# INTEGUMENT AND ITS DERIVATIVES IN VERTIBRATES:

**Definition**- Integument is the outermost covering of animal body, the skin, and its derivatives. Skin also includes the conjunctiva of eyeballs and external surface of eardrums. It is continuous with the mucous epithelial lining of mouth, rectum, nostrils eyelids and urinogenital duct.

## FUNCTION OF INTEGUMENT:

Skin performs several important functions-

i. **Protection-** The skin separates the animal body form its external environment. It has several protective devices.
   a. It protects the body from mechanical and chemical injuries, which may result from pressure, friction, blows, harmful gases, and fluids.
   b. Protective derivatives such as scales, bony plates, fat, feather, hairs, etc. reduce the force of injury, prevent excessive loss of body moisture, and do not allow entry of harmful bacteria and fungi, and other foreign bodies.
   c. Fur, plumage(feather), bristles or spines, claws, nails, hoofs, antlers, horns etc. serves for offence and defense.
   d. Protective coloration or camouflage serves to escape detection by enemies.
   e. Skin pigments also protect against solar radiation. **Uropygial glands** in birds secretes oil for preening feathers.

ii. **Locomotion**-Dermal fin rays in the fins of fishes and skin webs in the feet of frogs, turtles, aquatic birds help in swimming in water. Adhesive pads and claws on digits assist in climbing. Feathers on wings and short tail of birds and cutaneous patagia or wings of bat s and flying lizards and squirrels help in flying.

iii. **Dermal endoskeleton**: Skin contributes bony dermal armour such as crocodiles and turtles. Dermal endoskeleton in head shield the brain and sense organs.

iv. **Secretion**: Skin glands secrete substances having several uses-
   a. **Mucous gland** in aquatic forms (fish, frogs) keeps the moist and slippery.

b. Poisonous, bitter, or offensive secretions ward off potential enemies.

c. Oil from **Sebaceous glands** of mammals lubricates the skin and hairs.
d. **Mammary glands** manufacture milk for nourishment of the young.
e. Odors of **Scent glands** attract the opposite sex.
f. Tears from **Lacrymal glands** wash the conjunctiva of mammalian eyeball.
g. **Glands of auditory** meatus secretes an earwax, the **cerumen**, to grease eardrums.

v. **Food storage**: -Thick and fatty layer of **blabber** under skin of whale and seal serves as insulation as reserve food. Animal also accumulate subcutaneous fat prior to hibernation and migration.

vi. **Temperature control**: In warm blooded animals, fur, feathers, and scales insulates and conserve body heat in cold climate. Sweat glands of mammals provide cooling by evaporation in summer for elimination of heat.

vii. **Excretion:** excess of water, salts and urea are also eliminated in sweat. Shedding of skin during **ecdysis** also get rid of of some metabolic wastes.

viii. **Sensation**: cutaneous nerve endings and other sense organs are stimulated by touch pain, changes in pressure and moisture, extremes of heat and cold and chemicals etc.

ix. Sexual selection brilliantly coloured skins antlers of male deer long tail, coverts of peacock etc. lead to sexual dimorphism and serve to attract the females for mating.

x. **Miscellaneous:** Skin has many other functions
a. Vitamin D is synthesized in mammalian skin from sebum of sebaceous glands in UV light.
b. Brood pouches under the skin of some fishes and amphibians protect unhatched eggs.
c. Nasal glands or tetrapod's keeps nostril free of water and dirt.
d. Amphibians carry on considerable respiration through their richly vascular skin.

e. Skin shows selective absorption of oil ointments iodine beneficial sunrays etc.

## **STRUCTURE OF INTEGUMENTS**:

The skin of all vertebrates is multicellular and having 2 layers.

1. An outer **epidermis** developed from ectoderm,
2. An **inner dermis** derived from the mesoderm.

1. **Epidermis** – Epidermis is a stratified epithelium. It has 2 regions.
   a. The ***outermost*** region of many layers of dead, squamous cells form a Horney, resistant covering, or ***stratum corneum*** on the skin surface. Its cells accumulate a Horney protein called ***Keratin***, gradually die, and eventually wear off in the form of scurf or dandruff. Since keratin is tough and insoluble in water, the keratinized stratum corneum provides protection against mechanical injuries, fungal and bacterial attack, and loss of body moisture.
   b. The ***innermost or basal*** region of epidermis includes a single layer of living columnar cells, the Malpighian layer or ***stratum germinativum*** and it is separated by a basement membrane. Its cell actively divides and continually replace the worn-out cells of the cornified layer.

Epidermis is thin in aquatic vertebrates and rich with mucous glands. It is thicker in land vertebrates and structures such as – scales, feathers, hairs, nails, claws, horns, and enamel of teeth derived from the ***Malpighian layer***.

2. **Dermis or corium**: -It is inner layer of skin .it is composed of fibrous connective tissue and contains many blood capillaries, lymph vessels, muscle fibres, nerve fibres and sense organs and elastic fibres which bring the skin back to its normal shapes, melanin pigments and pigment granules are also found in epidermis. Fat may accumulate as reserve food in special cells adenocytes, in deeper parts of dermis and in the sub cutaneous tissue.

# DERIVATIVES OF INTEGUMENT

Depending upon the layer of skin from which they are derived, they **are Dermal derivatives and Epidermal derivatives.**

## A. Epidermal derivatives & B. Dermal derivatives

***A.*** ***Epidermal derivatives*** comprise (1). ***epidermal glands*** and (2). ***hard horny structure*** including epidermal scales, cutes, beaks, horns, claws, nails, hoof, feathers, and hairs etc. all the hard horny structure together forms exoskeleton. Of an animal.

***B.*** ***Dermal derivatives***-comprises bony or dermal scales plates or scouts, fin rays and antlers etc.

## A: Epidermal derivatives-

1. **Epidermal glands**. It is formed by the Malpighian layer of epidermis but often invade the dermis they may be unicellular or multicellular. They are as follows.
    a. **Mucous glands**- They secretes MUCIN which forms slimy or sticky mucous on coming in contact with water, it keeps the skin moist and slimy protect the skin from against harmful bacteria and fungi. Abundant in Amphion skin.
    b. **Poison glands**- they are modified multicellular cutaneous glands larger but fewer than mucous glands. The parotid glands behind the head of toads are aggregation of poison glands. secretion of poison glands may be bitter, irritating, an even dangerous to the predators.
    c. **Luminescence glands or photophores**: in deep sea luminous teleost fish's certain multicellular epidermal glands serve as light emitting organs known as photophores.
    d. **Femoral glands**-These are found in lizards on the ventral side of both thighs. The sticky secretion hardens in air to form temporary tiny spines. That serve to hold the female at the time of copulation.
    e. **Sweat glands**-It is abundant in most mammalian skin. they are slender coiled tubes embedded deep in dermis, with their long ducts opening on skin surface. It regulates the body temp.

Sweat glands are absent in scaly anteater and marine mammals. In some animals it is occurs in the soles of feet (cat), lips(rabbit) etc. Male giant kangaroo and hippopotamus secretes red coloured sweat. In eye lashes and long margin of eye lids are modified sweat glands.

f. **Sebaceous glands** These are branched alveolar glands opening into the hair follicles of mammals. There oily secretion, called SEBUM (grease) keeps the skin and hairs soft, greasy, waterproof, and glistering. In some mammals it is absent, which are practically devoid of hairs. CERUMINOUS glands of external ear canals are modified sebaceous glands, greasy secretion of this glands, called CERUMEN, helps to protect the ear from dust particles and trap the insects. MEIBOMIAN glands of eyelids are modified sebaceous gland.
g. **Scent glands**- they are modified sebaceous gland of mammals and their odor secretion serve as repel foes and attract the opposite sex. Scent glands may occur in between toes on feet (goat, rhino, horse) naval on abdomen (musk deer) etc.
h. **Mammary glands:** Characteristics of mammals, these are compound tubular glands that produces milk during lactation period for feeding the young ones. Usually, they are present only in female but in monotremes, primates and some other it presents in male also.

2. **Epidermal scales and scutes** - They are developed by the accumulation of a protein, known as KERATIN. All the stratum corneum cells are cornified and form horny hard exoskeleton like **scales, hairs, beaks, horns, claws, nails** etc.in different vertebrates.

**In reptiles** having continuous outer covering of horny epidermal **scales** that prevent water loss through the skin surface**. In snakes** also the scales are overlapping enlarged on head, called ***shield*** and on the ventral surface called ***scutes,*** which aid in **locomotion. Crocodiles** and **turtles** have **scutes**. In **birds**, small scales are present on the long leg, foot, and beak. In **mammals** like **scaly ant eater** the large **scales** on body. In **armadillos**, large body **scales** become fused into plates and bands.

## B: Dermal derivatives-

Dermal derivatives are I. **dermal scales and scutes**, ii **disital cornification, iii. horns, iv feathers and v. hairs.**

I. **Dermal scales and scutes**- Bony structures develop within the dermis and are mesodermal in origin.

**a. Dermal scales in fishes**: in fishes scales forms the exoskeleton. 5 types of scales are known depending on their structure, in fish. i.Cosmoid (extinct), ii. placoid scales are characteristic of elasmobranch (Chondrichthyes), iii. Ganoid scales in Ganoid fish (chondrostean and Holosteans). iv. Cycloid and v. Ctenoid scales, characteristic of modern teleosts.

**b. Dermal scales and scutes in Tetrapods**- A few lizards exhibit small dermal scales crocodiles; alligator have many oval bony plates embedded in the dermis and turtle large bony plates are present.

Amongst the mammals' bony plates(osteoderm) occurs in armadillo and in whales.

c. **Dermal fin rays**-Supporting the fins of fishes are long, flexible fin rays embedded in the dermis.

ii **Digital cornification**: They are modification of stratum corneum at the tip pf the digits and grow parrel to the skin.

a. Claws- A claw is made by a hard pointed, narrow, horny, curved dorsal plates. It is found in reptiles, birds, and mammals.
b. Nails: Claws are modified into nails which are characteristic of primates (Mammals)
c. Hoofs: It is the characteristic of ungulates (Hoofed mammals).

iii. **Horns:** Horn are found in hoofed mammals only. They are the organs of defense and offence. At least 5 types of horns are recognized but all are not true horns, that is the product of stratum corneum.

a. **True horn**: true horns or hollow horns are found in both sexes of goat, cattle, sheep, and others. They are unbranched and cylindrical and tapering, permanent structures that continue to grow throughout life and never shed.

b. **Prong horns**: Prong horns are true horns but the horny sheath of prong horn bears 1-3 branches, and it sheds every year. The permanent bony core become the base around which a new horn is developed.

c. **Antlers** – it is the characteristic of deer family. They only found on males. Antlers are annual growth and true horns.

d. **Giraffe horns** – It is stunted, unbranched and permanent antlers present in both sexes of giraffe. Each consists of a short bony dermal core, covered with simple unmodified skin or velvet which is never shed.

e. **Hair horns**- Hair horns or fibre horns are found in rhinoceros of both sexes, perched upon a roughened area of nasal bones. These horns are completely made of thick and keratinized epidermal fibres fused together. These are permanent structure, if broken they again grow out.

**iv. feathers**: Feathers are found only in birds. They are dry, nonliving and cornified products of stratum corneum of epidermis. They are light weight, but strong and waterproof. They show colours due to presence of pigments., they protect the body, conserve heat and broad surfaces of wings and tail for flight. Generally, three types of feathers are recognized, contour, down (plumules) and filoplumes (Hair like).

v. **Hairs**: Hairs are characteristic of mammals. They may cover entire body (furred animal) or may be reduced to patches(man) or to scattered hairs

(whales). Collectively all the hairs of mammals are knowns as PELAGE. It is periodically lost and by moulting and replace by new one.

Chief function of hairs seem tom serve for insulation of body and sensitive tactile organs (vibrissae). Hairs have several modifications (Bristle, quills or spine, scales, horns etc.) and variously used industries.



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