THE PIGEON & ITS EXOSKELETON

Indian Pigeon: ***Columba livia domestica***

Systematic Position

Kingdom:	Animalia
Phylum:	Chordata
Class:	Aves
Order:	Columbiformes
Family:	Columbidae
Genus:	*Columba*
Species:	*C. livia*
Subspecies:	*C. l. domestica*

Trinomial name

Columba livia domestica
Gmelin, 1789

Synonyms

Columba domestica
Columba livia rustica

GENERAL FEATURES OF BIRDS (AVES)

General Characteristics of Aves

- warm blooded animals.
- no skin glands except uropigial glands.
- feathers as exoskeleton.
- fore limbs are modified into wings.
- hind limbs are adapted tfor walking.
- the bones are spongy.
- lower jaw contain 5 or 6 bones.
- double headed vertebral ribs.
- The ankle joint is inter tarsal.
- lungs are non ditensible.
- Syrinx produce the voice.
- no vocal cord in lyrinx.
- heart is 4-chambered.
- R.B.C. are nucleated.
- sexes are separate.
- oviparous.
- skull is monocondylic.

COLUMBA IN FLIGHT

GENERAL INTRODUCTION TO PIGEON

COMMON NAME: *Kabutar* in Hindi and **Rock Pigeon** in English, ***Paira*** in Bengali.

DISTRIBUTION: found in India, Pakistan, Ceylon and Burma**.**

FOOD: cereals, pulses, ground nuts, etc.

IDENTIFYING CHARACTERS:

- **Body length**- about ***34 cm*** or more.
- **Body color**-slaty-grey, metallic green and purple.
- **Neck**- magenta in color.
- **Wings**- two dark bars on wings.
- **Tail**- a band is present across the end of the tail.
- The bird is so familiar to human.
- The nest is made up of twigs and straw.

SPOTTED DOVE: A CLOSE RELATIVE OF PIGEON

The **spotted dove** (*Spilopelia chinensis*) is a small and somewhat long-tailed pigeon which is a common resident breeding bird across its native range on theIndian Subcontinent and Southeast Asia. It is sometimes also called the **mountain dove**, **pearl-necked dove** or **lace-necked dove**. The genus contains at least 4 sub-species, such as, *chinensis* , *ceylonensis* , *hainana* , *suratensis* and *tigrina.*

GREEN PIGEON

Treron phoenicoptera (Latham, 1790), Indian Green Pigeon, very much endemic in Tripura. The **yellow-footed or legged green pigeon** is a common species of green pigeon found in the Indian subcontinent. It is called *Hariyal in Hindi*. The species feeds on fruit, including many species of ***Ficus***. They forage in flocks. In the early morning they are often seen sunning on the tops of emergent trees in dense forest areas. They especially are found sitting in couples on tree branches.

WHAT IS EXOSKELETON?

Exoskeleton is defined to the structure that has the following characteristics:

- an external supportive covering of an animal as chitin in arthropod, calcareous shell in mollusks or feathers in birds etc.
- bony or horny parts of a vertebrate produced from epidermal tissues, like keratin, chitin etc.

Exoskeleton is a hard, protective outer body covering of an animal, such as an insect, crustacean, or mollusk. The exoskeletons of insects and crustaceans are largely made of chitin. While feathers of birds and hair of mammals are made of keratin.

TYPES OF EXOSKELETON IN PIGEON

TYPES OF EXOSKELETON

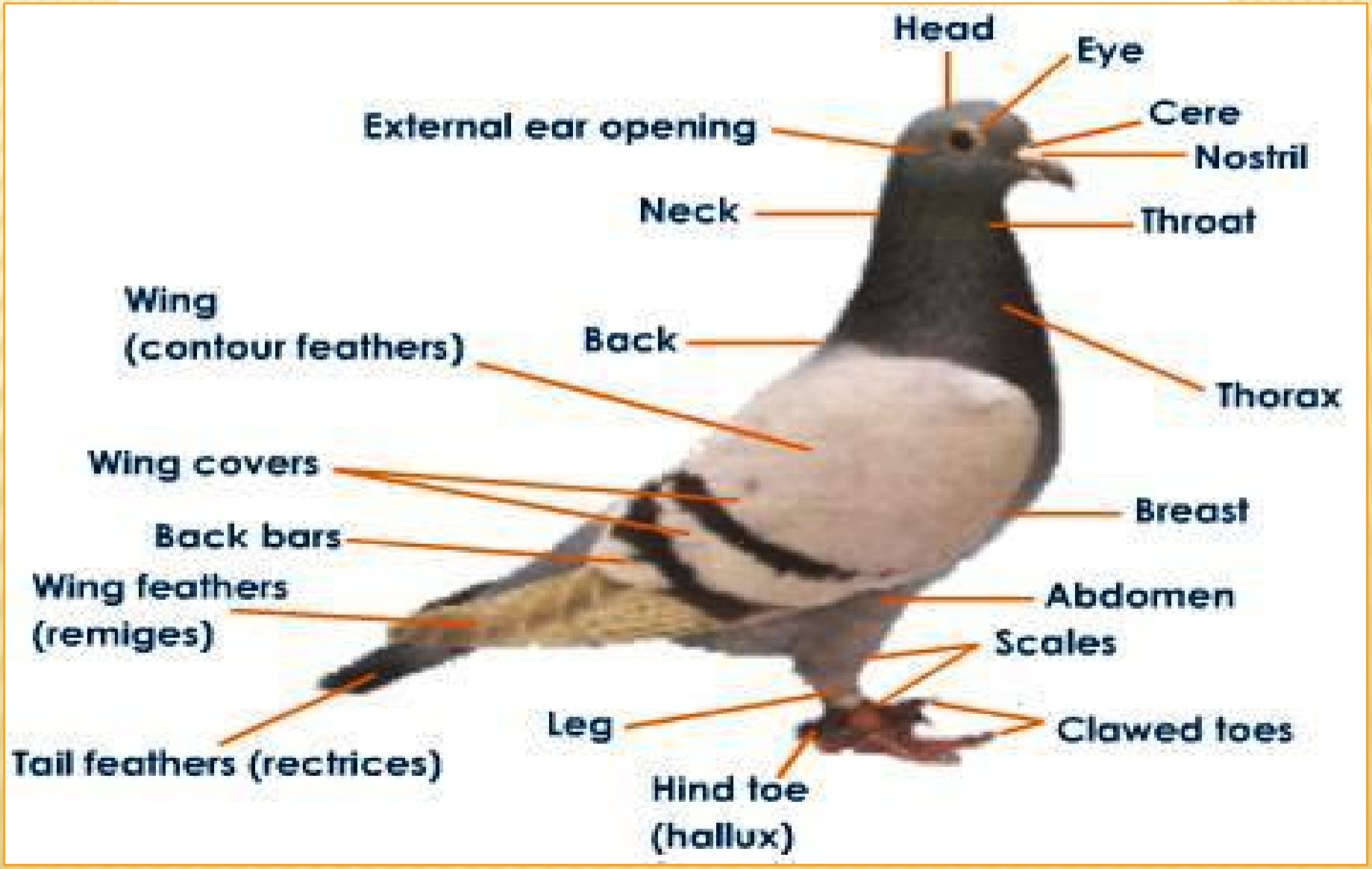
1. Feathers on Body

2. Claws in Digits

3. Scales in Legs

4. Rhamphotheca in Beak

EXTERNAL FEATURES OF PIGEON



SUGGESTED BOOKS FOR 1ST SEMESTER (GEN & MAJ)

ENGLISH

•**Introduction to General Zoology:** Vol-I & II : Chaki, Kundu & Sarkar, New Central Book Agency

•**Fundamentals of Zoology :** Ghosh & Manna , New Central Book Agency

•**Biology of Animals :** Vol-I : Ganguly, Sinha & Adhikari , New Central Book Agency

•**Biology of Animals :** Vol-II : Sinha ,Adhikari, Ganguly & Goswami, New Central Book Agency

•**Modern Approach:** Zoology (P-I/II/II), Chatterjee & Chakraborty, Nirmala

BENGALI

•**Tri Barshik Pranividya** Vol-I, II, III: **Bandopadhyay & Biswas**, Oriental Book Co.

•**Tri Barshik Pranividya** Vol-I, II, III: **Chattopadhya & Chakraborty**, Nirmala Library

•**Pranivigyan with Practicals**: **Kedarnath Bhattacharjya** , Books & Allied Pvt. Ltd

•**Pranividya** Vol-I, II, III: **Bigyan Roy & others**, Abhinaba Prakashani

•**Pranividya** Vol-I, II, III (Bengali) : **Maity & Middya**, New Central Book Agency

•Baybaharik Pranividya: Chattopadyay & Chattopadyay, Nirmala

ENGLISH REFERENCES

•**Text Book of Zoology:** Vol-I (Invert) Vol-II (Vert), Parker & Haswell (Ed. Marshall-William), Macmillan

•**Biological Science:** Taylor, Green & Stout (Ed. Soper), Cambridge, LPE

•**Vertebrate Life:** F.H. Pough, J.B. Heiser & W.N. McFarland, Prentice Hall

•**The Life of Vertebrates:** J.Z. Young, Oxford Univ. Press

• **Vertebrates:** Kardong, Tata McGraw Hill

• **Biology Invertebrates:** Pechenik, Tata McGraw Hill

• **Genetic:** Verma & Agarwal, S. Chand

• **Genetics:** Strickberger, MacMillan

• **Principles of Genetics:** Tamarin, Tata McGraw Hill

• **Evolution:** Strickberger, CBS

• **Statistical Methods:** Bailey, Cambridge Univ. Press

• **Biostatistics:** Lewis, East-West Press

• **Handbook of Economic Zoology**: Ahsan & Sinha, S. Chand

• **Text Book of Immunology**: Annadurai, S. Chand

• **Introduction to Bio-Statistics:** P.K. Banerjee, S. Chand

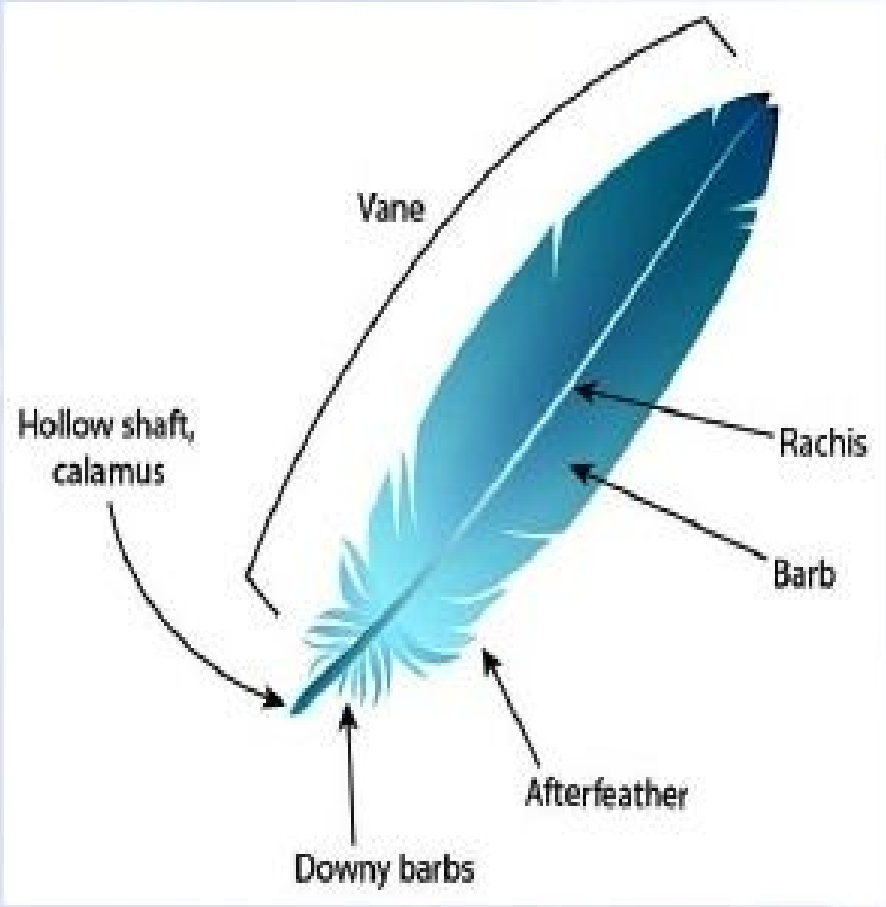
• **Introduction to Bio Physics**: Banerjee, S. Chand

• **Comprehensive Bio-technology:** Ramawat & Goyal, S. Chand

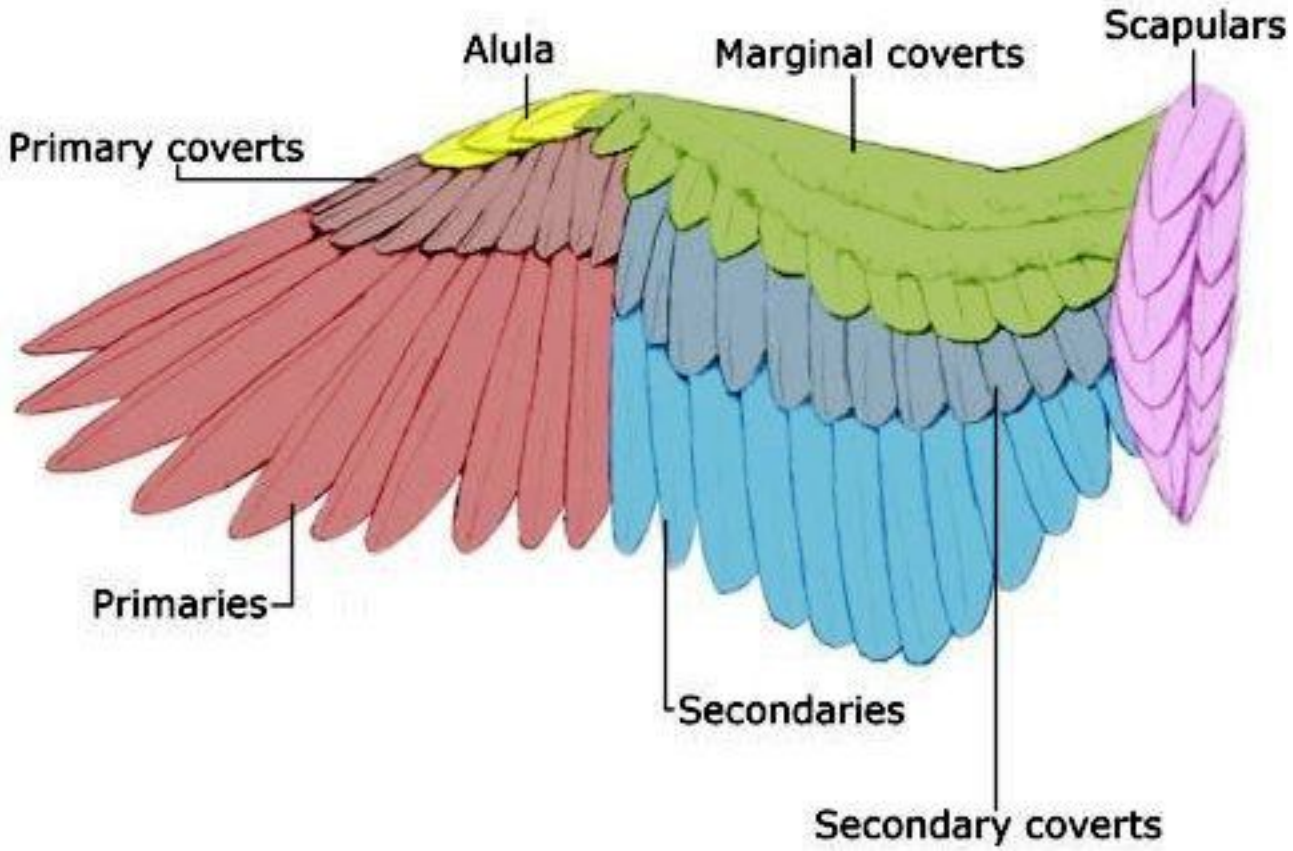
• **Genetic Engineering:** Verma & Agarwal, S. Chand

FEATHER: A MARVELOUS PRODUCT OF EVOLUTION

Feathers distinguish birds from other vertebrates. Feathers provide insulation, waterproofing, and a smooth body surface that reduce friction for flight. Different types of feathers serve different purposes. The large flight feathers that cover most of the body, the wing and tail, and the tiny feathers on the face are called contour feathers. They are strong, flexible, lightweight, and waterproof

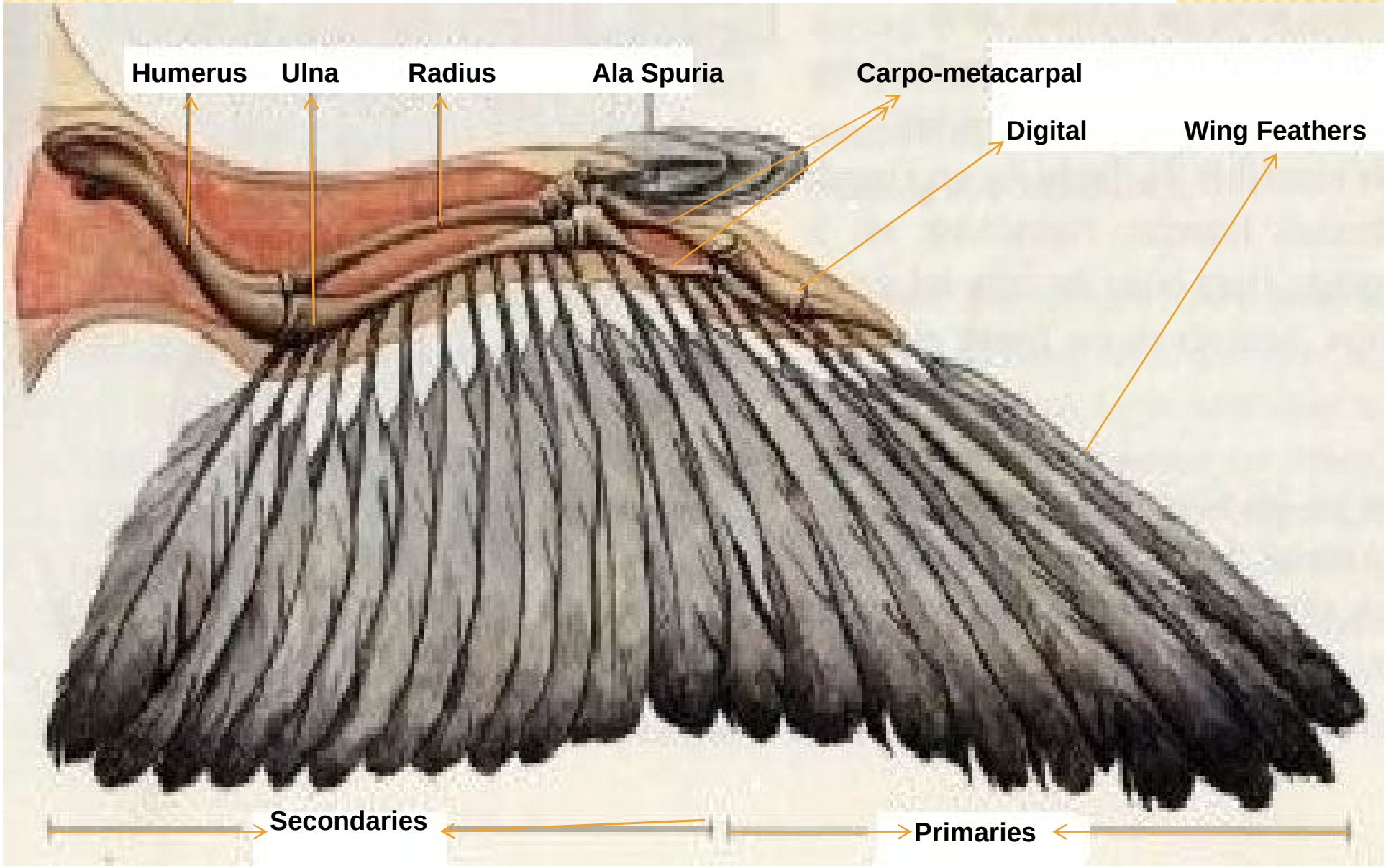


WING FEATHERS: REMIGES

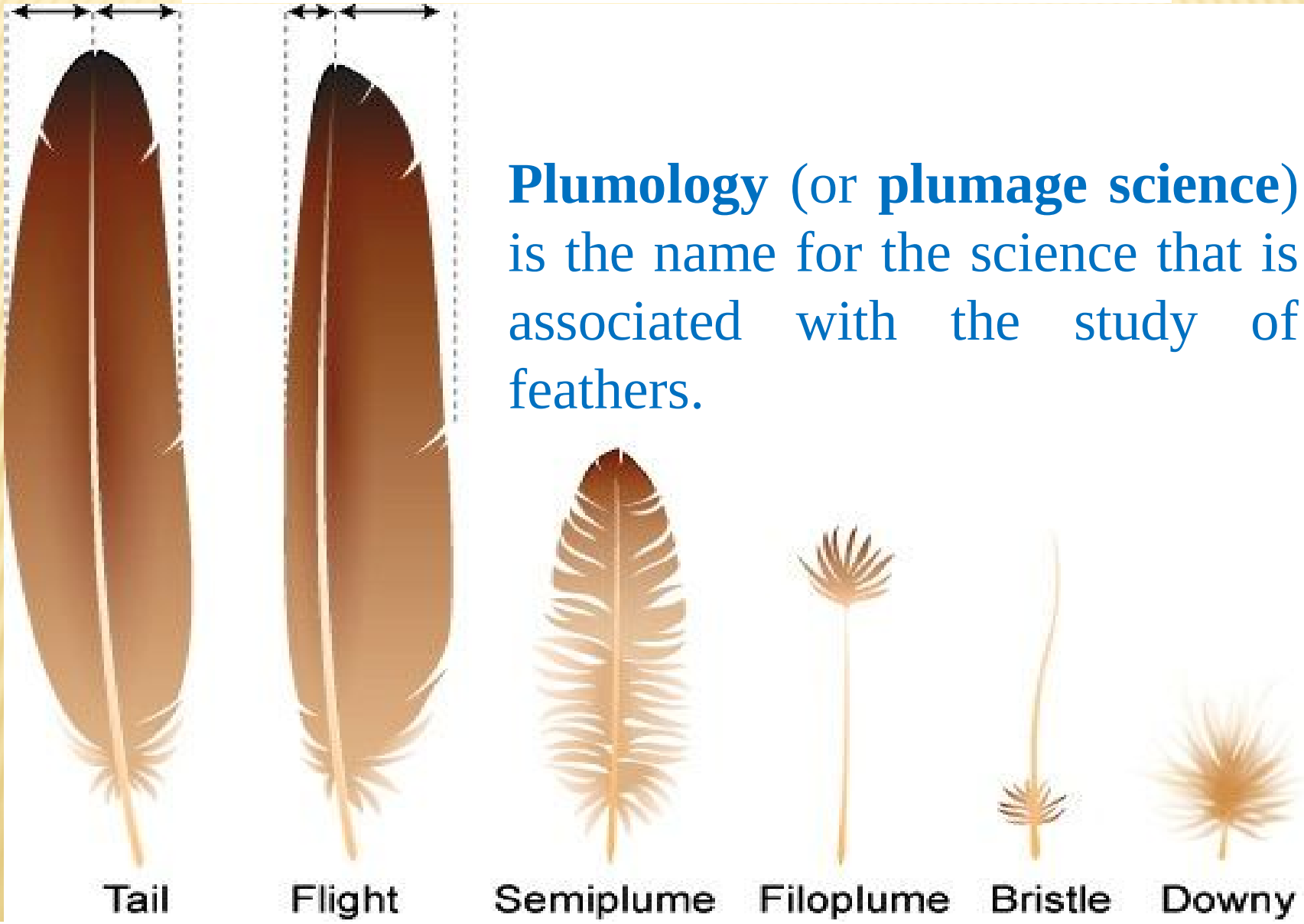


Tail feathers: Rectrices

WING FEATHER WITH BONES

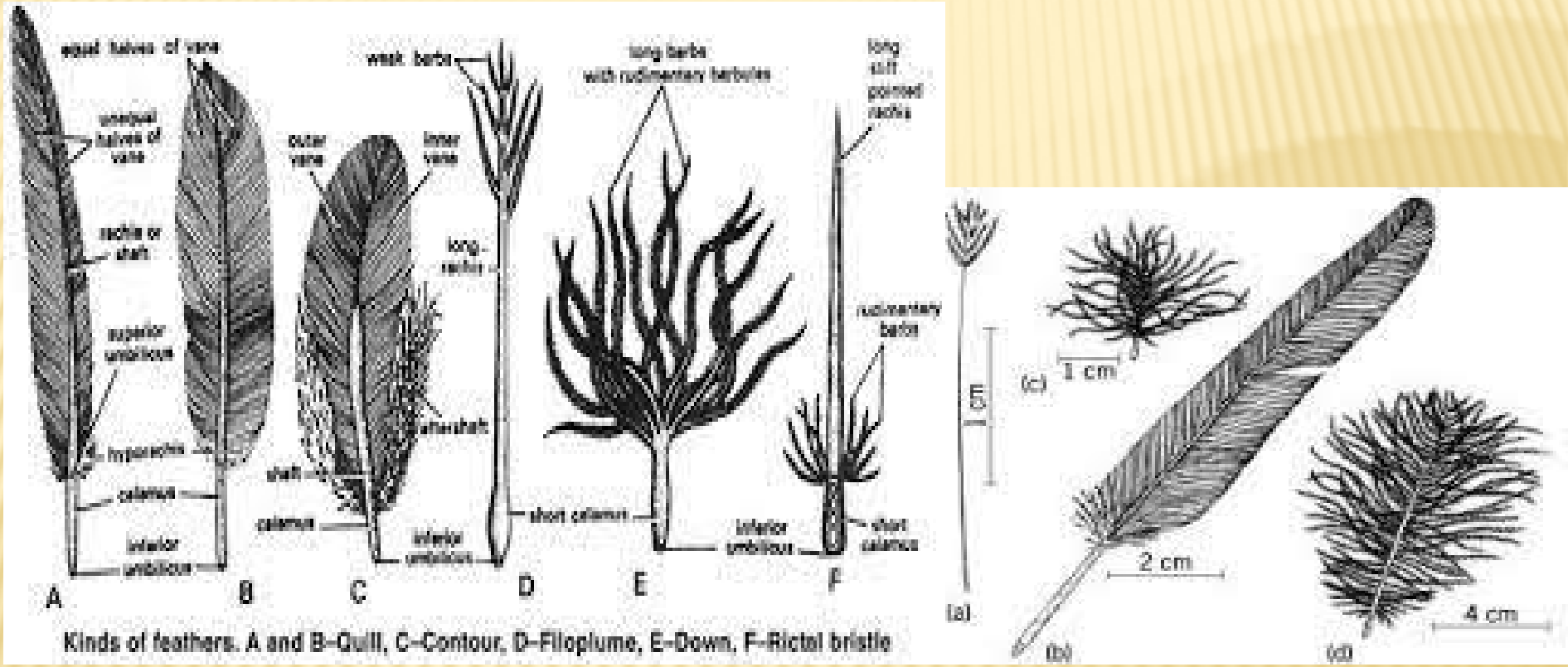


DIFFERENT FEATHERS OF BIRDS



Plumology (or **plumage science**) is the name for the science that is associated with the study of feathers.

VARIOUS FEATHER TYPES & ITS GROWTH



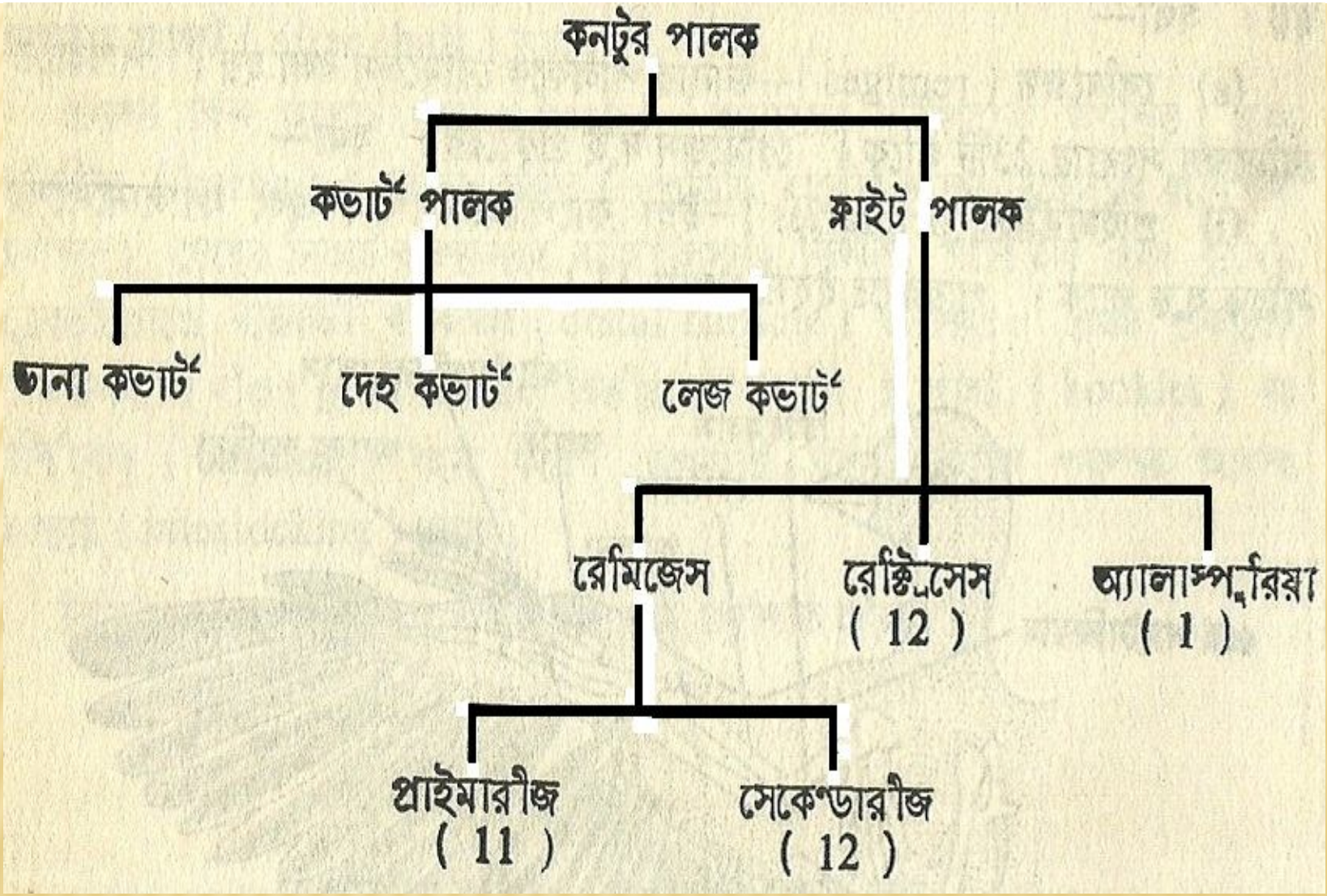
Kinds of feathers. A and B–Quill, C–Contour, D–Filoplume, E–Down, F–Rictal bristle

Feather growth

Like hair, feathers develop in a specialized area in the skin called a **follicle**. As a new feather develops, it has an artery and vein that extends up through the shaft and nourishes the feather. A feather at this stage is called a **blood feather**. Due to the color of the blood supply, the shaft of a blood feather will appear dark, whereas the shaft of an older, mature feather will be white. A blood feather has a larger quill (calamus) than a mature feather. A blood feather starts out with a waxy keratin sheath that protects it while it grows. When the feather is mature, the blood supply will

VARIETIES ON FEATHERS

CLASSIFICATION OF CONTOUR FEATHERS



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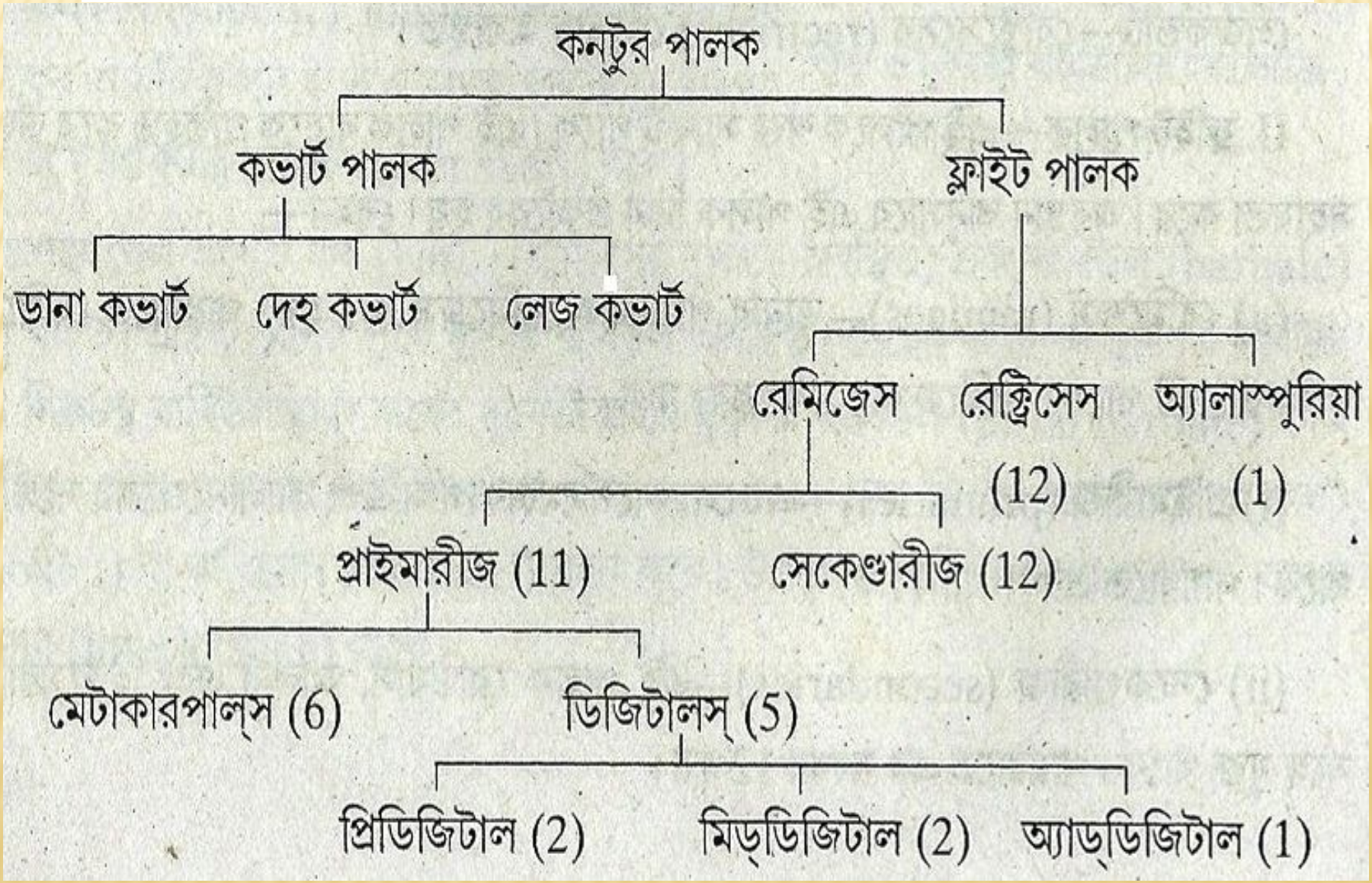
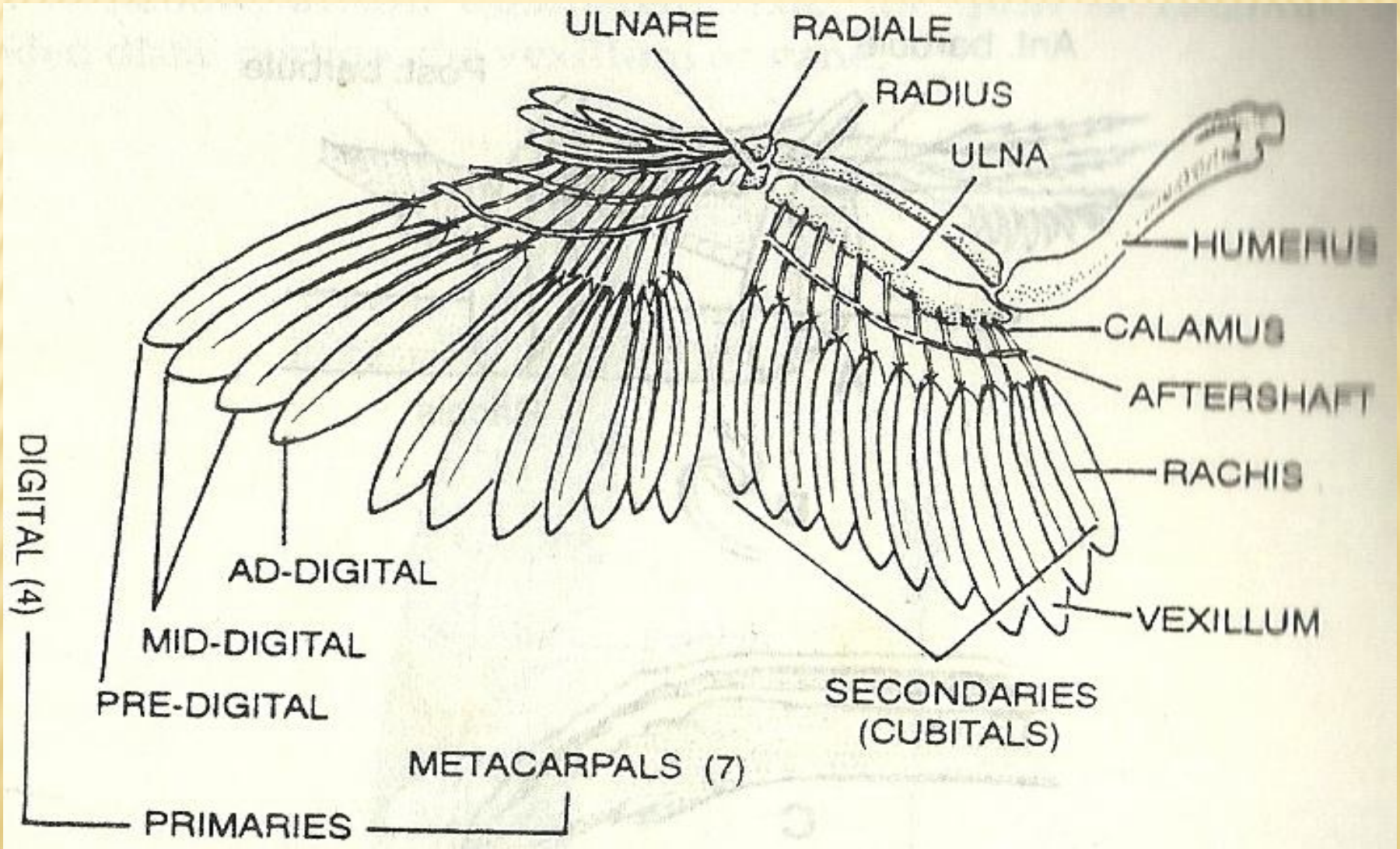


DISTRIBUTION OF FLIGHT FEATHERS

WING FEATHERS (PIGEON) HELD ON BONES

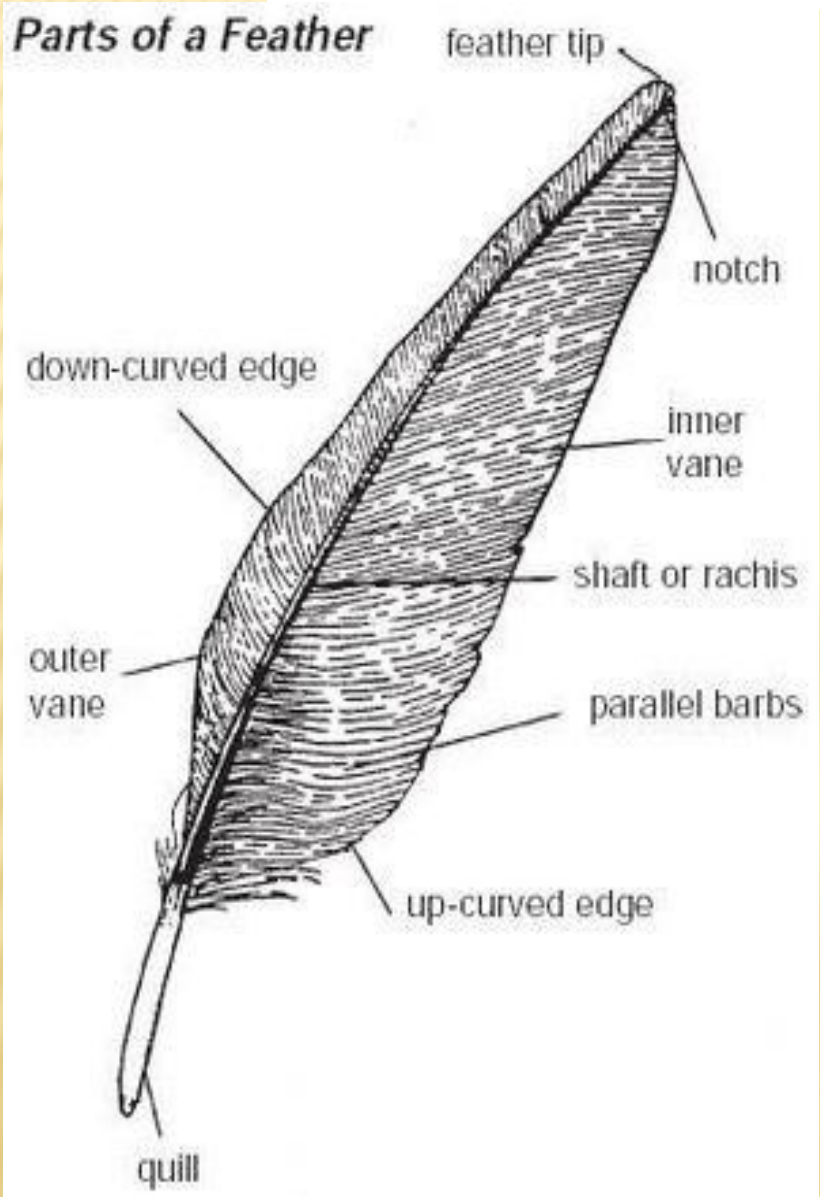


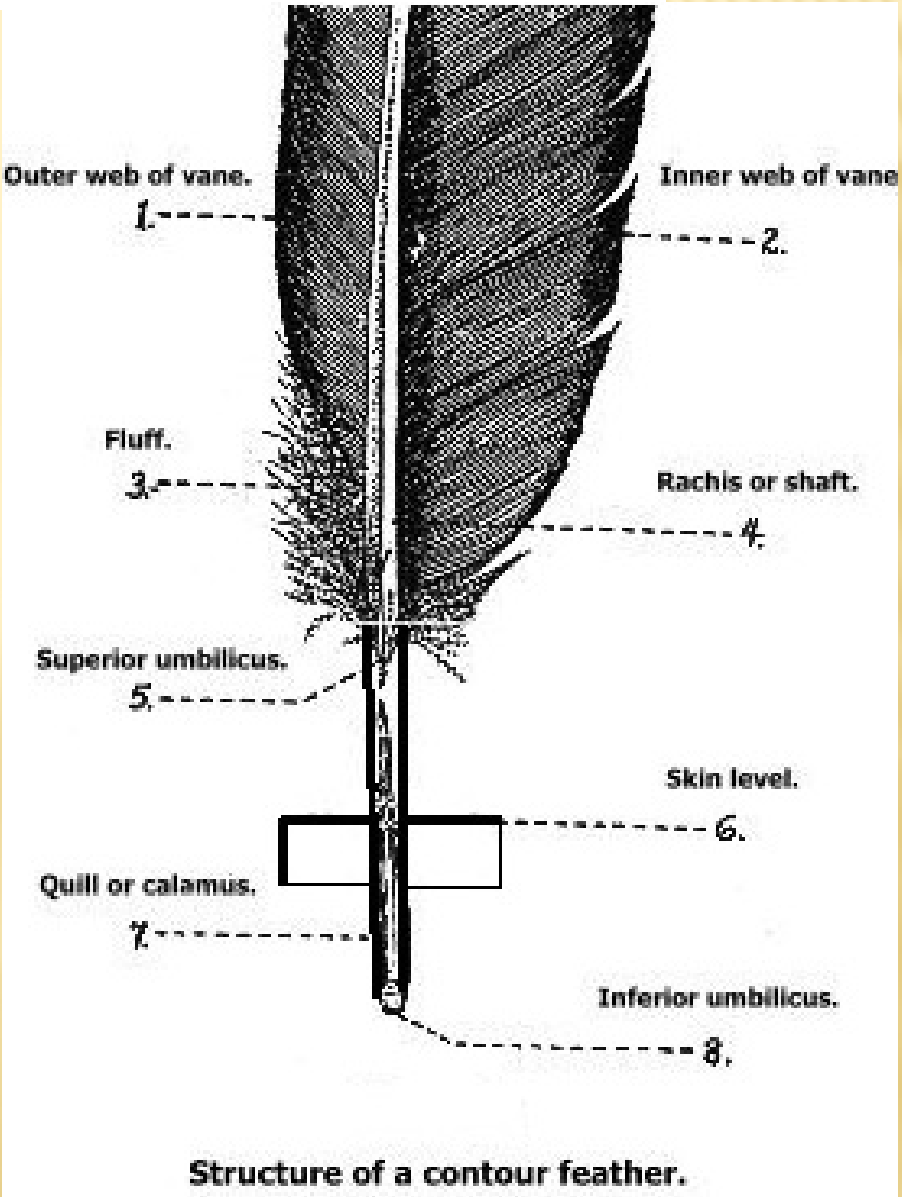
GENERAL STUCTURE OF FEATHERS

Flight feathers are of two types the **remiges** of **the wing**, and **rectrices of the tail**. Both of these are the most important feathers for flight.

A typical feather features a main shaft, called the **rachis** that contains on either side the **vexillum** or **vane/s** (broad inner & narrow outer). Originating from rachis are a series of branches, called **hypo-rachis** or **barbs**. The barb bears oblique rows of processes, called the **barbules**. The distal edge of each barb has two sets of barbules: proximal & distal. The distal one possesses **hooklets/barbicles/hamuli**, while the proximal one bears **flanges or grooves**. Hooklets & grooves interlock to render a compact (cross-attachment) surface of the vane. At the base of the feather, the rachis expands to form the hollow tubular ***calamus*** **(or quill) which inserts into a follicle in the skin.** The basal part of the calamus is without vanes. This part is embedded within the skin follicle and has an opening at the base (***inferior/proximal umbilicus***) and a small opening on the side (***superior/distal umbilicus***). **Down feathers** are fluffy because they lack barbicels, so the barbules float free of each other, allowing the down to trap air and provide excellent thermal insulation.

DIFFERENT PARTS OF A FEATHER





Structure of a contour feather.

INTERLOCKING SYSTEM IN A FEATHER

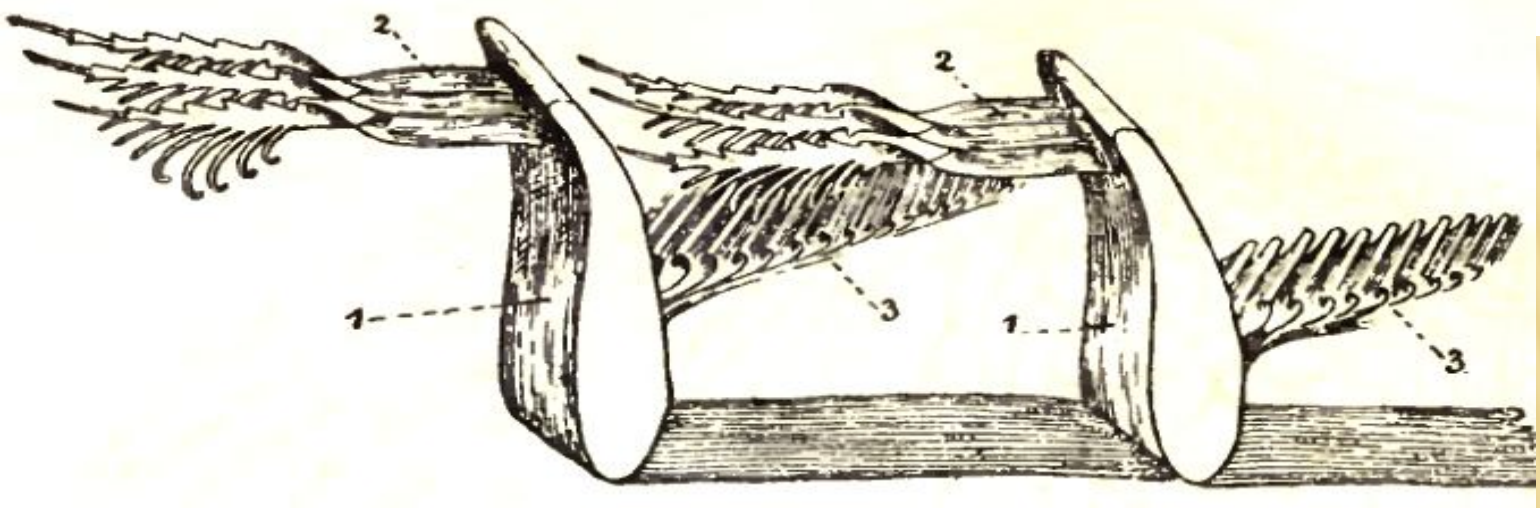
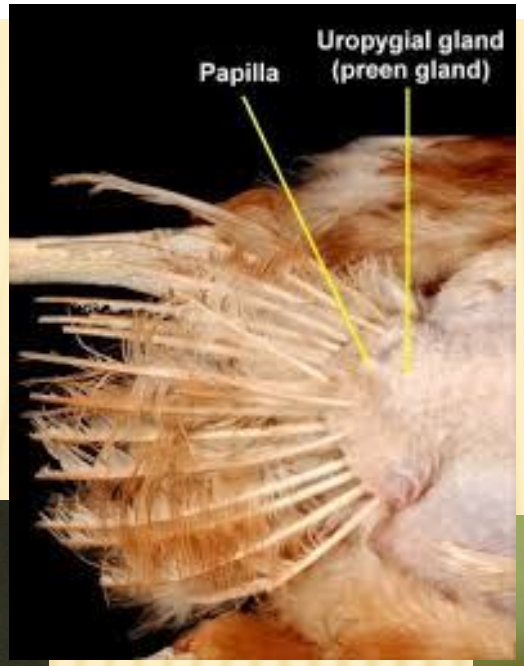
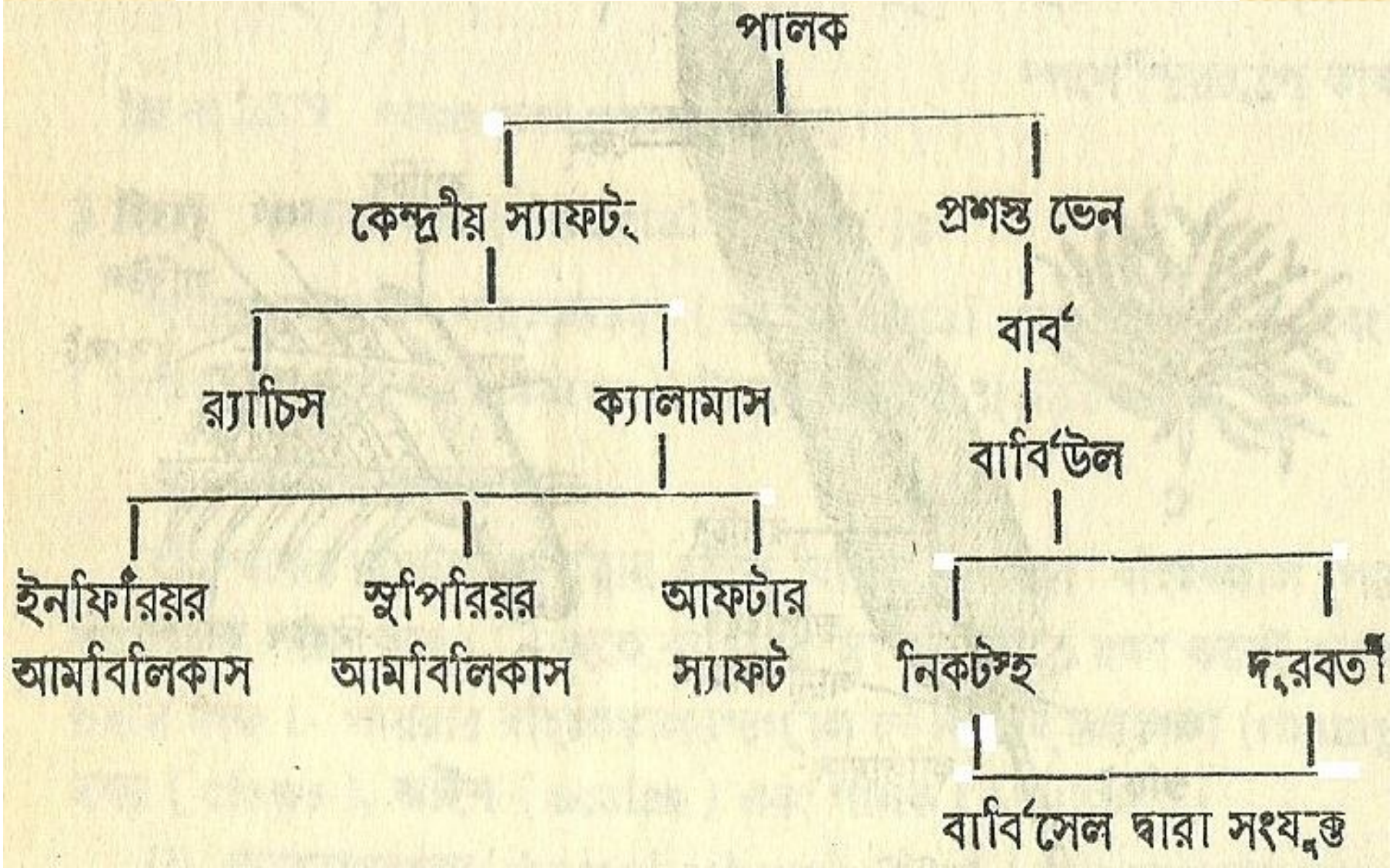


Figure shows the arrangement proximal & distal barbules arising from either side of a **barb (1)**: distal one possesses a series of **barbicles or hooklets (2)**; while the proximal barbules bear series of **grooves or flanges (3)**. Both hooklets & grooves remain in temporary interlock with each other to render a compact (**cross-attachment**) surface of the vane. Sometimes a bird at res arrange the broken interlocking system with his/her beak using oil frequently taken from the **uropigeal gland** located above base of tail, dorsal to cloacal aperture (vent).

CLEANING FEATHER WITH OIL OF UROPYGIAL GLAND



ANATOMY OF A MODEL FEATHER



CONTOUR FEATHERS

- **Contour Feathers cover an adult bird's body**
- **Contour feathers on the tails and wings are called flight feathers, and provide lift for flight**
- **Contour feathers have many branches called barbs**
- **Barbs are linked together giving the feather a:**
  - **@ smooth surface**
  - **@ sturdy flexible shape**

Although feathers cover most parts of the body of birds, they arise only from certain well-defined tracts on the skin. They aid in flight, thermal insulation, waterproofing, and coloration that helps in communication and protection.

DOWN FEATHERS

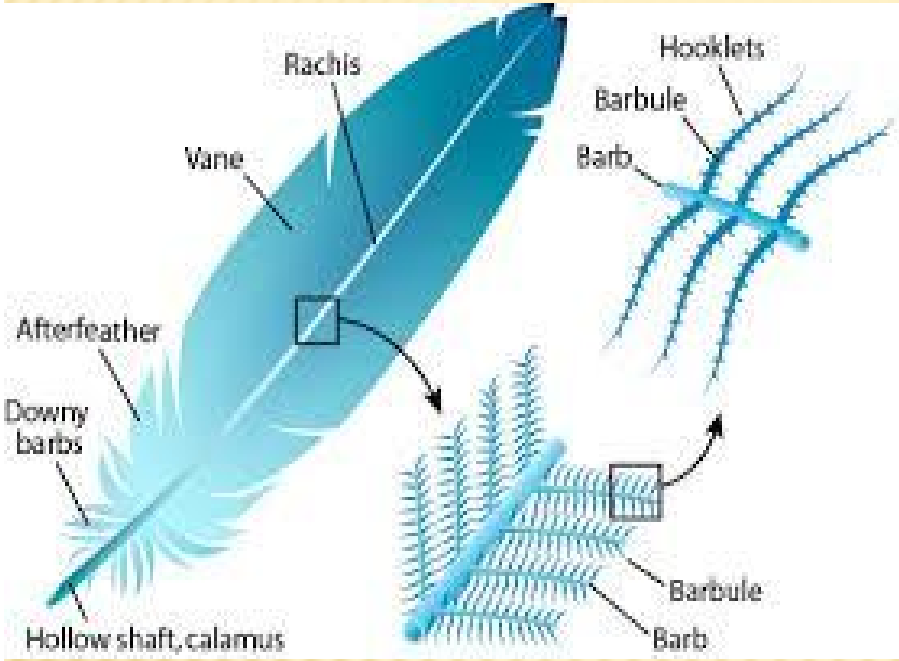
Down Feathers

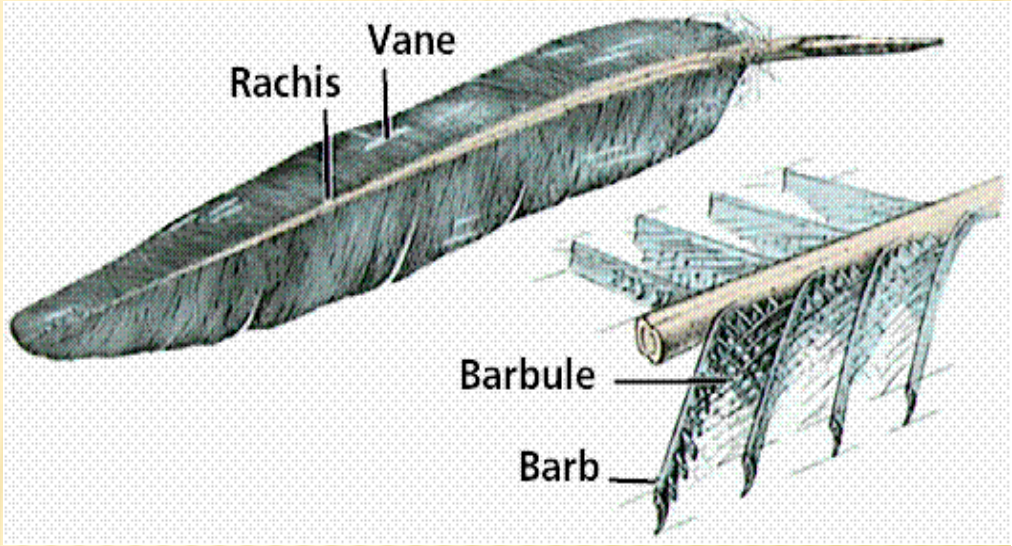
cover the body of young birds and are found beneath adult bird's contour feathers

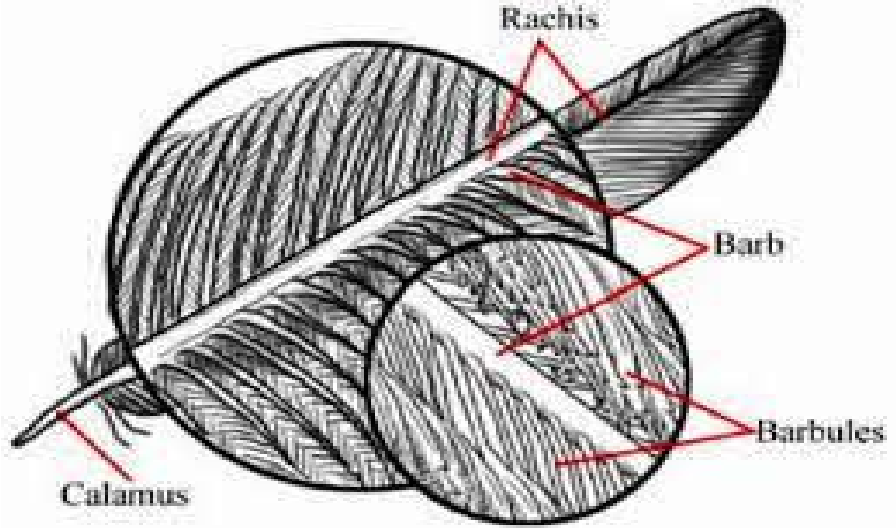
Down Feathers

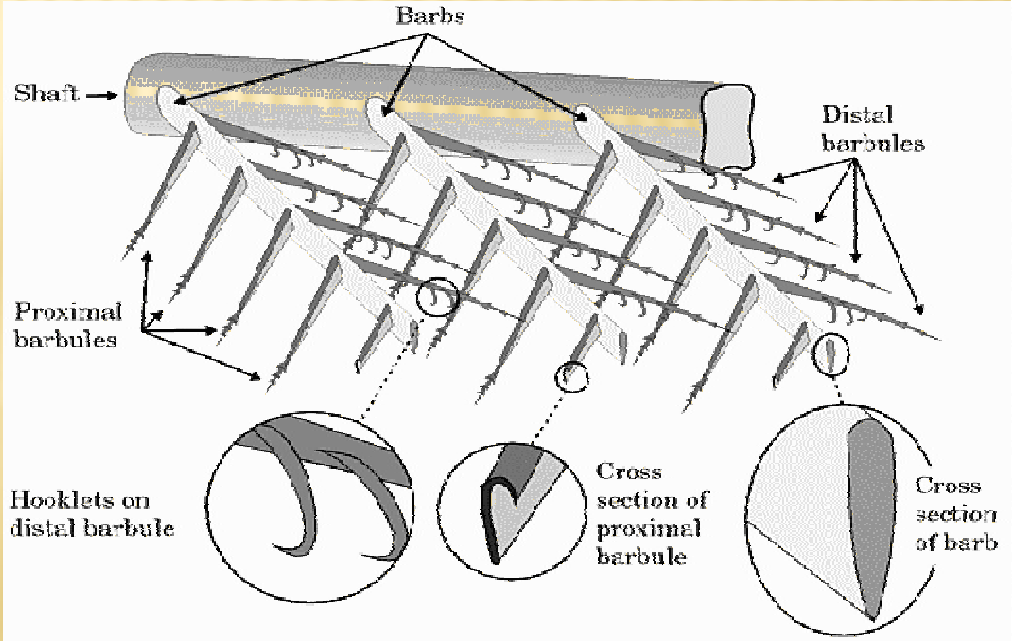
trap warm air and conserve body heat

DETAILS OF A MODEL FEATHER









COMPOSITION OF FEATHERS

Feathers are among the most complex integumentary appendages found in vertebrates and are formed in tiny follicles in the epidermis, or outer skin layer, that produces keratin proteins. Here the protein is of β-keratin type as found in feathers, beaks and claws. β-keratin is very much stronger in structure than α-keratins of mammalian hair, horns and hoof.

A BRIEF ACCOUNT ON FEATHERS

Flight feathers: Flight feathers are the large feathers of the wing and tail. Flight feathers of the wing are collectively known as the **remiges**, and are separated into three groups. The primaries attach to the metacarpal (wrist) and phalangeal (finger) bones at the far end of the wing and are responsible for forward thrust. There are usually 10-11 primaries and they are numbered from the inside out. The secondaries (usually 12) attach to the ulna, a bone in the middle of the wing, and are necessary to supply "lift." They are also used in courtship displays. The tail feathers, called **rectrices**, act as brakes and a rudder, controlling the orientation of the flight. Most birds have 12 tail feathers. The bases of the flight feathers are covered with smaller contour feathers called **coverts**. There are several layers of coverts on the wing.

Down feathers: Down feathers are small, soft, fluffy, and are found under the contour feathers. They are plumaceous, and have many non-interlocking barbs, lacking the barbules and hooklets seen in contour and flight feathers. This makes it possible for them to trap air in an insulating layer next to the skin, protecting the bird from heat and cold. They are so efficient, humans use these feathers for insulation, too, in down jackets and comforters.There are special types of downy feathers called **powder down feathers**. When the sheaths or barbs of these feathers disintegrate, they form a fine keratin powder, which the bird can spread over its feathers as a water-proofing agent. The powder also assists in cleaning as the bird preens

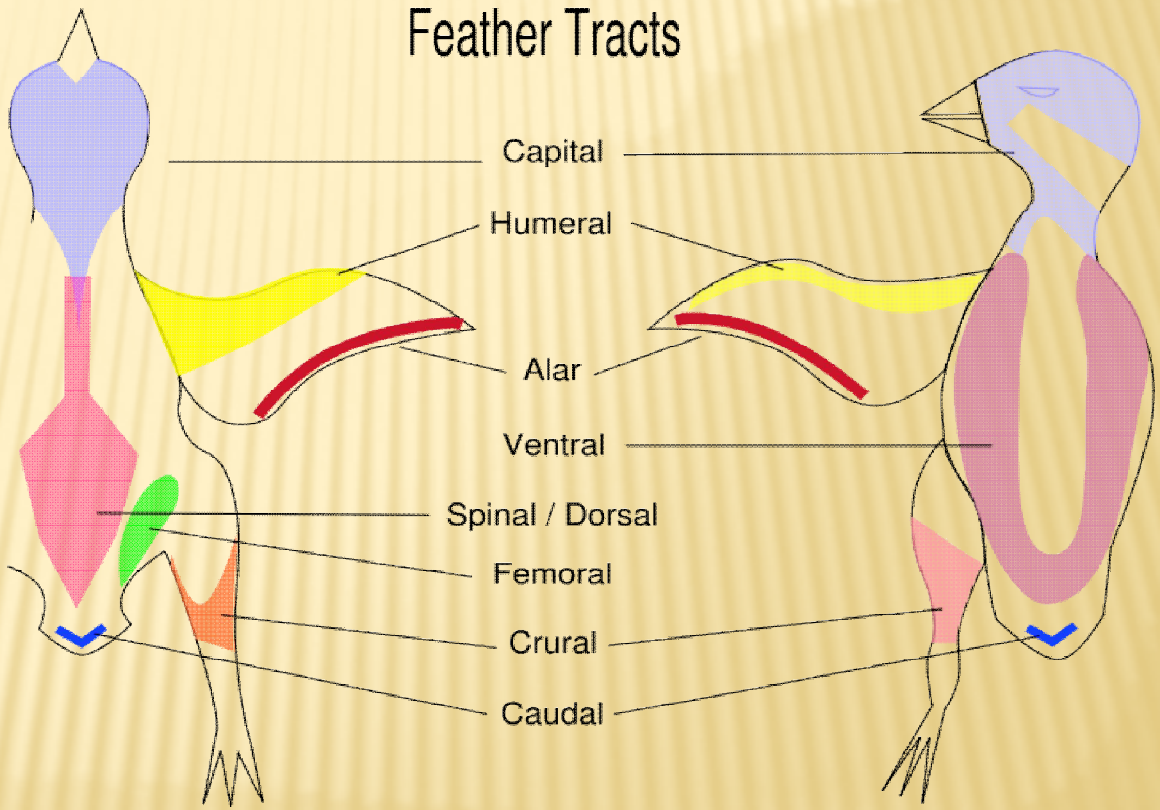
Filoplumes: Filoplumes are very fine, hair-like feathers, with a long shaft, and only a few barbs at their tips. They are located along all the pyterlae. Although their function is not well understood, they are thought to have a sensory function, possibly adjusting the position of the flight feathers in response to air pressure.**Semiplumes:** Semiplumes provide form, aerodynamics, and insulation. They also play a role in courtship displays. They have a large rachis, but loose (plumaceous) vanes. They may occur along with contour feathers or in separate pterylae.

Bristle feathers: Bristle feathers have a stiff rachis with only a few barbs at the base. They are usually found on the head (around the eyelids, nares, and mouth). They are thought to have both a sensory and protective function.

PTERYLAE & PTERYLOSIS

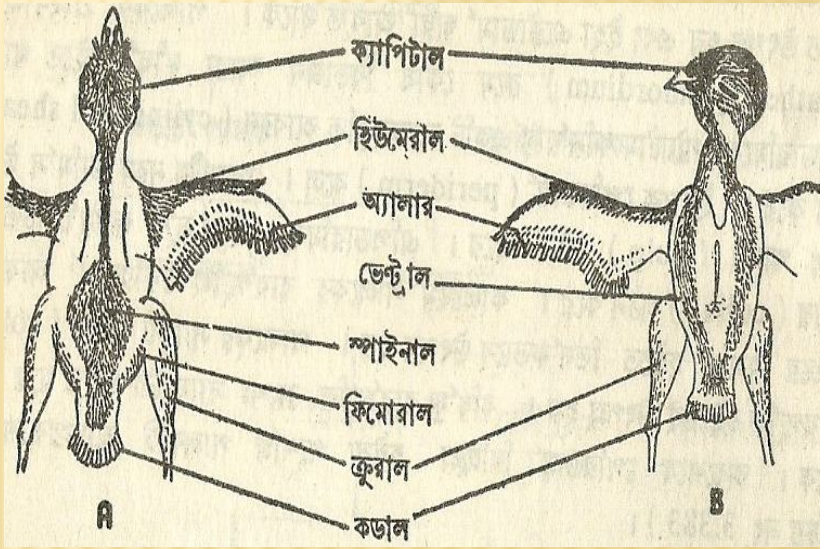
In most birds the feathers grow from specific tracts of skin called ***pterylae***; between the pterylae there are regions which are free of feathers called ***apterylae***.

Filoplumes and down feathers may arise from the apterylae, while all contour feathers (coverts and flights) originate from pterylae. The arrangement of feather tracts is called ***pterylosis*** or ***pterylography***.



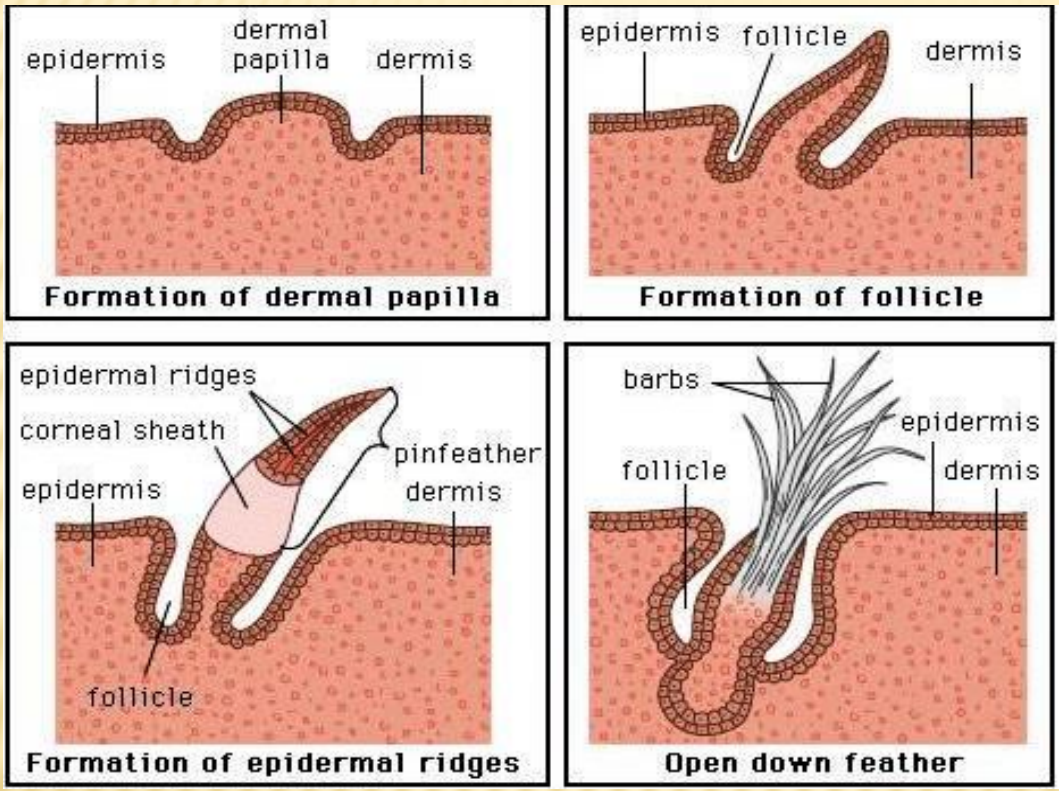
Pterylae & Apterylae

টেরিলির নাম	বিস্তার
ক্যাপিটাল (capital) টেরিলা	মস্তকের পৃষ্ঠদেশ।
স্পাইনাল (spinal) টেরিলা	পৃষ্ঠদেশ হইতে পুচ্ছদেশ পর্যন্ত।
কডাল (caudal) টেরিলা	পুচ্ছ অঞ্চল।
অঙ্কীয় (ventral) টেরিলা	পার্শ্ব অঙ্কীয়দেশ এবং মধ্যাঞ্চল অঙ্কীয় অ্যাপ্‌টেরিয়াম দ্বারা পৃথকীকৃত।
হিউমেরাল (humeral) টেরিলা	উর্ধ্ববাহু এবং স্কন্ধ অঞ্চল।
অ্যালার (alar) টেরিলা	উর্ধ্ব ও পুরোবাহু এবং করতলের উড্ডয়ন পালক উৎপন্ন অঞ্চল।
ফিমোরাল (femoral) টেরিলা	পশ্চাৎপদের উর্ধ্ব অঞ্চল।
ক্রুরাল (crural) টেরিলা	পশ্চাৎপদের নিম্নাঞ্চল।



In *Columba and many speceis the number of pterylae is 8 as their names and distribution are shown in this figure and the table of next page.*

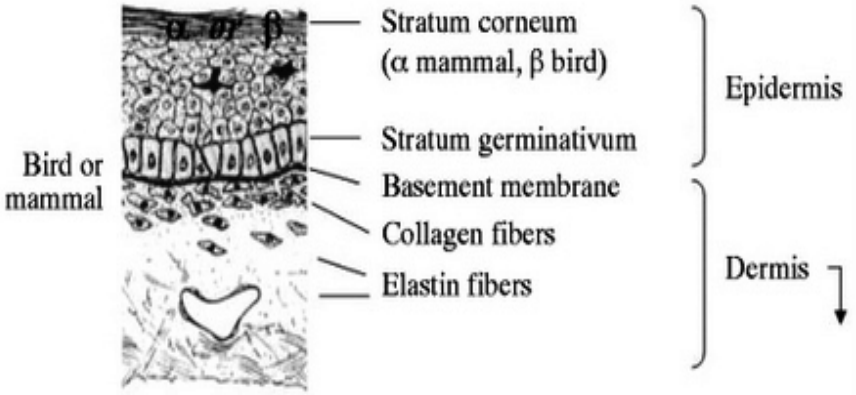
ORIGIN & DEVELOPMENT OF FEATHERS



Schematic diagram of the development of a feather follicle. (A) Development of the epidermal feather placode and the dermal condensation. (B) Development of a feather papilla (or elongate feather bud) via the proliferation of dermal cells. (C) Formation of the feather follicle by the invagination of a cylinder of epidermal tissue around the base of the feather papilla. (D) Opening of down feather after the rupture of corneal sheath.

The follicle consists of a series of tissue layers (from peripheral to central), including the dermis of the follicle, the epidermis of the follicle (outer epidermal layer), the follicle cavity or lumen (the space between epidermal layers), the follicle (epidermal) collar (or inner epidermal layer), and the dermal pulp (tissue at the center of the follicle). The proliferation of feather keratinocytes and most of the growth of the feather occurs in the follicle, or epidermal, collar.

ORIGIN & FORMATION OF FEATHER



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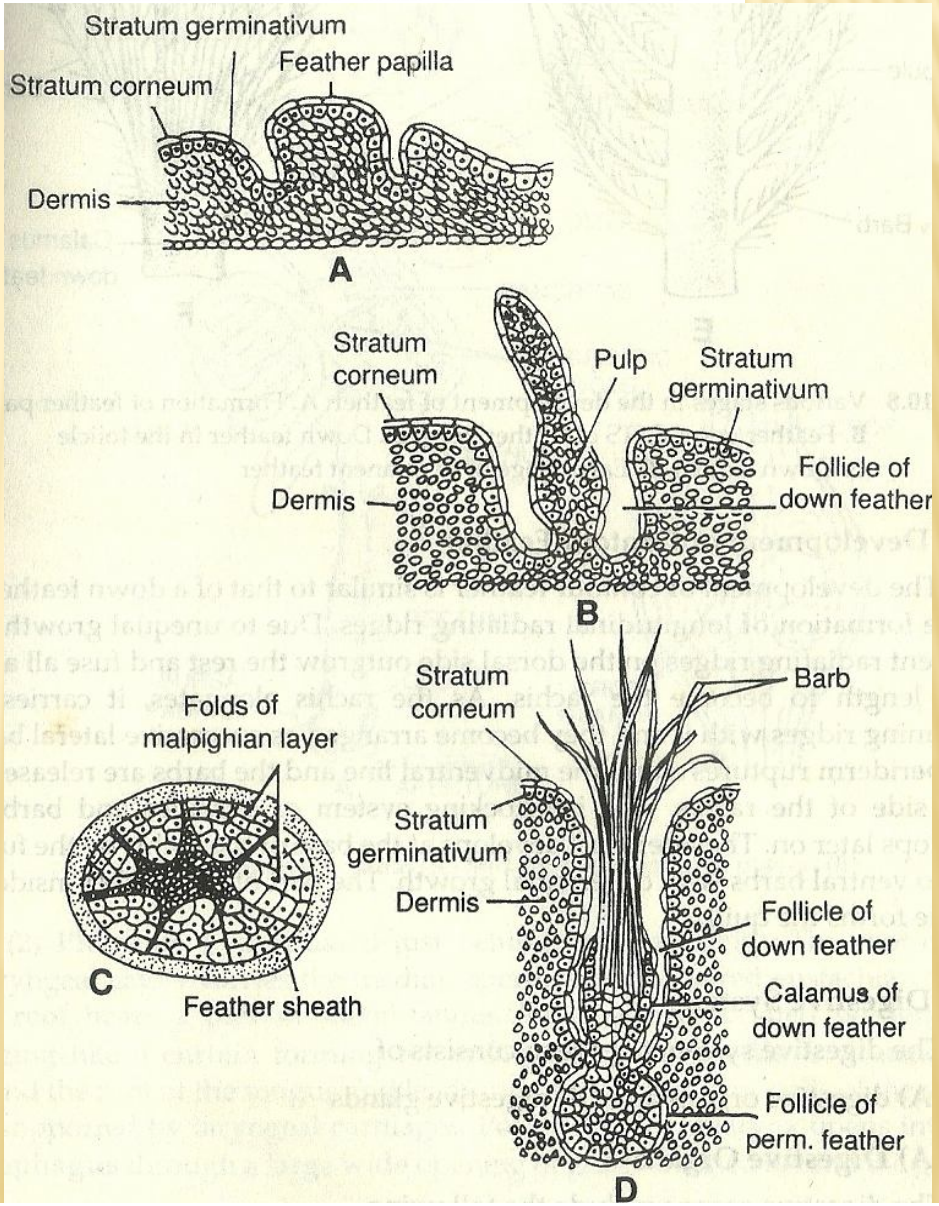
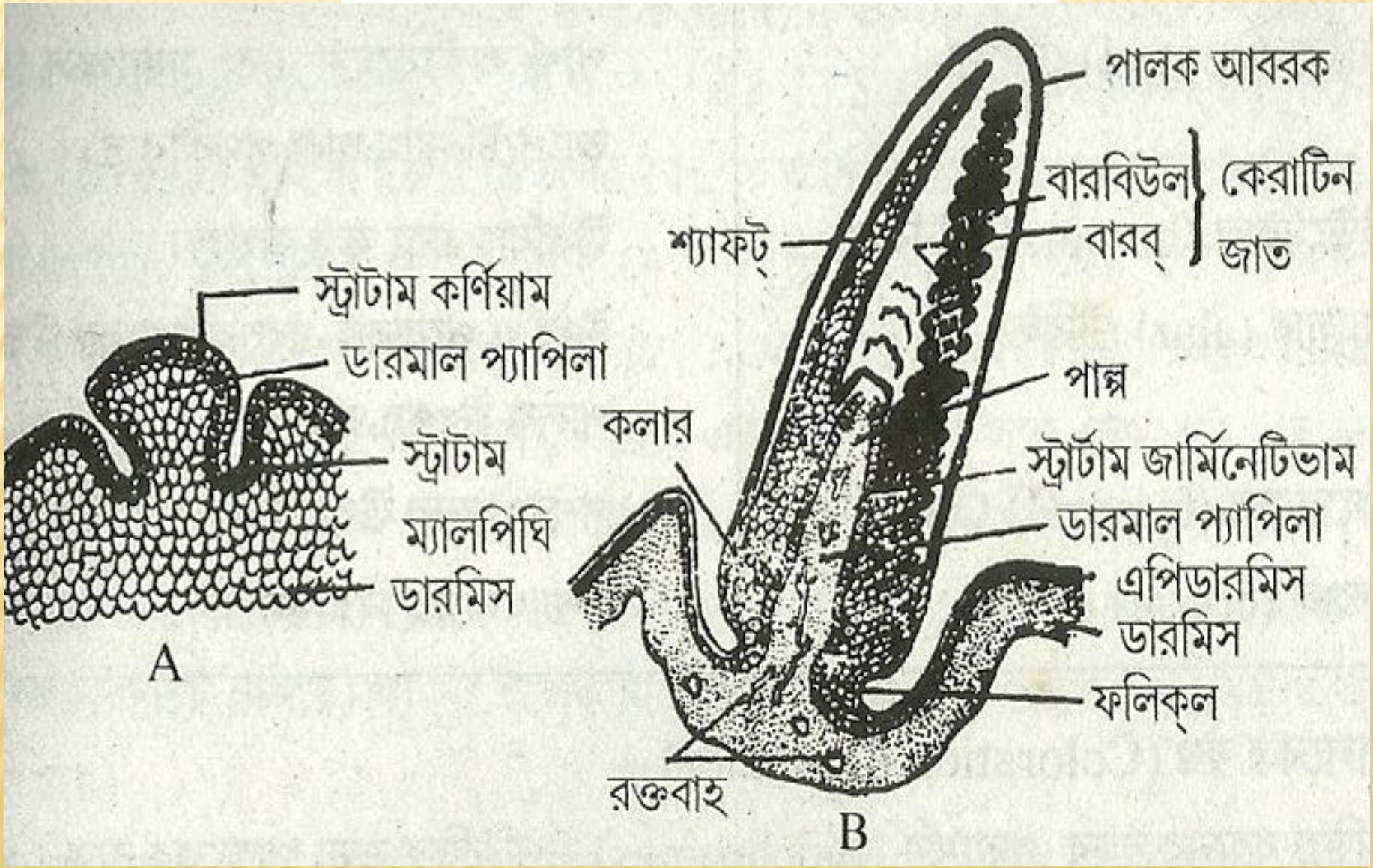


ORIGIN OF FEATHER

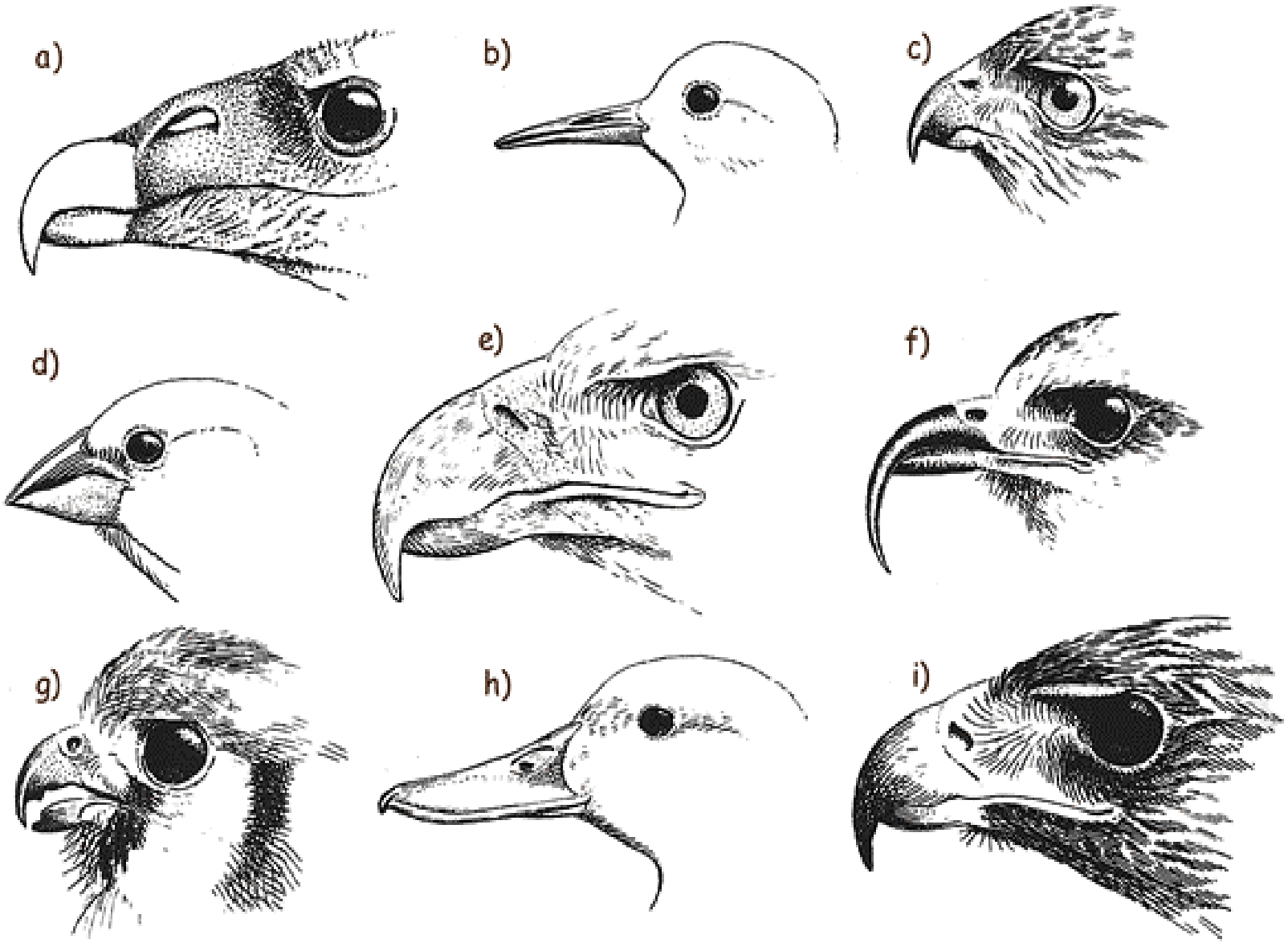


BEAK & RHAMPHOTHECA

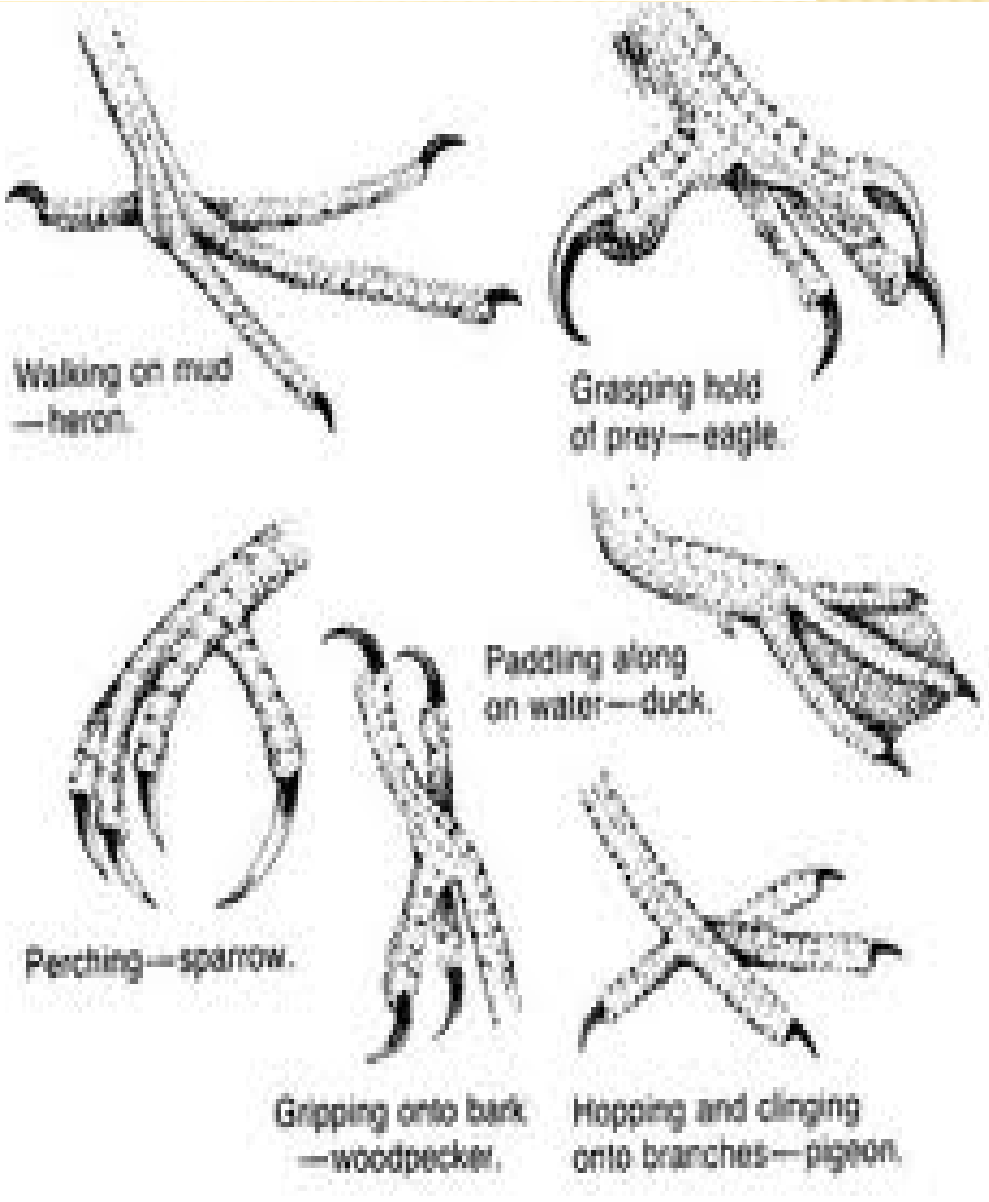
A hard keratin layer covers the upper and lower jaws of beaks that are called maxillary and mandibular **rhamphotheca**, respectively. These rhamphotheca are actually modified keratinized skin. They help in food collection, nest building, fighting and maintaining of body feathers by polishing with the oily secretions of uropygeal or preen gland. Beaks are modified mainly based on the feeding habit of bird and the play major taxonomic role in bird's classification.

There are many different types of beaks on birds and evolution has played a big part in developing the great variety of beaks adapted by their varied food habits. All of them, however, arise in fundamentally the same way. Although beaks vary significantly in size, shape, color and texture, they share a similar underlying structure. Bird beaks are essentially a compact layer of epidermal cells molded around the bony core of each mandible, the upper and lower jaws. In nearly all birds, unlike mammals, both upper and lower jaws can move.

DIFFERENT FORMS OF BEAK



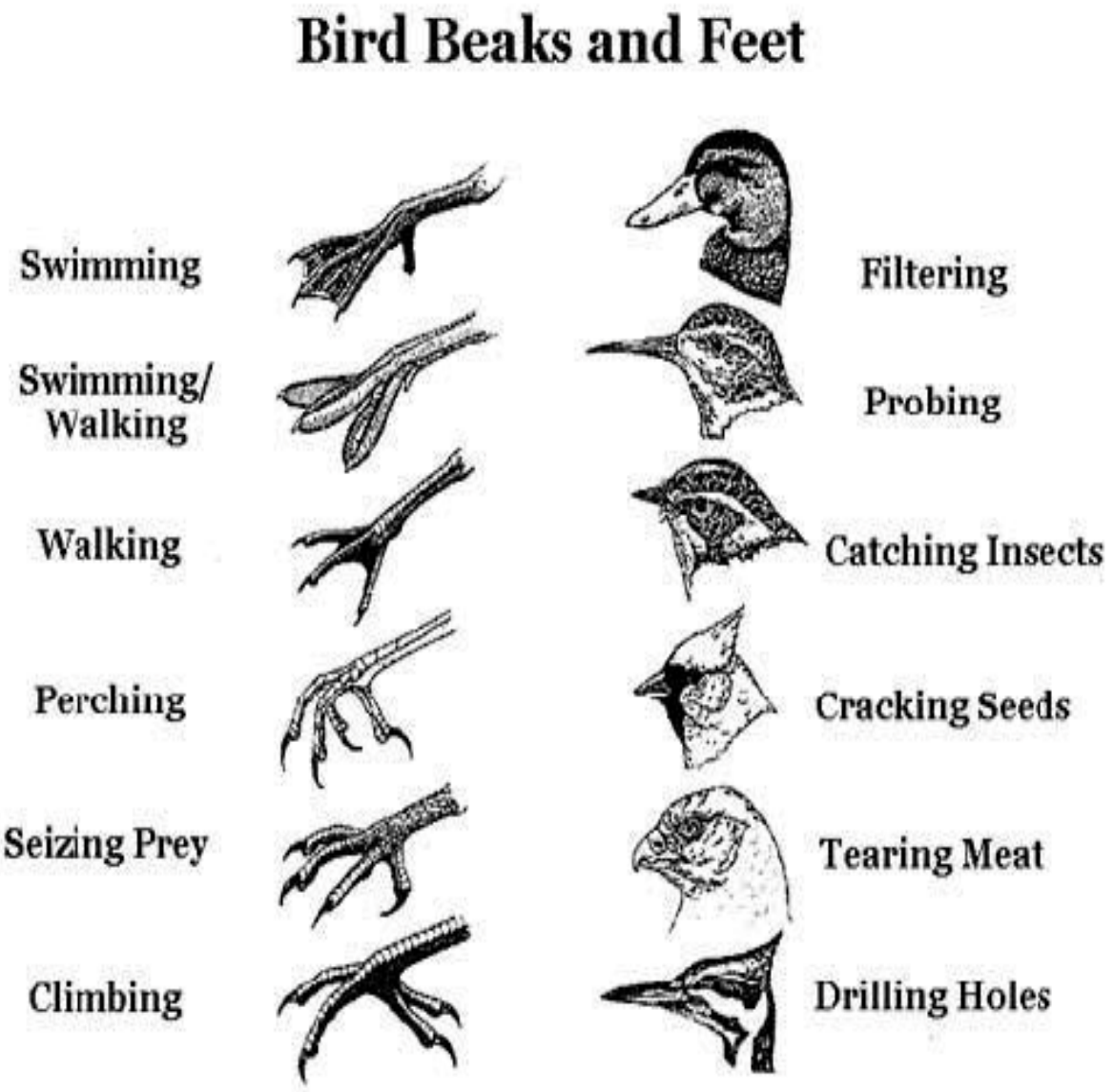
BEAKS ,SCALES, CLAWS & NAILS



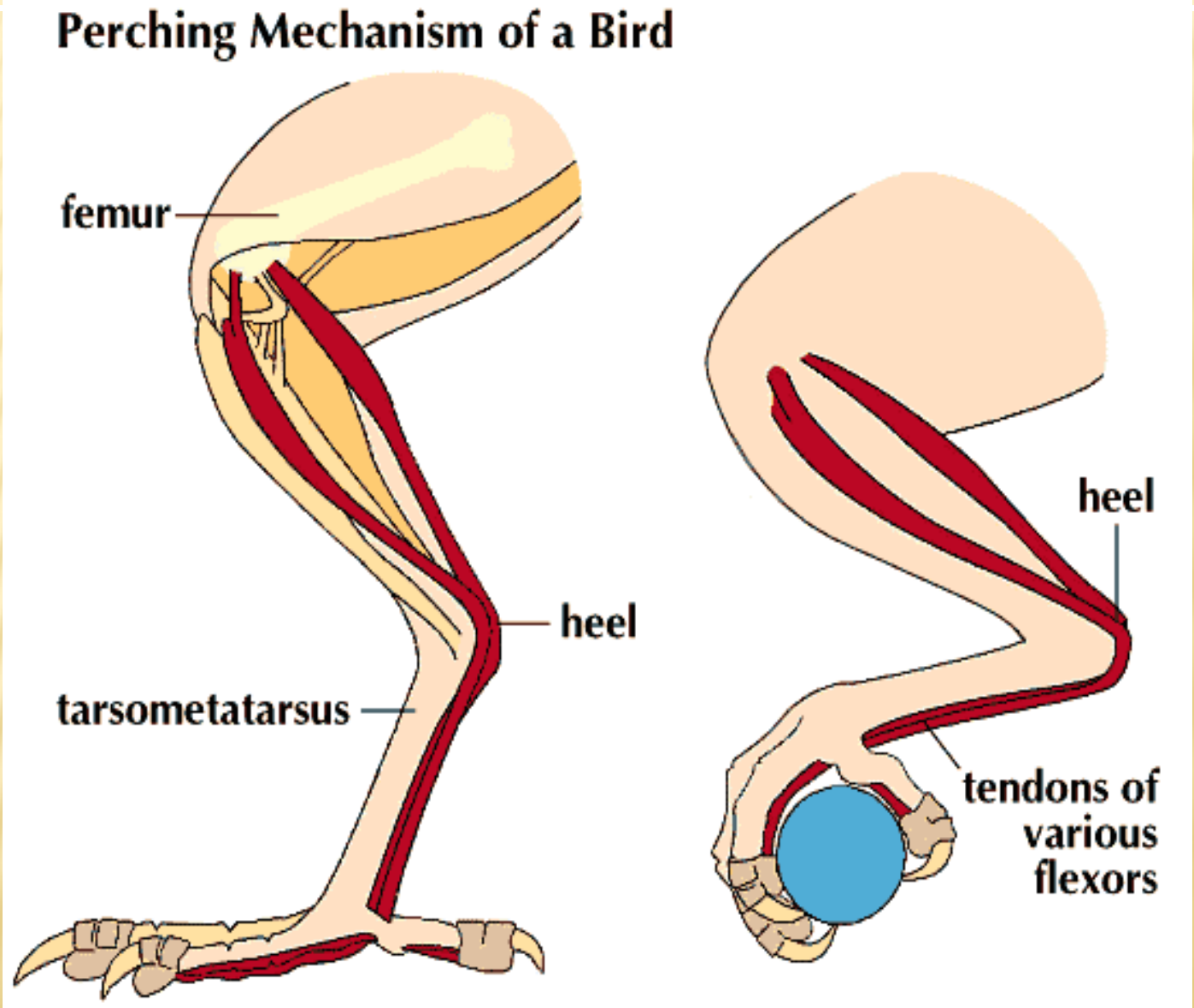
DIVERSITY IN BEAK & FEET OF BIRDS

Claws are pointed, sharp and horny exoskeleton that are present at the extremities of the toes. The claws are typically reptilian in construction and help during perching, walking, nestling, fighting and food capturing.

Birds cannot fall off a perch when asleep. Each toe is connected to a cord inside the leg. When the leg is bent, the cords stretch tight and pull the toes around the branch. It takes more energy to leave the perch than to stay there.



MECHANISM OF PERCHING



TYPES OF FEET & MECHANISM OF PERCHING

Wading Foot. The long legs of killdeer make it possible for them to wade into ponds and streams to catch and eat small water animals.

Swimming Foot. Ducks and loons have webbed feet which they use to paddle through water.

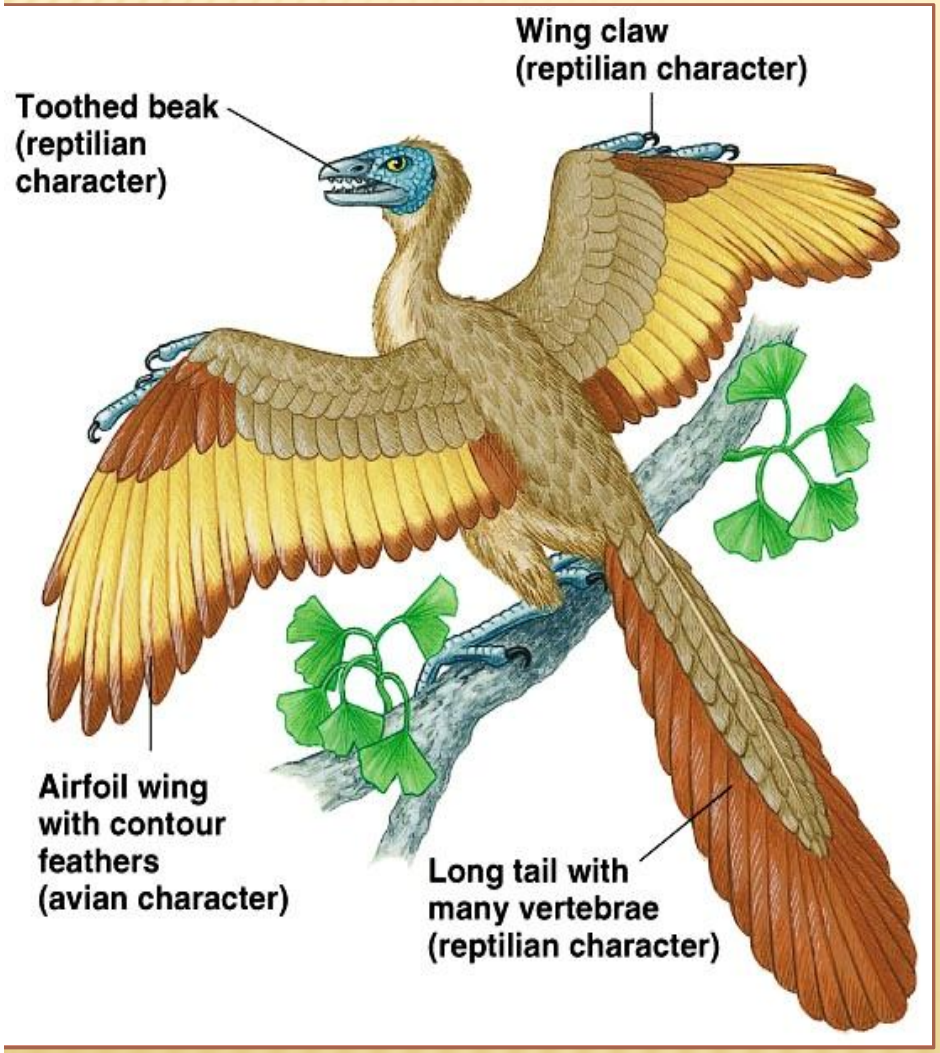
Climbing Foot. Woodpeckers have sharp, curved claws that help them to climb and to clutch the bark of trees. Two toes point forward, and two point backward.

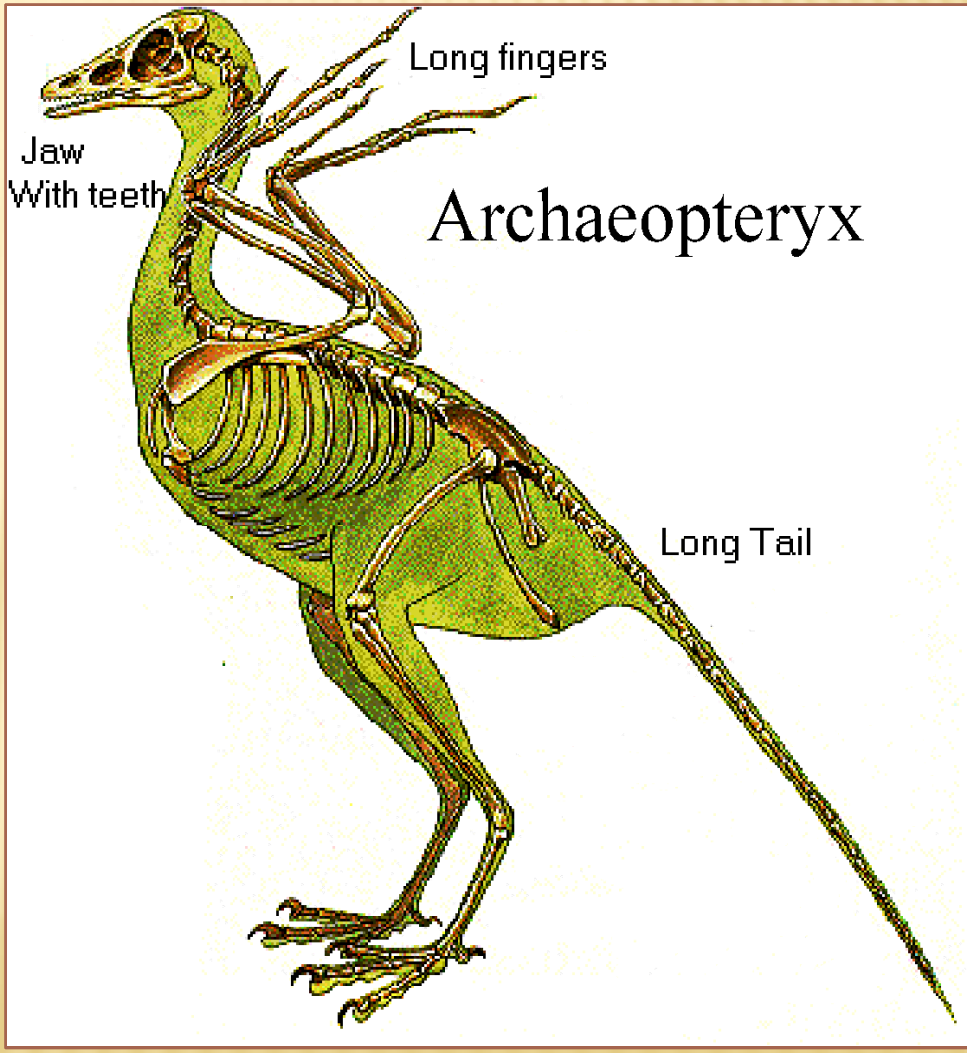
Grasping Foot. Hawks and owls have sharp, curved claws, or talons, with which to catch their prey. They use their strong claws to crush their victims, and to carry them away.

Perching Foot. All songbirds, or perching birds, have three toes pointing forward and one pointing backward. Such birds clamp their toes around a branch twig.

Mechanism of Perching: The arrangement of many bird's foot and leg tendons is such that when their leg is bent as they rest on the perch, the toes are pulled tightly around the perch without the bird having to exert any extra energy. Aside from momentum, this is another reason they straighten their legs a bit and actually jump off the perch when leaving; they have to change the position of their legs to release the tension of the tendons. It allows them to sleep while perched without falling.

RESTORATION OF ARCHEOPTERYX





ARCHAEOPTERYX, THE CONNECTING LINK

Archaeopteryx , sometimes referred to by its German name *Urvogel* ("original bird" or "first bird"), is a genus of bird-like dinosaurs that is transitional between non-avian feathered dinosaurs and modern birds.
A particulary important and still contentious discovery is *Archaeopteryx lithographica*, found in the Jurassic Solnhofen Limestone of southern Germany, which is marked by rare but exceptionally well preserved fossils. *Archaeopteryx* is considered by many to be the first bird, being of about 150 million years of age. It is actually intermediate between the birds that we see flying around in our backyards and the predatory dinosaurs like *Deinonychus*. In fact, one skeleton of *Archaeopteryx* that had poorly preserved feathers was originally described as a skeleton of a small bipedal dinosaur, *Compsognathus*. A total of seven specimens of the bird are known at this time.

Fossil of complete Archaeopteryx, including indentations of feathers on wings and tail discovered in Germany in 1860

SEE YOU NEXT TIME

THANKS

Uploaded on 16-01-2019

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Aug, 2018