* Basic Concept of Biosystematics and Taxonomy :-

The amount of diversity in living world staggering. About 1 million species of animals and of a million species of plants having already been described, and estimate on the number of still undisturbed living species range from 3 to 10 million. An estimate of half a billion for the extinct species is consistent with known facts. Each species may exist in numerous different forms. It would be impossible to deal with this enormous diversity if it were not ordered and classified.

* Taxonomy And Systematics :-

The ancient looked for a natural order (Kosmos) which would explain the bewildering diversity of phenomena. They attempted to discover the true "nature" of things and approached the classification of inanimate objects and loving being by the procedures of logic. The major purpose of classification was to serve as an identificatio keys, and the philosophy of early taxonomists

P.T.O.

was well suited for utilitarion purpose of taxonomy. No longer was he interested merely in producing identification keys: he know interporeted groups of organisms as descendants of common ancestors, and inevetably he became interested in the pathways and causations responsible for evolutionary changes. Imperceptibly a new branch of biology began to emerge, the study of diversity of organisms. This had an effect on defination to the terms taxonomy and systematics. until quite recently these terms were generally considered to be synonymes. The term taxonomy is derived from the Greek words taxis, arrangement and nomos law and was first proposed in its French form by de candolle (1813) for theory of plant classification. It agrees best with current thinking to define it as follow.

The term Systematics stems from the Latinized Greek word systema as applied to the systems of classification developed by early naturalist, notably . we follow Simpson (1961) Modern redefinition of any

all relationship among them or most simply, Systematics is the scientific study of the kinds and diversity of organisms. This explains why such a broad area of common interest has developed between systematics evolutionary, biology, ecology and behavioral biology.

* Place of Systematics in Biology *

Systematics is unique among the biological science in its dominant concern with diversity. The reductionist tendency at the cellular and molecular level the endeavor to reduce everything to common denominators. It is Student of Systematics who helps to restore the balance by interest in and insistence on uniqueness of Systematics. It concern Systematics hold a unique and indispensable position among the biological sciences. Systematics deals with population species and higher taxa.

P.T.O

It not only supplies urgently needed information about these levels but, more important it cultivates a way of thinking, a way of approaching problems. Other branch of biology made taxonomy superflous. Is it futile to search for classification based on evolution Is the method of binomial nomenclature in conflict with its function in information retrieval Stimulating if not provocative reading is provided by Michener (1963), Ehrlich (1964), Constance (1964), and Rollins (1964). The impression the taxonomist receives from a discrimination reading of current biological literature is that were never a greater needs for strong science of systematics than there is at present However legitimate the study is of that which will organism have in common, it is equally legitimate to study the unique characteristic of taxa at all levels down to the species. And this is precisely what the taxonomist is doing.

Term and Definition

In systematic zoology, as in all branches of science, the danger of misunderstandings is greatly reduced by the precise definitions of terms. Terms that are frequently used in this volume, such as species, type, polytypic, etc. will be carefully defined in the relevant chapter and in glossary. At this some terms will be considered that relate to all the chapters.

Taxon:

The words bluebirds, thrushes, songbirds, or vertebrates refer to group of organisms. These are the concrete objects of zoological classification. Any such group of populations is called a taxon if the zoologist considers it sufficiently distinct to be worthy of being formally assigned to a definite category in the hierarchic classification. As Simpson defines it, "A taxon is a group of real organisms recognized as a formal unit at any level of a hierarchic classification." The same thought can also be expressed as follows: A taxon is a taxonomic group of any rank that is sufficiently distinct to be worthy of being assigned to a definite category. This definition calls attention to the fact that the delimation of taxon against other taxa

of same rank is often subject to the judgement of the taxonomist.

Phenon

The first step in classification is the separation of reasonably uniform samples and their assortment into taxa at the species level. There is no generally accepted technical term for a phenotypically reasonably uniform sample, but it may be designated as a phenon, a term introduced by camp and Gilly (1943) for phenotypically homogeneous sample at the species level. Males and females often belong to different phena while in the case of sibling species it is possible that several species belong to a single phenon. The term morphospecies has sometimes have applied confusingly to what is here designated as a phenon. Recognition of a technical term for the phenotypically uniform sample greatly facilitates the description of the taxonomic procedure. Its recognition is of particular importance in the procedures of computer taxonomy. Sokal and Sneath (1963) use the term phenon in a very different sense.

A full understanding of the meaning of category depends on an understan-

ding of hierarchical classification. Such
terms as species, genus, family and
other designate categories. A category,
thus is an abstract term, a class name
while the taxa placed in these categories
are concrete zoological objects until
the word taxon was introduced into the
literature, the term category was often
confusingly used both for group and
for rank. Ghiselin (1966a) suggest that
confusion will be further reduced by
exercising more precision in the use
of the verb associated with the term
category and taxon. Since we
define words, we may also legitim-
ately define categories such as the
species, or the genus. Taxa however,
are things, and we can only discribe
but not define things. When the
destinction is clearly kept in mind,
many of the arguments about "defining
species" are automatically elimnated

For a fuller discussion of the
theory of classification and the meaning

of the status terms see Gregg (1954), Beckner (1959), Cain (1958, 1962) Simpson (1961, 1963) and Buck and Hull (1966).

During the 18th century, the works of Linnaeus and his followers helped systematics to blossom further. Carl Linnaeus, later Carolous of Linné (1707-1778) the son of a clergyman and subsequently professor of Sweden. He followed Aristotelian philosophy. He published his small book of eleven pages in 1735 at Leydon. He was the first to introduce the hierarchic system both in animal and plant kingdoms. He followed four categories (class, order, genus and species) for the animal world. He published 12 editions of this book but his greatest contribution to systematic was the use of binomial nomenclature for all species of plants and animals in the tenth edition of Systema Naturae in 1758.

Or the 9th edition the name Mammalia was used in place of quadrupeda for which binominal nomenclature was conceived the species as a fixed and unchanging thing which was divinely created and persisted unchanged in the form in which they appears This concept is now greatly opposed in view of biological species concept. He presented the first character based classification which serves as basis for the arrangement of specimens in the collection and the bonomial nomenclature for information storage and retrieval system for the great bulk of biological data. Due to such great contributions he is rightly called the father of taxonomy. Due to him the date of 1 January, 1758 is of great importance in zoological taxonomy because it has been adopted as the starting point in nomenclature.

Lamarck's taxonomy was mainly static in nature and his classification does not show its true

value for the development of modern taxonomy. He believed that the species are the creation of God and yet had reasons to believe that all the groups of animals originated through evolutionary process. He further stated that the process of evolution is a continuous one and its apparent interruption we due to our ignorance.

Cuvier (1769-1832) was critical of Lamarck's evolutionary concept which thereafter remainded in oblivion for half a century. Cuvier is regarded as the founder of the comparative anatomy which is an important part of systematics. He divided animals into four sections - Animaux Vertebras, molluscs, articules and rajonnes. But this did not throw any light on phylogeny and had even very little to recommend it. His greatest contribution to systematics was his insistence that extinct fossil form should be included in the table of classification.

VERTEBRATES

7

VERTEBRATES INTEGUMENTS - COMPARATIVE

The integument is the protective covering of body. The term integument includes the skin or cutis and its derivatives. It performs various functions viz. protection, excretion, sensation, etc. hence called as "Jack of all trades".

General Structure of Skin

The skin is multicellular and multilayered structure consisting of an outer epidermis & inner dermis.

1. Epidermis - The epidermis may be distinguish into two regions.

(i) Stratum Corneum - It is an inner layer composed of flatened dead cells. The cells lack nuclei and are keratinized.

(ii) Stratum malpighi - It is an inner layer composed of varying number of rows of cells. Numerous derivative of integument such as glands, scales, feathers, claws, nails, hairs, hoofs and sensory organs are derived from stratum malpighi layers.

(ii) Dermis - This part is thicker than

epidermis. It consists of fibres, connective and elastic tissue to give strength. It is supplied by a series of blood vessels with a network of capillaries. It is also supplied with sensory cells and nerve endings to form a network for sensitiveness. Pigment cells (chromophores) also remain lodged in dermis.

Integuments in different vertebrates group:

In Cyclostomes :-

In cyclostomes (lamprey & hagfishes) the epidermis is many layered. The inner malpighian layer rest on basement membrane.

In lamprey below upper layer of epidermis below cuticle into calcareous cells.

In Myxine, the epidermis contain large bladder cells and some what smaller thread like.

The dermis in lamprey consists of outer thick layer of fibrous connective tissue and inner thin layer of pigment cells.

In Myxine, dermis consists of outer thick fibrous layer and inner subcutaneous layer of fatty tissue. Scales are not in cyclostomes.

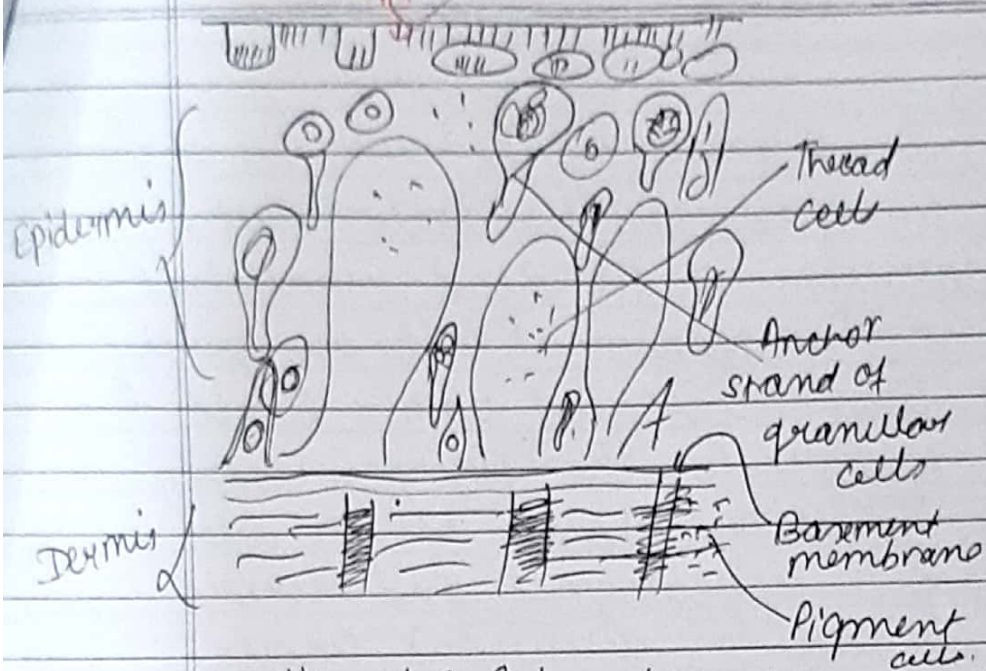


Fig:- V.S. Skin of Lamprey

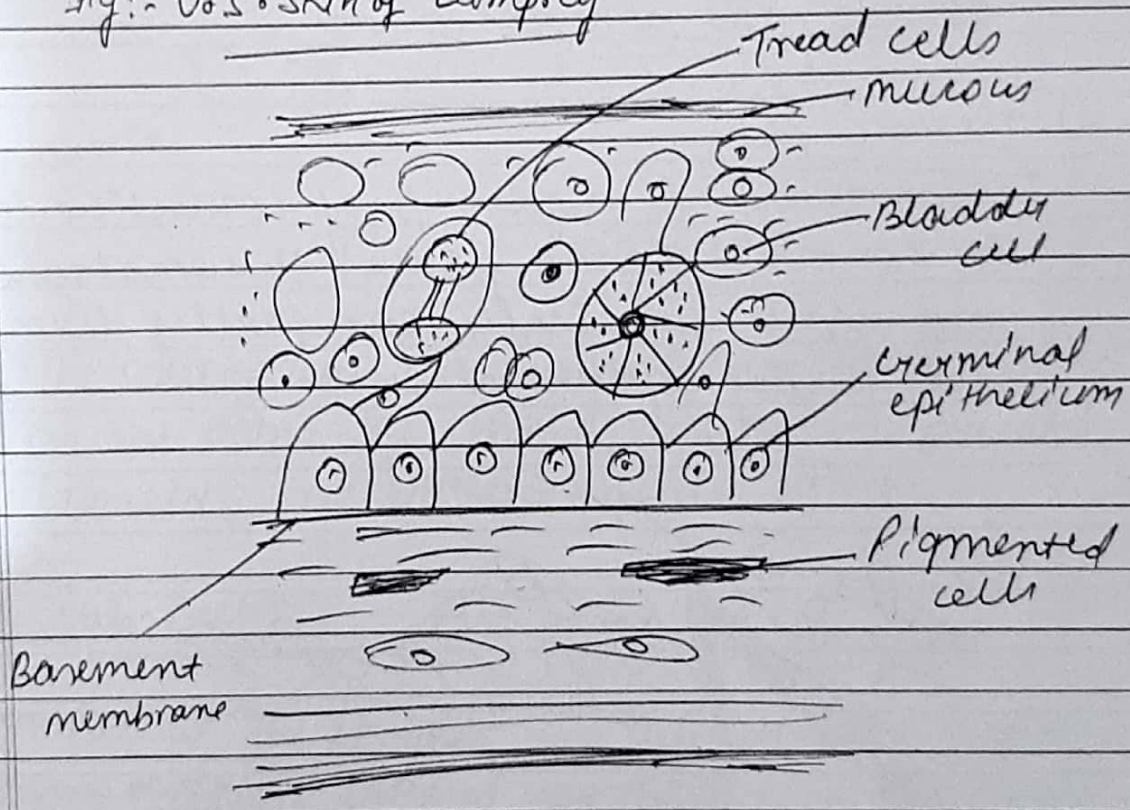


Fig - V.S. Skin Myxine

IN FISHES

The Integument is tough and less slimy in Elasmobranch fishes. while soft & Softy in bony fishes.

i) Epidermis :

The epidermis is multilayered with five or six layers of stratified epithelial cells. But a stratum corneum with dead keratinized cells is not. The epidermal cells are partly flattened and nucleated with a little amount of keratin. The epidermis contain unicellular mucous glands which are goblet shape in appearance and secretes mucous. In addition uniserous, serous glands are also not.

ii) Dermis :

The dermis is made up of connective tissue. It contains elastin fibres, chromatophores and scales. The scales are partly dermal and partly epidermal in origin.

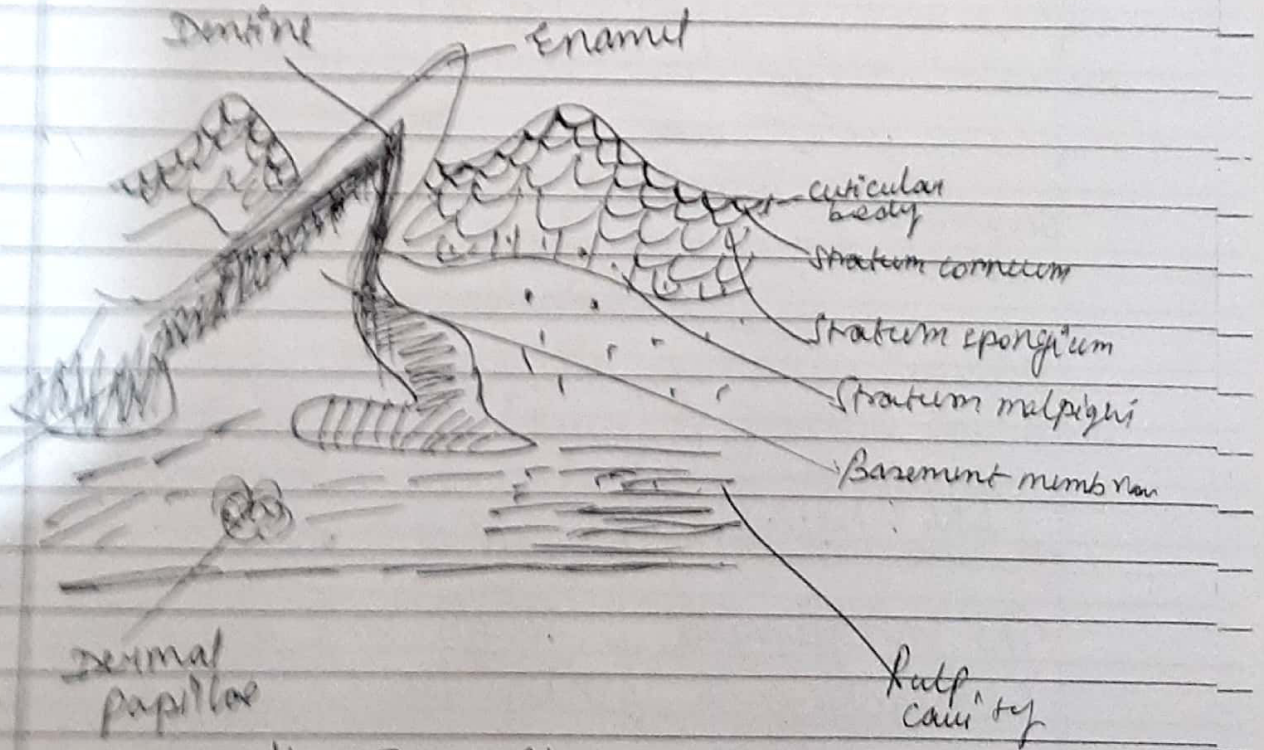


Fig. T.S. of Shark's skin showing developing placoid scale

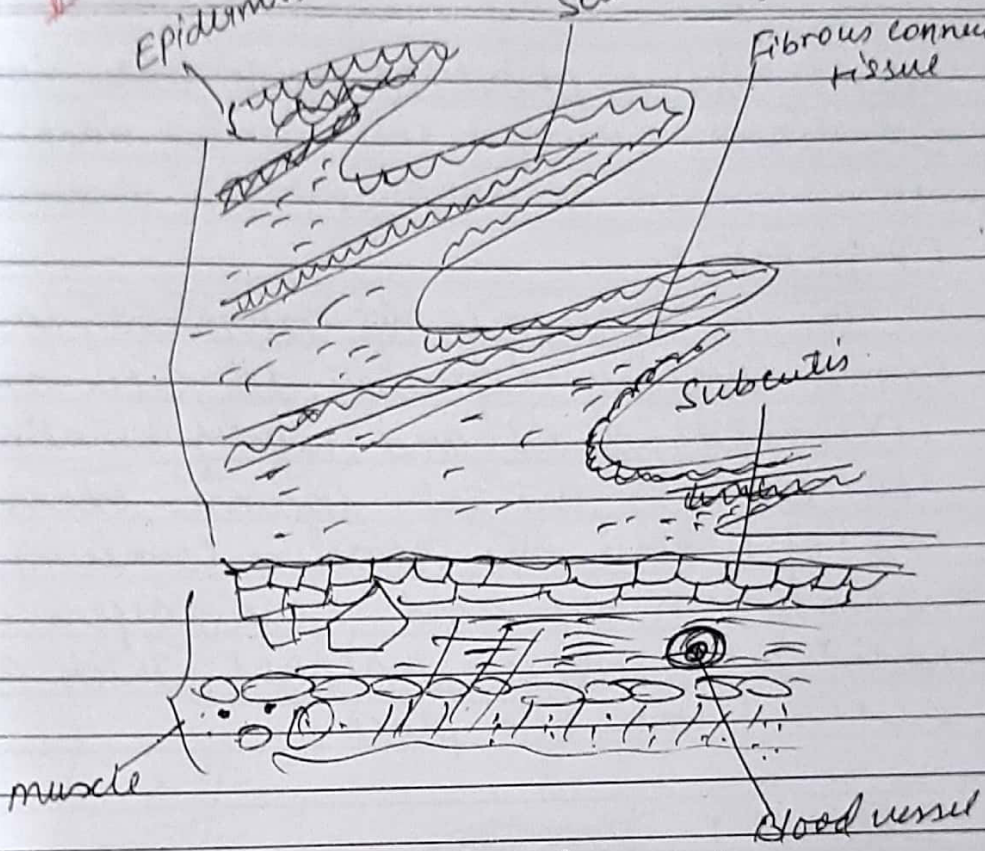


Fig - V.S. Skin of Labeo

The scales may be grouped into four classes on the basis of their structure - placoid, ganoid, cycloid & ctenoid.

iii) Sub-Cutis

Below the dermis is sub-dermal tissue or subcutis formed of bundles of connective tissue; tissue usually running parallel to the body surface.

IN AMPHIBIA

The skin is soft and slimy but it is tough and dry in toads which live on

land and is provided with scales in Coecilians.

EPIDERMIS:-

On the epidermis the outermost layer forms stratum corneum. Its cells are flattened, dead and highly keratinized. It protects the skin against excessive loss of water. The stratum corneum is cast off in bits and new layers are added by stratum malpighi which are used to take its place.

DERMIS :-

The dermis is made up of connective tissue. Generally three distinct layers are distinguished in dermis. These are:
an upper lamina terminalis
a middle layer, stratum laxum and
a lower layer stratum compactum.
The connective tissue fibres in the dermis run horizontally as well as vertically In this layer are lodged the slime and poison glands and scales, if they occur (Gymnophiona) Dermis is further characterized by the the of papillae, which may contain taste cells, blood Capillaries or sensory cells.

SUB-CUTIS LAYER:-

The Sub-cutaneous layer is thin

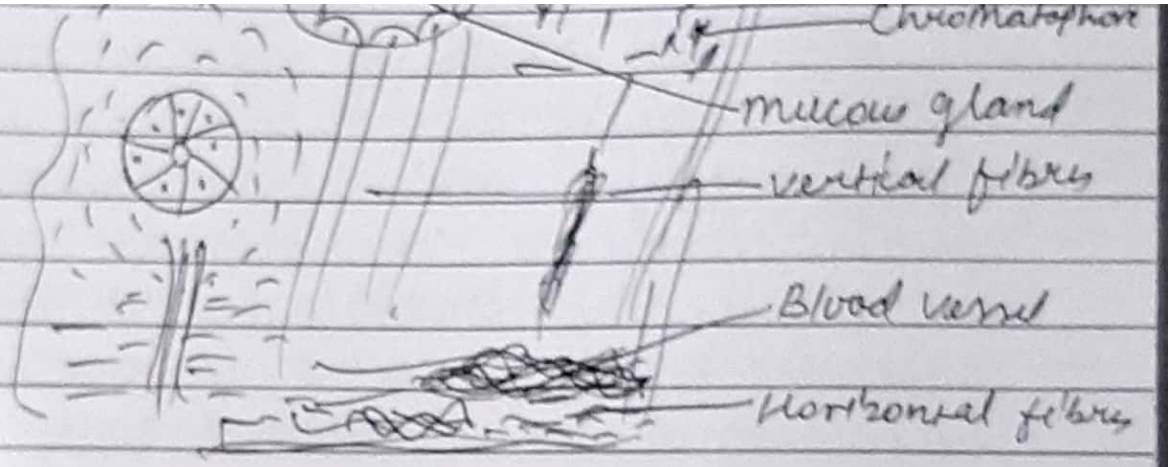


Fig - V.s of skin of frog

IN REPTILES

The integument is rough, thick, dry and scaly. This type of skin is best suited to the terrestrial life.

1. EPIDERMIS :-

The epidermis have heavily cornified stratum corneum which is produced into horny scales. The exoskeleton of scale is periodically cast off either in fragments or as a single piece. In certain forms (turtles & tortoise)

bony dermal plate are found below the epidermal scales which are already fused into epidermal horny plates. In others, scales are modified into spines, transverse plate or shields, etc. Only the scent glands are int.

2) **DERMIS:-**

The dermis of reptiles consists of two layers, an upper and a lower layer. The upper layer contains abundant chromophores in snakes and lizards. The lower layer contains connective tissue, fibres. Situated beneath the epidermal scales, dermal bony plates may be found.

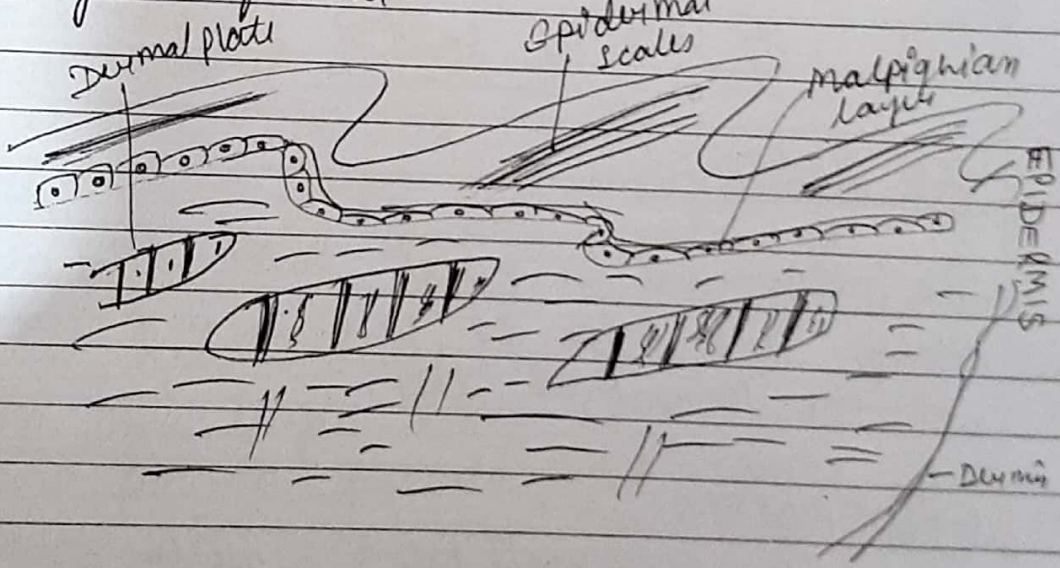


Fig - V.S. Skin of reptiles

IN BIRDS

The skin is thin loose and dry. It devoid of glands except the single uropygial gland situated at base of tail.

Epidermis

The epidermis is thin and delicates all over the body except on shank and feet where it is thick and form epidermal scales. The exoskeleton is in the form of feathers which are derived from stratum corneum of epidermis. The feathers are keratinized. Other keratin derivatives are beak and claws.

Dermis

The dermis of birds are thin and consists of connective tissue fibres, cells and smooth muscles fibres. It is distinguished into an upper and a lower layer. With intermediate vascular layer present b/w the two layers. Fat cells are also fnt in the dermis. The chromophores are also found in dermis. The dermis bears a number of cutaneous receptors. Pigments occurs in feathers and scales only.

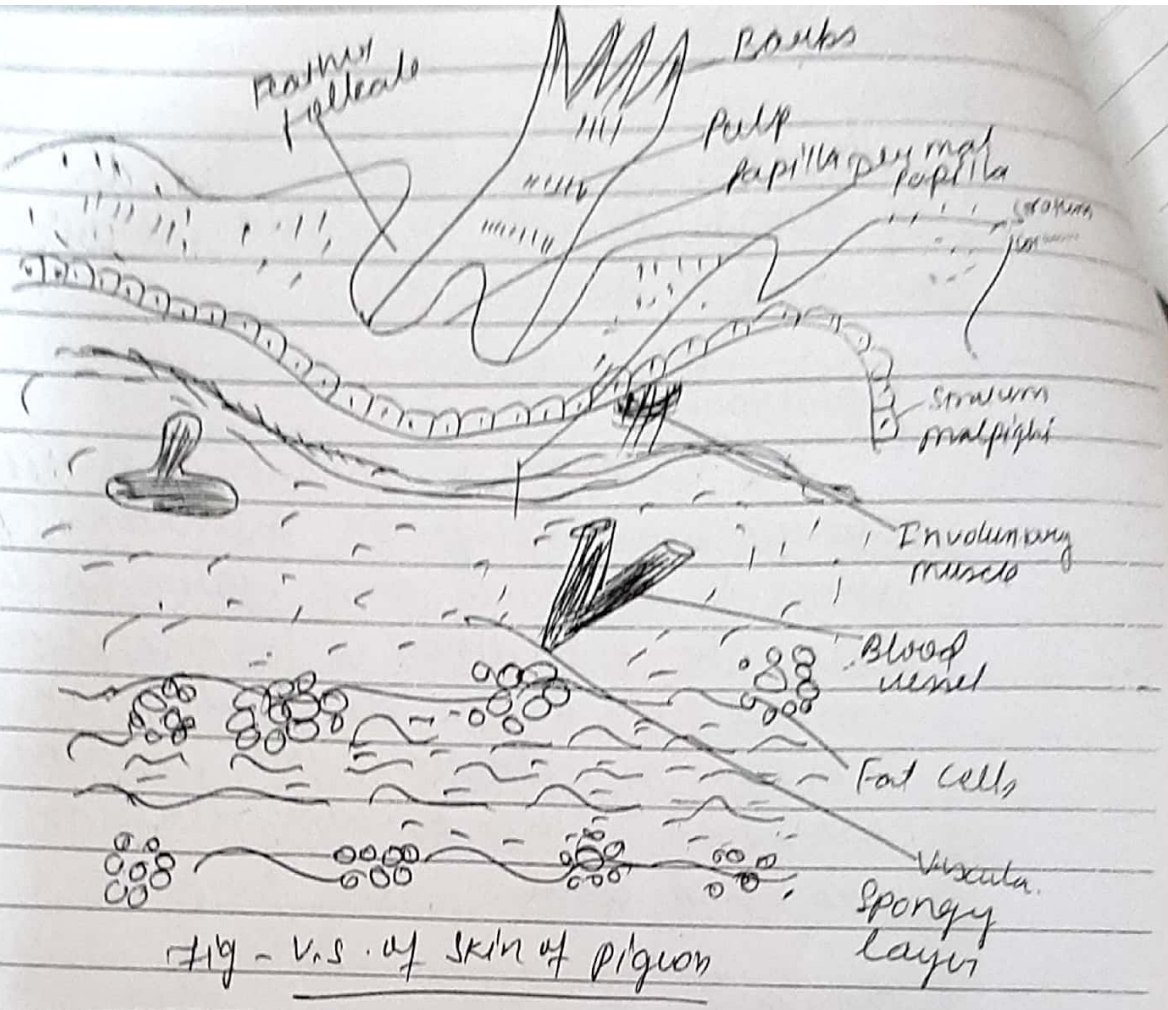


Fig - V.S. of skin of Pigeon

IN MAMMALS

The skin is thick, elastic and waterproof. The skin of mammals reach highest degree of specialization.

EPIDERMIS

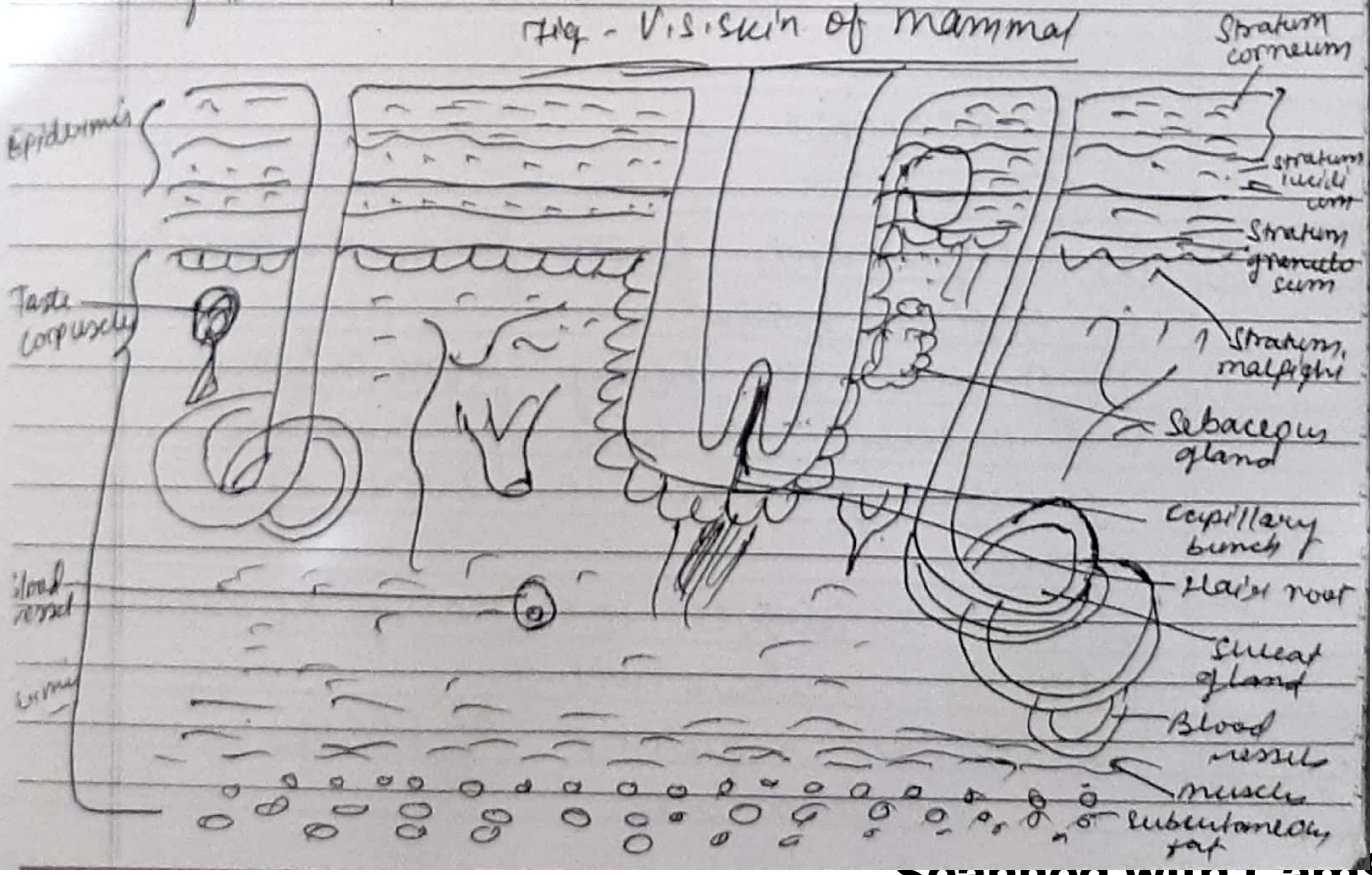
The epidermis is thick and has outer layer of flattened keratinized dead cells, the stratum corneum. The thickness of stratum corneum depends upon the amount of to which skin is exposed eg - it is thick in the sole. The sequence of cell layers in epidermis is

as follows - (I) A basal stratum germinativum which rest upon the basement membrane (II) Stratum spinosum (III) Stratum granulosum (IV) Stratum lucidum and (V) Stratum Corneum - outer dead keratinized cells.

DERMIS

The dermis is very thick and developed to the maximum. The chromophore cells are not but pigments granules melanophores are not. The dermis is distinguished into two layers. The outer stratum papillaris and inner stratum reticulare. The stratum papillary consists of numerous papillae while stratum reticulare composed of massive bundles of connective tissue fibres, blood vessels, lymphatics, smooth muscle fibres & nerves.

Fig - V.S. skin of mammal



DERMAL DERIVATIVES OR DERMAL SCALES

In fishes dermal scales form the exoskeleton they are placoid scales (eg - Elasmobranchs), Ganoid scales (eg - Polypterus), Cycloid scales (eg - Amia, Neoceratodus) and Ctenoid scales (eg - Teleosts fishes).

Mordern amphibians lacks scales except Coecelians and some toads.

In turtles and tortoise, the dermal scales are large plates cover the entire body. These form box like shell having dorsal carapace and ventral plastron. The scutes may be ~~int~~ in certain lizards & snakes.

In birds the dermal scales are usually absent.

~~In mammals, a~~

FUNCTIONS

(i) The integuments ~~from~~ form the covering of entire body.

(ii) It protect the body from injury and prevent the loss of moisture. It also prevent the entry of germs.

(iii) It acts as barrier to exchange of materials with the environment.

(iv) It involves regulation of body temperature.

v) Skin pigments prevents to intake of injurious amount of light.

(vi) In many vertebrates skin provide respiratory surface.

(vii) Unicellular mucous glands keep the skin moist

(viii) Horny teeth used for scraping of food.

(ix) Poison glands help to protect from enemy.

(x) The skin acts as storage organ for reserve food materials.

(xi) Sweat glands secrete sweat which help in maintaining the body temperature & removal of waste materials.

(xii) The dermal part of skin help in formation of dermal bones.