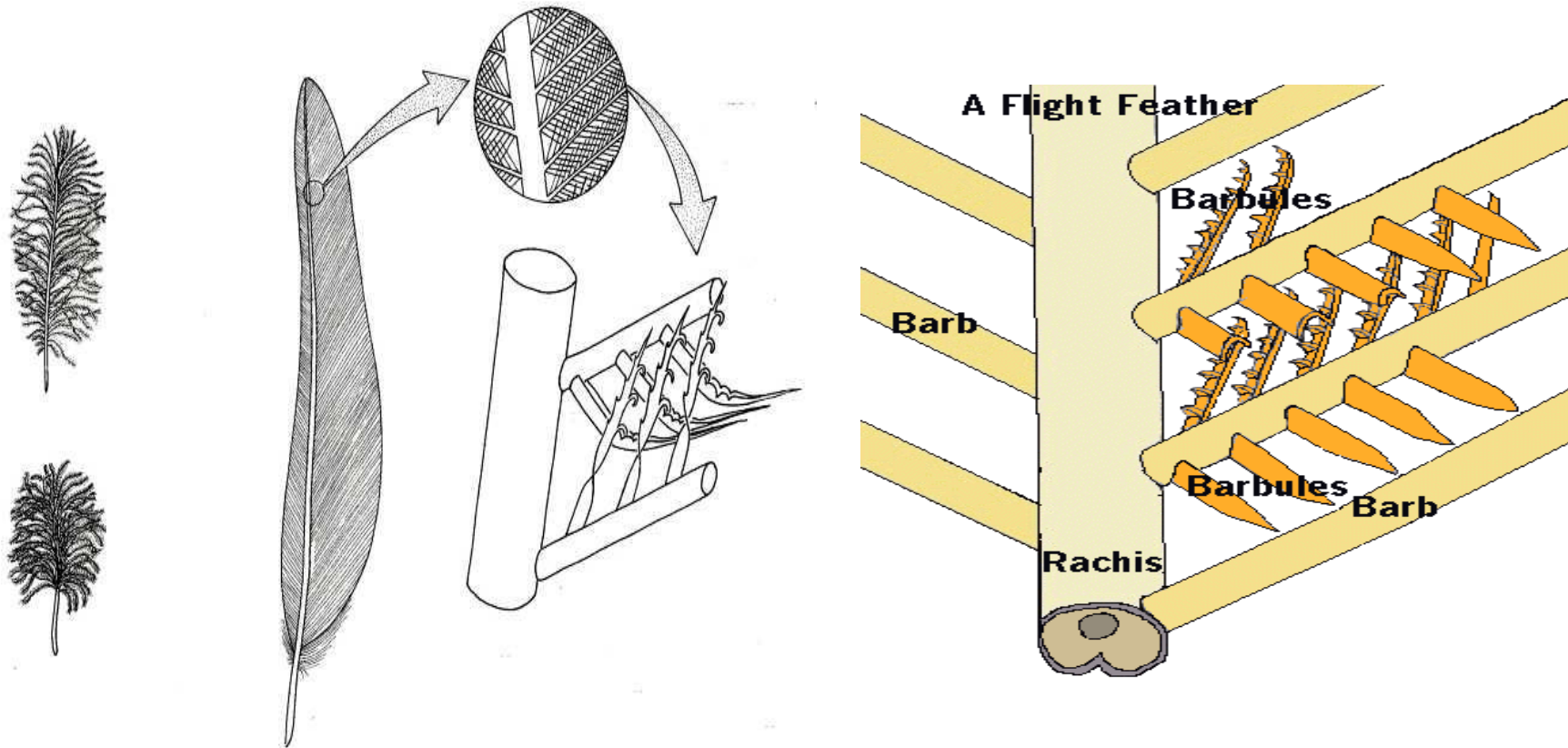
Plumae



- Contour feathers give the body its outline.
- A typical contour feather consists of a long shaft and a broad, flat portion called the vane.
- The shaft is made up of two parts:
 - A hollow quill, or calamus, embedded in the skin.
 - A solid rachis, which bears the vane.
- At the lower end of the quill is a small opening, the inferior umbilicus.
- At the junction of the rachis and quill is another opening, the superior umbilicus.

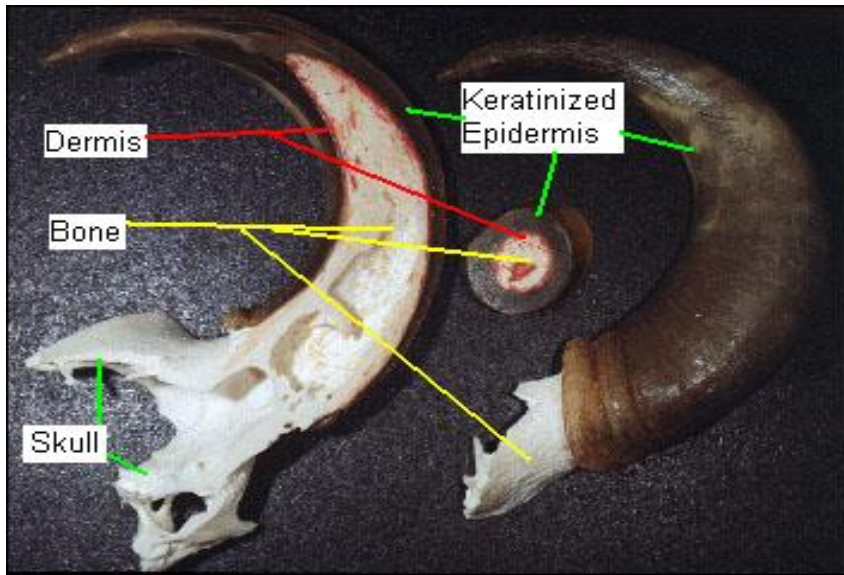


- The vane is composed of barbs which arise from the rachis.
- Each barb in turn bears small barbules.
- The lower part of each distal barbule bears tiny hooklets.



Horns & Antlers

- Horns
 - In Bovine family
 - Unbranched, not shed
 - Outgrowth of dermal core
 - Covered by epidermal horny, keratinized sheath
 - Permanent



- Antlers and horns of giraffe
 - Deer family
 - Branched, shed annually
 - Dermal bone of antler attaches to skull bone
 - Outside layer is highly vascularized



References

For further reading please see:

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