

## Derivatives of Integument

Structures derived from the integument are of two types : Those derived from the epidermis and the others derived from the dermis.

### I. Epidermal Derivatives

The epidermal derivatives are of two types : **soft and hard.**

#### **A. Soft Epidermal Derivatives**

These are glands which may be **unicellular** or **multicellular**, **tubular** or **saccular** and **simple** or **compound**. On the basis of function, these are of the following types :

**1. Mucous Glands :** These are unicellular in cyclostomes and fishes and multicellular alveolar in Amphibia. These secrete mucin which on coming in contact with water forms a slippery substance, the **mucus**. The mucus protects skin against bacterial and fungal growth and also provides slippery touch to the body. This keeps the skin moist and helps integumentary respiration.

**2. Poison Glands :** These are modified multicellular alveolar glands which are found mostly in Amphibia. These are larger than mucous glands but less numerous. In toads these are grouped behind the head to form **paratoid glands**.

**3. Femoral Glands :** These are found in male lizards below the thigh region and arranged in a row from the knee to the cloaca. These secrete a sticky substance, which hardens to form spines to be used for holding the female during copulation.

**4. Uropygial Glands :** These are branched alveolar glands of birds located on the dorsal side of uropygium. The secretion is an oily odoriferous oil which is used for preening and water proofing the feathers, and helps in attracting the mate.

**5. Photophores or Luminiscent Glands :** Fishes possess multicellular glands in their skin. In deep sea teleosts some of the epidermal glands are modified into **light-emitting organs** or **photophores**. These are arranged in longitudinal rows.

**6. Sweat glands or sudorific Glands :** These are long coiled tubular glands found in mammals. The coiled portion lies deep in the dermis and opens on the surface of the skin by long duct. These secrete sweat and help in maintaining the body temperature and removal of metabolic wastes. The sweat glands are not uniformly distributed but are concentrated in different parts in different organisms. These are totally absent in *Sirenia*, *Cetacea* and *Tachyglossus*. **Glands of Molls** developed in connection with the eye-lashes of human eye and **ceruminous glands** in the eustachian tube of ear are the modified sweat glands. In some mammals the secretion of sweat glands is red in colour, e.g. *Hippopotamus* and *Macropus bufus*.

**7. Mammary Glands :** These are found in the females of class Mammalia and are compound tubular glands. These secrete milk to nourish the youngs. In Monotremes, the mammary glands are functional in both the sexes (**gynaecomastism**) and open directly on the surface of the skin. In Metatheria and



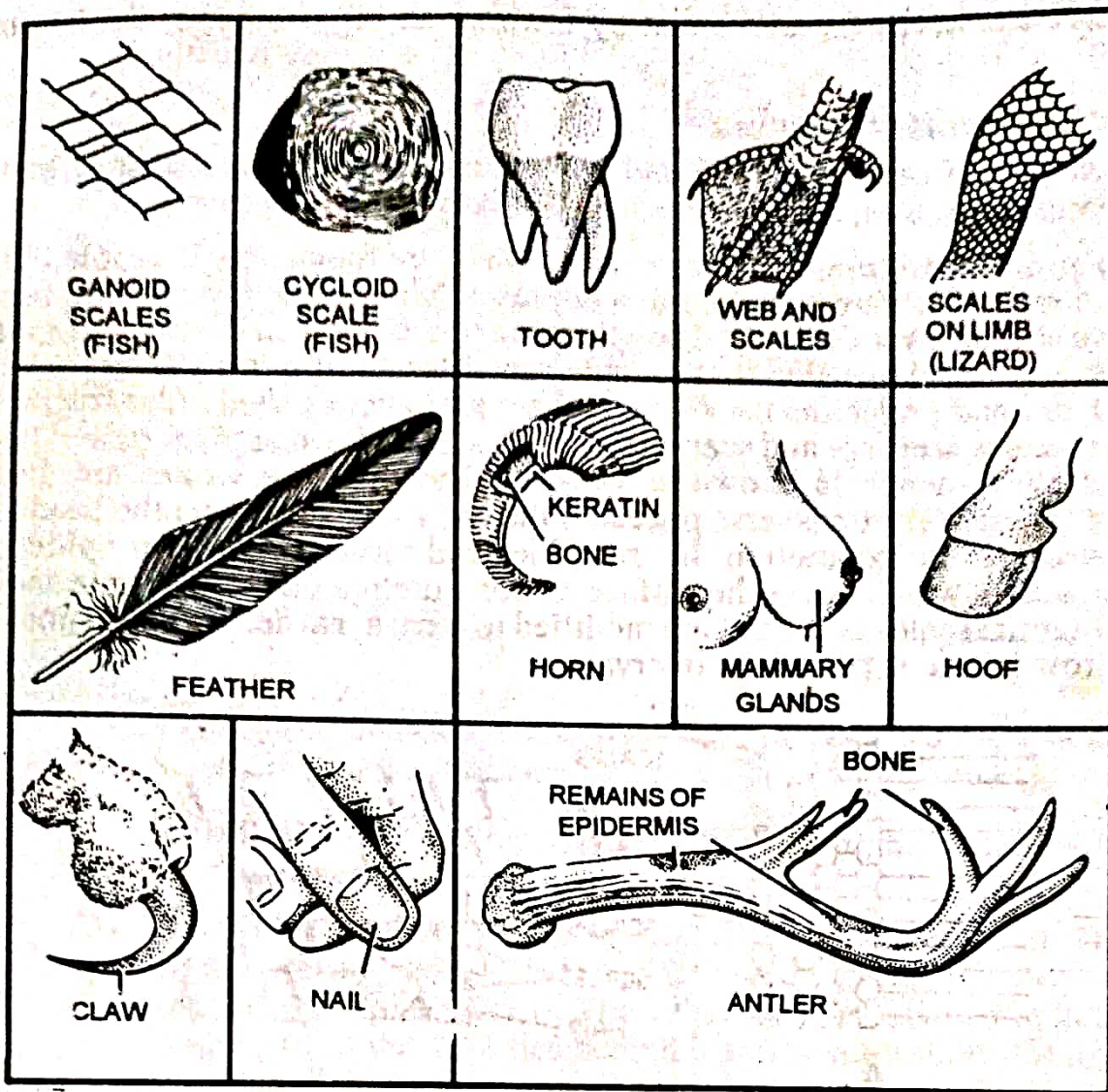


Fig. 1. Derivatives of integument in different groups of vertebrates.

Eutheria these open into the **nipple** or **teat**. The mammary glands along with fat form swellings, which are known as **mammæ** or **breasts**.

**8. Scent Glands :** These are either modified sweat glands or sebaceous glands producing odorous fluid which is used for attracting the mate. The scent glands are found in the head near eyes in deers, around anus in skunks and carnivores and between the toes in pigs and goats.

**9. Sebaceous Glands :** These are branched alveolar glands usually developed in relation with the hairs in mammals. These are also found around the genital organs, tip of nose and the edges of the lips. These secrete an oily secretion, the **sebum**, which lubricates hairs and forms oily film over the skin.

The sebaceous glands are absent in *Sirenia*, *Cetacea* and *Pholidota*. **Meibomian glands** in the eyelids represent modified sebaceous glands.

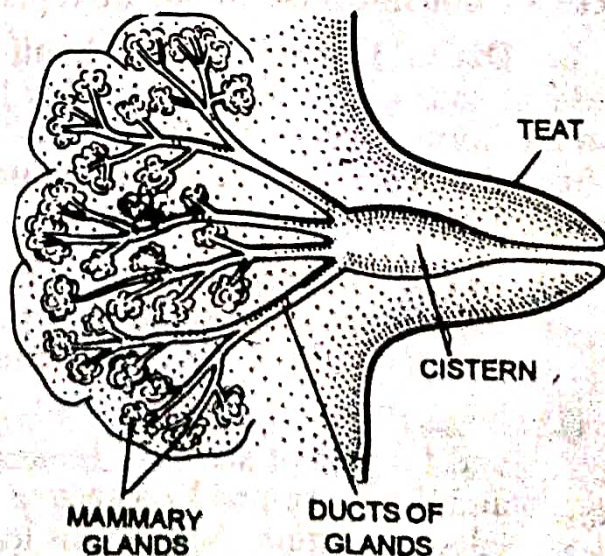


Fig. 2. V.S. Mammary glands.



Their secretion keeps the eye moist by forming an oily film over the lacrimal fluid.

## B. Hard Epidermal Derivatives

These arise from the dermis and comprise dermal scales, plates or scutes, feathers, corneal scales, digital cornifications, horn and antlers etc.

**1. Epidermal Scales :** True epidermal scales are found only in reptiles, birds and mammals. These are cornified derivatives of Malpighian layer. These form a protective armour over the body. The scales are overlapping in lizards and snakes but are arranged end to end in turtles and crocodiles. In lizards the scales are thin, flattened, dry and projecting backward and are periodically shed off in fragments. In snakes scales are large and scaly covering is shed off as one piece turned inside out. This phenomenon is known as ecdysis. The scales in snakes are greatly modified. These form transverse plates on the belly and shields on the head. The belly plates help in locomotion. In crocodiles and turtles these form epidermal plates or scutes which cover the surface of bony dermal plates. In rattle snakes, some epidermal scales of the tail are modified to form a rattle. These are not shed off but grow in size at periodical intervals.

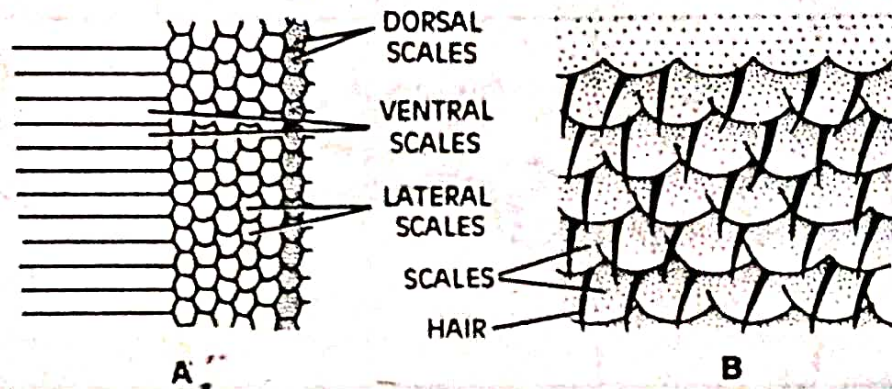


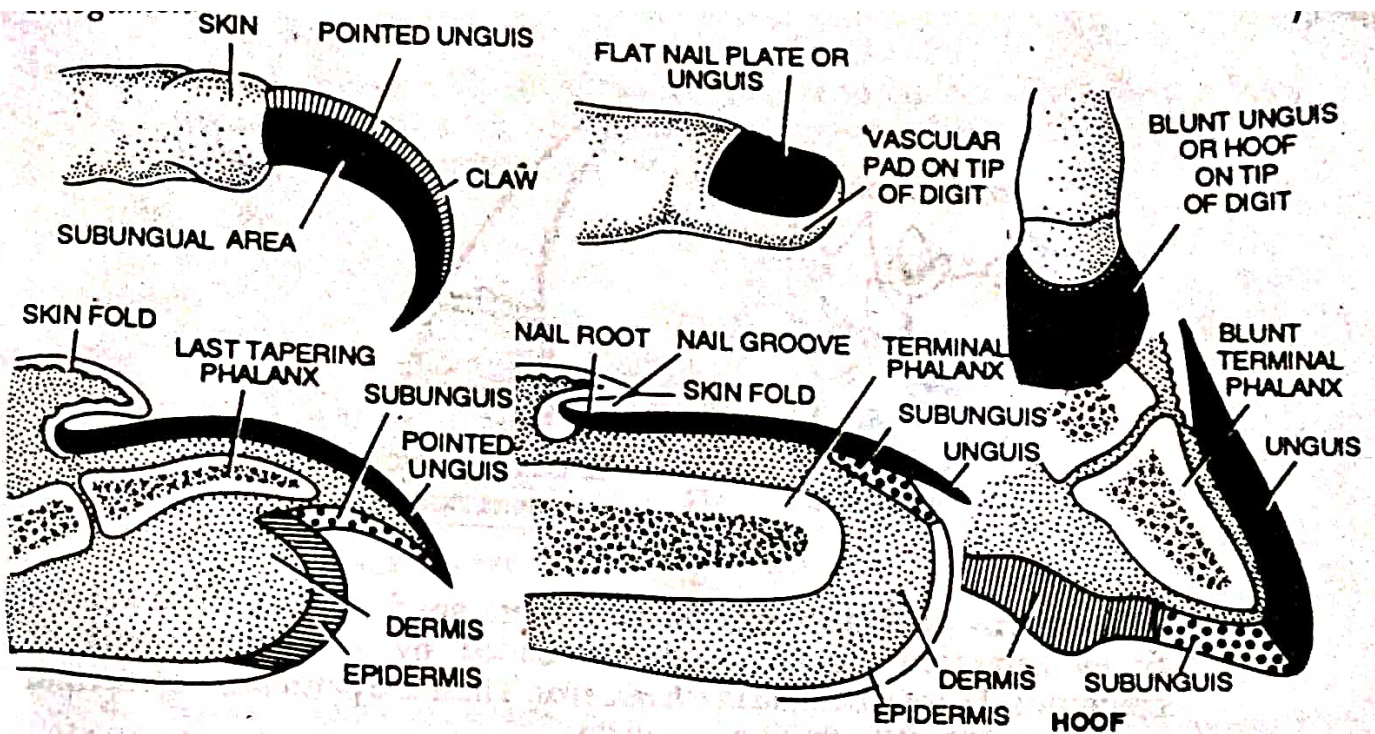
Fig. 3. Scales in snakes.

In birds, the epidermal scales are found on the legs and feet and at the base of beak. Epidermal scales of similar nature are found in certain mammals. In rats and certain other rodents, these are developed over the tail and paws, and are never sloughed off. In scaly ant-eaters, the entire body surface is covered by epidermal scales which are sloughed off only once in the life-time. *Armadillos* possesses large scales over the body, which fuse on the head, shoulders and lips to form the plates. These are not sloughed off but are replaced when worn out.

**2. Digital Cornifications :** In all amniota *i.e.* reptiles, birds and mammals, the distal ends of the digits invariably have either claws, nails or hooves formed from the horny layer of epidermis. These grow parallel to the surface of skin and are formed of a dorsal plate, **unguis** or **nail plate** and a ventral plate, the **subunguis** or **sole plate**.

- (1) **Claws :** The reptilian and avian claws are similar with unguis in the form of a long plate of keratin sharply curved and is continuous with the fleshy pad of the digit. These are retractile in carnivores but reduced in others.
- (2) **Nails :** These are found only in primates. The unguis is broad and flattened and formed of **stratum lucidum**, while the subunguis is much reduced and is represented by a narrow strip of less modified epidermis below the edge of unguis. A well developed fleshy pad lies below the nail and its dermis is highly vascular. At the base of the nail epidermis is invaginated





**CLAW** **NAIL**  
 Fig. 4. Relation between claw (eagle), nail, (human) and hoof (horse).  
 Digital tips are complete above and in section below.

to form the nail groove and its part covering the nail root is known as **eponychium**.

(3) **Hoofs** : These are found in ungulates. The unguis is large, greatly thickened and curved all around the end of the digit. It touches the ground and animal walks over it. The subunguis lies below the unguis and the fleshy pad of the digit lies behind it and never touches the ground.

3. **Horns** : Horns are found in ungulates of hooved mammals. These are :

(1) **True or hollow horns** : These are unbranched hollow cylinders of keratin having permanent bony dermal core. These are found in both the sexes in cows, buffaloes, sheep and goats, etc.

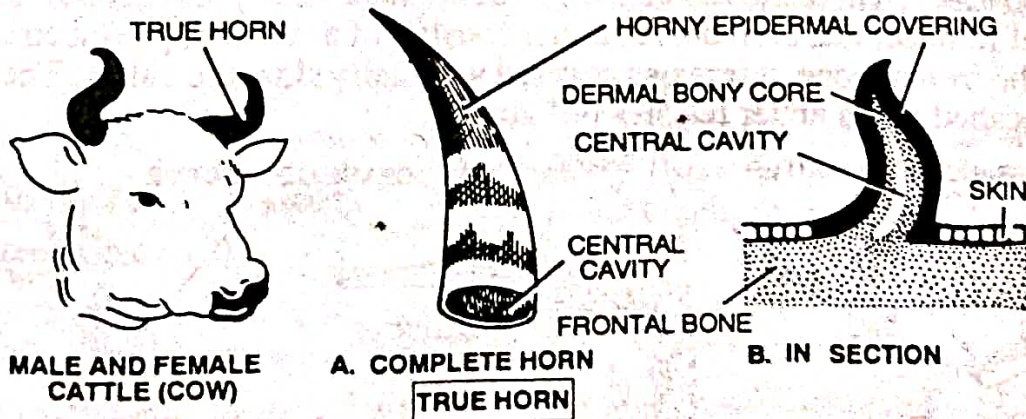


Fig. 5. True horn.

(2) **Prong horns** : These are similar to hollow horns but their bony core is permanently covered with hard, horny epidermal sheath usually forked and bears one to three prongs. The horny sheath is shed annually. These are found in **antelopes**.



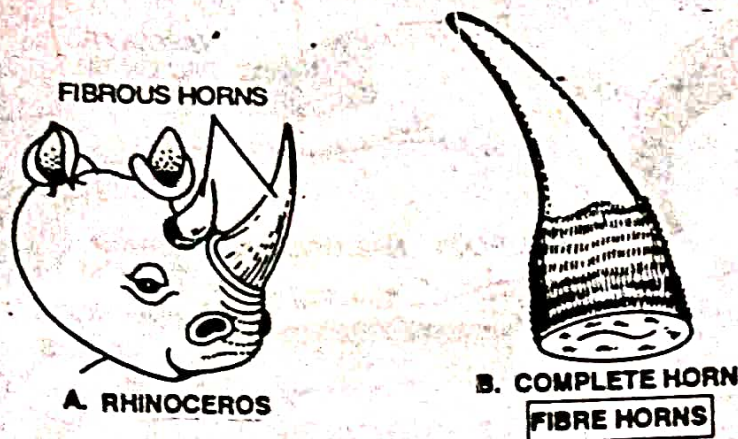


Fig. 6. Prong horns.

- (3) **Fibre horns or Rhinoceros horns** : These are formed of thick keratin fibres cemented together and surrounded by keratinized cells of epidermis. These are found in *Rhinoceros*. These are permanent epidermal structures. If broken these grow again.

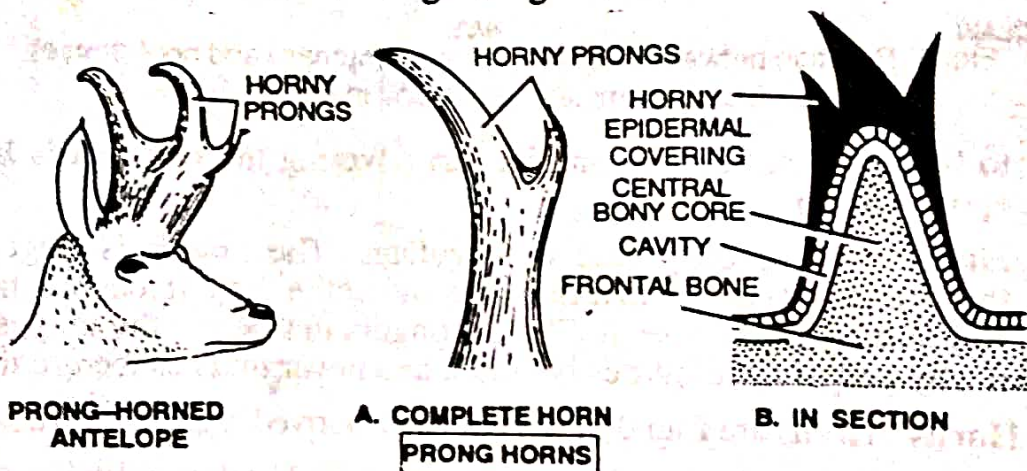


Fig. 7. Fibrous horns.

- (4) **Antlers** : These are found in the males of deer family and in both the sexes of reindeer and caribou. An antler consists of a branching projection from the frontal bone. It remains covered with hairy skin, the velvet. The velvet is shed when antler reaches full growth.

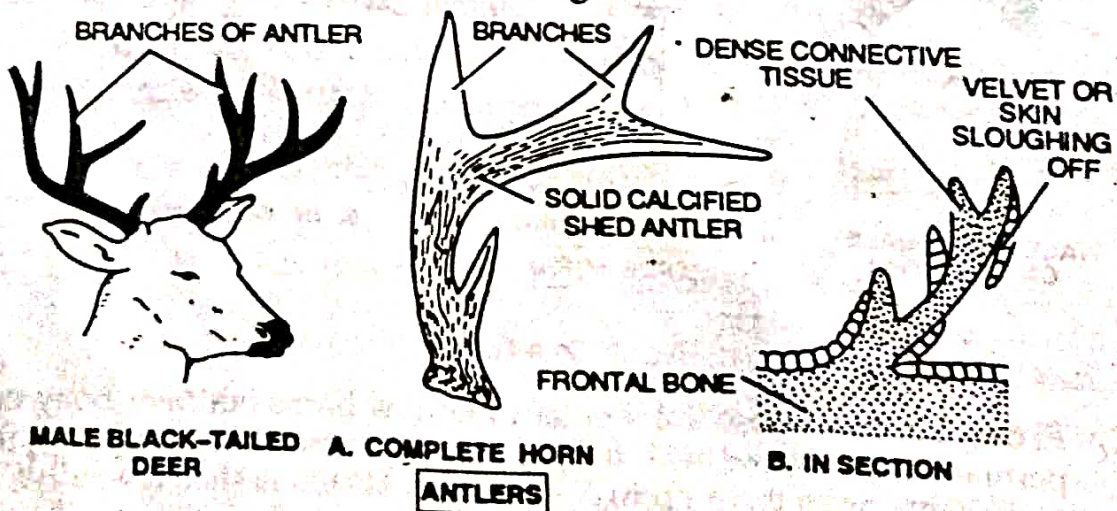


Fig. 8. Antler's horns.



- (5) **Giraffe horns** : These horns are similar to antlers. They have a bony dermal core covered with **epidermal velvet**, which is never shed. The horns are short, unbranched and permanent.

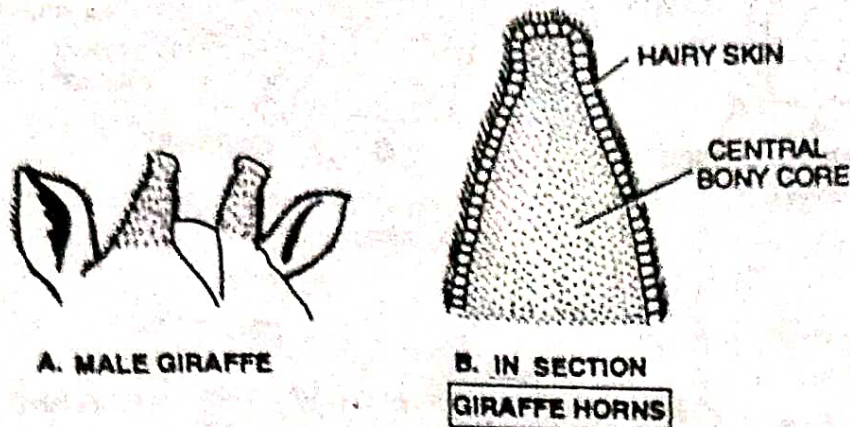


Fig. 9. Giraffe's horns.

4. **Beaks** : Beaks are characteristic of birds. These are formed of enlarged epidermal scales which form hard keratinized covering over the jaw bones. Similarly, in turtles and tortoises the jaw bones are edentulous and covered by horny epidermal plates.

5. **Horny Teeth** : These are found in lampreys, tadpole of frog and the embryos of turtles, tortoises, birds and egg laying mammals. These are used for scrapping food or opening the egg shell.

6. **Feathers** : These are found in birds and are regarded as modified epidermal scales. These develop from the stratum corneum of epidermis. These are light, strong and water-proof structures which protect the body, retain the body heat and help in flight. Their mode of development is very similar to the development of scales.

7. **Hairs** : These are keratin derivatives of integument and are exclusively found in mammals. These usually cover the entire body surface that may be reduced to few hairs restricted to the snout or interspersed with the scales. These are strictly epidermal structures being derived by the downgrowth of stratum Malpighii.