UG CBCS Semester-II (Chordata)

Aves: The Birds

Distinctive Characters

Birds constitute a well-defined group of vertebrate animals. As a class they form a more homogeneous group than any other class of vertebrates. They possess a series of strongly marked characters such as distinguish hardly any other class. The diagnostic features of birds are:

1. Feather-clad, air-breathing, warm-blooded, oviparous, bipedal flying vertebrates.
2. *Body* is more or less spindle-shaped and divisible into four distinct regions: head, neck, trunk and tail. law bones prolonged into a toothless *beak* or *bill Neck* is long and flexible. *Tail* is short and stumpy.
3. *Limbs* are two pairs. Forelimbs are modified as *wings* for flying. Hind limbs or legs are large, and variously adapted for walking, running, scratching, perching, food capturing, swimming or wading, etc. Each foot usually bears four clawed toes, of which the first or *hallux* is directed backwards.
4. *Exoskeleton* is epidermal and horny, represented by (i) *feathers* forming a nonconducting body covering for warmth, (ii) *scales* on the legs, similar to those of reptiles, (iii) claws on the toes, and (iv) sheaths on the beaks.
5. *Skin* is dry and devoid of glands except the *oil* or *preen gland* at the root of tail.
6. *Pectoral muscles* of flight are well developed.
7. *Endoskeleton* fully ossified, light but strong and without epiphyes. Long bones pneumatic or hollow and have no marrow. Usually, there is a fusion of bones.
8. *Skull* smooth and *monocondylic,* bearing a single occipital condyle. Cranium large and dome-like. *Sutures* indistinct.
9. *Lower jaw* or *mandible* consist of 5 or 6 bones and articulates with quadrate.
10. *Vertebral column* short. Centra of vertebrae *heterocoelous* (saddle-shaped). Cervical vertebrae numerous, bear small cervical ribs. Some thoracic vertebrae fused together. A *synsacrum* results by fusion of posterior thoracic, lumbar, sacral and anterior caudal vertebrae. *Tail vertebrae* few, compressed laterally and the last 3 or 4 fused into a ploughshare bone, *pygostyle.*
11. *Sternum* large, usually with a vertical, mid-ventral *keel* for attachment of large flight muscles.
12. *Ribs* double-headed *(bicephalous)* and bear posteriorly directed *uncinate processes.*
13. Both clavicles and single interclavicle fused to form a V-shaped bone, called *furcula* or *wishbone.*
14. *Pelvic girdle* large, strong and fused with synsacrum throughout its length. Pubic and ischiatic symphyses lacking. Acetabulum perforated.
15. Proximal carpals free. Distal carpals fuse with three metacarpals to form *carpometacarpus.*
16. Proximal tarsals and tibia fused to form *tibiotarsus.* Distal tarsals fused with II, III and IV metatarsals to form *tarso-metatarsus.* 1 metatarsal remains free.
17. *Ankle joint* is inter-tarsal.
18. Oesophagus is frequently dilated into a crop for quick feeding and storage. Stomach divided into a glandular *proventriculus* and muscular *gizzard.* Junction of small intestine and rectum marked by a pair of *rectal caeca.* A three-chambered *cloaca* present.
19. *Heart* completely 4-chambered. There is neither sinus venosus nor truncus arteriosus. Only *right aortic (systemic) arch* persists in adult. *Renal portal system* vestigial. Red blood corpuscles nucleated.
20. Birds are the first vertebrates to have *warm blood.* Body temperature is regulated *(homoiothermous).*
21. Respiration by compact, spongy, nondistensible *lungs* continuous with thin-walled *air-sacs.*

22. *Larynx* without vocal cords, A sound box or *syrinx,* producing voice, lies at or near the junction of trachea and bronchi.
23. *Kidneys* metanephric and 3-lobed. *Ureters* open into cloaca. *Urinary bladder* absent. Birds are *urecotelic.* Excretory substance of urates eliminated with faeces.
24. *Brain* large but smooth. Cerebrum, cerebellum and optic lobes greatly developed. *Cranial nerves* 12 pairs.
25. *Olfactory organs* poor. Middle ear contains a single ossicle. *Eyes* large and possess nictitating membranes, sclerotic plates and a vascular pecten.
26. *Sexes* separate. *Sexual dimorphism* often well marked. Male has a pair of abdominal *testes* and a pair of sperm ducts. A copulatory organ absents except in ratites, ducks, geese, etc. Female has a single functional left *ovary* and *oviduct.*
27. Fertilization internal, preceded by copulation and courtship. Females *oviparous.* Eggs large with much yolk and hard calcareous *shell.*
28. Eggs develop by external *incubation.* Cleavage discoidal, *meroblastic.* Development direct. *Extra-embryonic membranes* (amnion, chorion, allantois and yolk-sac) present.
29. Newly-hatched young fully formed *(precocial)* or immature *(altricial).*
30. *Parental care* is well marked.

Classification of Aves

Birds show less diversification than any other group of vertebrate animals. This singular uniformity of structure is imposed upon them by the demands of flight. The great homogeneity of birds, therefore, fails to present convenient external features, such as the teeth of mammals, for their classification. About 9,000 living species of birds are known at present 25 to 30 avian orders are recognized depending on the taxonomist. According to Wetmore (1960), there are 34 orders, 27 orders of living birds of which two have recently become extinct, and 7 orders of fossil birds. To define each order adequately is beyond the scope of this book, so that, we shall list only the more economic groups. The names of orders end in *'formes',* which means 'form'. Class *Aves* is first divided into two subclasses as follows:

Sub-class I. Archaeornithes (Gr., *archios,* ancient+*ornithos,* bird).

Extinct, archaic, Jurassic birds of Mesozoic Age, about 155 million years ago. Wings primitive, with little power of flight. Tail long, tapering, with more than 30 vertebrae, lizard-like, bearing two lateral rows of rectrices. Each hand bearing three unfused and clawed fingers. Skull with teeth in both jaws, embedded in sockets (alveoli). Vertebrae amphicoelous. Tail with 18-20 free caudal vertebrae, without pygostyle. Sternum without a keel. Carpals and metacarpals free. Thoracic ribs slender, without unicinate processes. Abdominal ribs present. Cerebellum small. This sub-class includes a single order.

Order Archaeopterygiformes

Example: *Archaeopteryx lithographic a,* from Jurasic of Bavaria, Germany; one specimen lying in the British museum, London, the other lying in the Berlin Museum, Berlin.

Sub-class II. Neornithes (Gr., *neos,* modern+*omithos,* birds)

Modern as well as extinct post-Jurassic birds. Wings usually well-developed and adapted for flight, with few exceptions. Tail short and reduced, caudal vertebrae 13 or even less, with rectrices arranged in a fanlike manner. Wing composed of 3 partly fused fingers without claws. Teeth absent except in some fossil birds. Vertebrae heterocoelous in living forms. Few caudal vertebrae free. Rest fused into a pygostyle. Sternum usually with a keel. Distal carpals fused with metacarpals to

form carpometacarpus. Thoracic rtbs usually with uncinate processes. Abdominal ribs absent. Cerebellum large. The sub-class is divisible into 4 super-orders:

Super-order 1. Odontognathae (Gr., *odontos,*teeth)

Extinct, Upper Cretaceous birds. Jaws bear teeth, "so advantageous for catching fish." Brain of the avian type.

Order 1. Hesperornithlformes

Large flightless marine birds. Sharply pointed pleurodont teeth, present in grooves rather than in sockets. Vertebrae amphicoelous. Shoulder girdle reduced. Sternum without a keel.

Examples: *Hespemmis, Enaliornis, Baptornis,* etc.

Order 2. Ichthyornithiformes

Whether teeth were present is not definite. Neck vertebrae amphicoelous. Shoulder girdle well-developed. Sternum with a well-developed keel. Examples: *Ichthyomis, Apatcrnis.*

Super-order 2. Palaeognathae or Ratitae (Gr., *palaios* old + *gnathos* jaw; L., *ratis,* raft)

Modern big-sized, flightless, running birds, without teeth. Wings vestigial or rudimentary; feathers devoid of interlocking mechanism. Rectrices absent or irregularly arranged. Pterylae are irregular. Oil gland is absent, except in Tinamus and Kiwi. Skull is dromaeognathous or palaeognathous that is, vomer is large and broad and interpolated between palatines. Skull sutures remain distinct for long time. Quadrate articulates by a single head with skull. Sternal keel vestigial, absent or flat, raft-like. Uncinate processes are vestigial or absent. Tail vertebrae free. Pygostyle small or absent. Scapula and coracoid are comparatively small and fused at an obtuse angle (more than a right angle). Clavicles are small or absent. Ilium and ischium not united posteriorly except in Rhea and Emu. Pectoral muscles poorly developed. Syrinx is absent. Male has a large and erectile penis; female has a clitoris. Young are precocious. Distribution is restricted. The flightless birds or rallies are not represented in India. They are grouped in 7 orders as follows:

Order 1. Struthioniformes (Gr., *struthio,* ostrich+form)

Legs strongly developed, each with two toes (3rd and 4th) with stunted nails. Flightless, terrestrial birds. Pubis form a ventral symphysis. Sternum lacks keel. Pygostyle absent. Head, neck and legs sparsely feathered. Feathers without aftershaft. Examples: True ostriches *(Struthio camelus)* of Africa and western Asia (Arabia).

Order 2. Rheiformes (Gr., *Rhea,* mother of Zeus+form)

Each leg bears three clawed toes. Ischia form a ventral symphysis. Sternum lacks keel. Head and neck partly feathered. Feathers lack aftershaft. Examples: American ostriches _ or common rhea *(Rhea americana)* represented by two species in South American pampas; Darwin's rhea *(Pteroneemia pennata).*

Order 3. Casuariformes (NL., *Casuarius,* genus of cassowary+form)

Forelimbs greatly reduced. Head bears a comb-like structure. Neck and body densely feathered. Feathers with aftershaft nearly equal to shaft. Examples: Cassowaries *(Casuarius)* of Australia, and New Guinea and Emus *(Dromaius novaehollandiae)* of New Zealand.

Order 4. Apterygiformes (Gr., a, *not+pteryx,* wing+form)

Feathers simple, hair-like or bristle-like. Wings vestigial. Long bill with nostrils near the tip.

Examples: Kiwis *(Apteryx)* of New Zealand.

Order 5. Dinornithiformes

Giant birds, became extinct nearly 700 years ago. Wings almost absent, beaks short and massive legs bearing four toes each. Examples: Moas (*Dinornis maximus)* of New Zealand.

Order 6. Aepyornithiformes
Recently exterminated, rather later than moas. Wings tiny, but legs powerful and 4-toed. Coracoid, scapula and wing bnes reduced or absent. Hind limbs massive. Feathers with large aftershaft. Examples: Giant Elephant-birds of Africa and Madagascar. *Aepyorms man, Mulleomis.*
Order 7. Tinamiformes (NL., *tinamus,* genus of tinamou+form)
Small terrestrial birds, not flightless but essentially great runners (cursorial). Sternum is keeled. Pygostyle reduced. Eggshells with high gloss. Examples: Tinamous *(Tinamus), Eudromia.*

Super-order 3. Impennae
Order 1. Splieulsclfornies (Gr., *spheniscus,* wedge + form)
Modern, aquatic, flightless, with paddle-like wings or flippers. Feet are webbed. Feathers small, scale like, covering entire body. Thick layer of fat beneath skin. Nest in colonies or rocky islands or ice. Examples: Penguins *(Aptenodytes)* of Southern Hemisphere.

Super-order 4. Neognathae or Carinatae (New jaw or L., *carina,* a keel)
Most modern, usually small-sized, flying birds. Wings well-developed, feathers with interlocking mechanism. Rectrices present and arranged regularly. Pterylae are regular. Oil gland is present. Skull is neognathous, that is, vomer is short allowing palatines to meet. Skull sutures disappear very early. Quadrate is double-headed. Sternum with a well-developed keel. Uncinate processes are present. Pygostyle is present. Scapula and coracoid meet at a right angle or acute angle. Clavicles are always well developed. Ilium and ischium are united posteriorly. Pectoral muscles large. Male has no copulatory organ. Young are altricious. Distributed all over the world. The super-order Neognathae includes several orders. For the sake of study, they may be grouped into at least 6 homogeneous ecological groups, as follows:
Group A. **Arboreal Birds**
Under this group may be placed the majority of birds spending most of their lives in and around shrubs and trees.
Order 1. Passeriformes (L,, *passer,* sparrow + form)
This is the largest of all the bird orders including half the known species. Feet are - adapted for perching, while beaks are adapted for cutting. Examples: Common house sparrow *(Passer domestic us),* common house crow *(Corvus splendens),* indian jungle crow *(Corvus macrorhynchos),* common myna *(Acridotheres tristis),* bank myna *(Acridotheres ginginianus),* Indian robin *(Saxicoloides fulicata),* flycatchers *(Muscicapa),* swallows, bulbuls *(Molpestes).*
Order 2. Piciformes (L., *picus,* wood pecker + form)
It includes woodpeckers, toucans, sap-suckers and their allies. Examples: Yellow fronted pied woodpecker *(Dendrocopos mahrattensis),* golden-backed woodpecker *(Dinopium benaghalensis)*
Order 3. Columbiformes (L,, *columba,* dove + form)
It includes doves and pigeons. Examples: Blue rock pigeon *(Columba livia),* green pigeon *(Crocopus),* crowned pigeon *(Goura cristata),* passenger pigeon *(Ectopistes migratorius),* ringed turtle dove *(Streptopelia risoria),* spotted dove *(Streptopelia chinensis),* extinct dodo *(Raphus)* and solitaire *(Pezophaps).*
Order 4. Psittaciformes (L., *psitacus,* parrot + form)
It includes parrots, parakeets, cockatoos, macaws, love-birds, etc., denizens of the equatorial jungles. Examples: Large Indian parakeet *(Psittacula eupatria),* green parrot *(Psittacula krameri),* budgeriger *(Melopsittacus).*

Group B. **Terrestrial Birds**

These birds are perfectly able to fly but spend most of their time walking or running on ground.

Order 5. Galliforines (L,, *gallus,* a cock + form)

It includes gamebirds notable for their palatability, massive scratching feet, short and powerful flight and largely graminivorous diet. Examples: Red jungle fowl *(Gallus),* peafowl *(Pavo cristatus),* quail *(Cotrunix coturnix),* grey partridge *(Francolinus pondicerianus*), chukor *(Alectoris grecca),* pheasants *(Phasianus).*

Order 6. Cuculiformes (L., *cuculus,* cuckoo + form)

It includes cuckoos and their allies. Examples: Cuckoo (*Cuculus canorus),* Koel *(Eudynamis scolopaceous),* crow-pheasant *(Centropus sinensis).*

Group C. **Swimming and Diving Birds**

Order 7. Anseriformes (L., *anser,* goose + form)

Aquatic birds such as geese, swans and ducks belong to this order. Examples: Wild duck or mallard *(Anas),* common teal *(Nettion crecca*), bar-headed goose *(Anser indica),* swan *(Cygnus).*

Order 8. Coraciiformes (Gr., *korax,* crow or raven + form)

It includes kingfishers and their allies. Examples: White breasted kingfisher *(Halcyon smyrnensis).* pied kingfisher *(Cetyle rudis),* great hombill *(Dichoceros bicornis),* grey hornbill *(Tochus birostris),* hoopoe *(Upupa epops).*

Order 9. Gaviiformes (L,, *gavia,* sea mew + form)

It includes marine birds, called loons *(Gavia)* represented by only four species.

Order 10. Podkipediformes or Colymbiformes (Gr., *kolymbos,* diving bird)

It includes grebes *(Podicipes),* often called divers because of their habits.

Order 11. Procellartformes (L., *procella,* a tempest + form)

It includes tube-nosed, long and oily winged sea-birds such as albatrosses (*Diomedea).* Petrels *(Procellaria),* shearwaters.

Order 12. Pelecaniformes (L,, *pelicanus,* pclican + form)

It includes pelicans, darters, ganncts and cormorants. Examples: Pelicans *(Pelecanus),* little cormorant *(Phalacrocorax niger),* Indian darter *(Anhinga melanogaster).*

Group D. **Shore Birds and Wading Birds**

These aquatic birds seldom swim or dive beneath the water to any great extent.

Order 13. Charadriiformes (NL., *charadrius,* genus of plovers + form)

This order includes a rather diverse group of water frequenting shore birds characterized by long wading legs, webbed toes and mudprobing beaks. Examples: Red wattled lapwing *(Lobivanellus indicus),* pheasant-tai led jacana (*Hydmphasianus chirugus),* sand piper *(Tringa glariola).*

Order 14. Ciconiiformes (L., *ciconia,* a stork + form)

It includes long-legged, marshy wading birds with long snake-like neck and javelin or pincer-like beak for piercing their aquatic prey. Examples: Cattle egret *(Bubulcus ibis),* heron *(Ardea hemdias),* night heron *(Nycticorax),* spoonbill *(Platalea leucorodia).* stork *(Ciconia),* flamingo *(Phonicopterus).*

Order 15. Gruiformes (L. *grus,* crane + form)

It includes cranv like wading birds with long legs and partially webbed feet. Examples: Common coot (*Fulica atra*), sarus crane (Antegone *antegone),* bustard *(Choriotis*) rail.

Group E. **Birds of Prey**

Order 16. Falconifortnes (L. *falco*, falcon + form)

The diurnal birds of prey with sharp hooked beaks and strong curved claws are as follows:

Examples: Common pariah kite *(Milvus migrans*), brahminy kite *(Haliaster indus),* sparrow hawk *(Asiur badius),* white backed vulture (*Pseudogypus bengalensis*)*,* king vulture (*Sarcogyps* calvus).

Order 17. Strigiformes (Gr., *strix,* owl + form)

It includes owls which are nocturnal birds of prey characterized by large heads, huge yellow frontal eyes and powerful grasping feet feathered upto toes. Examples: Brown fish owl *(Ketupa zeylonensis),* great horned owl *(Bubo), Tylopus.*

Group F. **Aerial Birds**

These birds are mostly on wing, and have weak or vestigial perching feet.

Order 18. Micropodiformes or Apodiformes (Gr., *apous,* footless + form)

Includes swifts and humming birds. Examples: Indian swift *(Micropodus),* palm swift *(Cypsiurus).*

Order 19. Caprimulgiformes (L., *caprimulgus,* goat sucker + form)

It includes shy, nocturnal, insectivorous birds such as night hawks *(Chordeiles),* whippoorwills *(Phaelaenoptilus),* goat suckers *(Caprimulgus).*

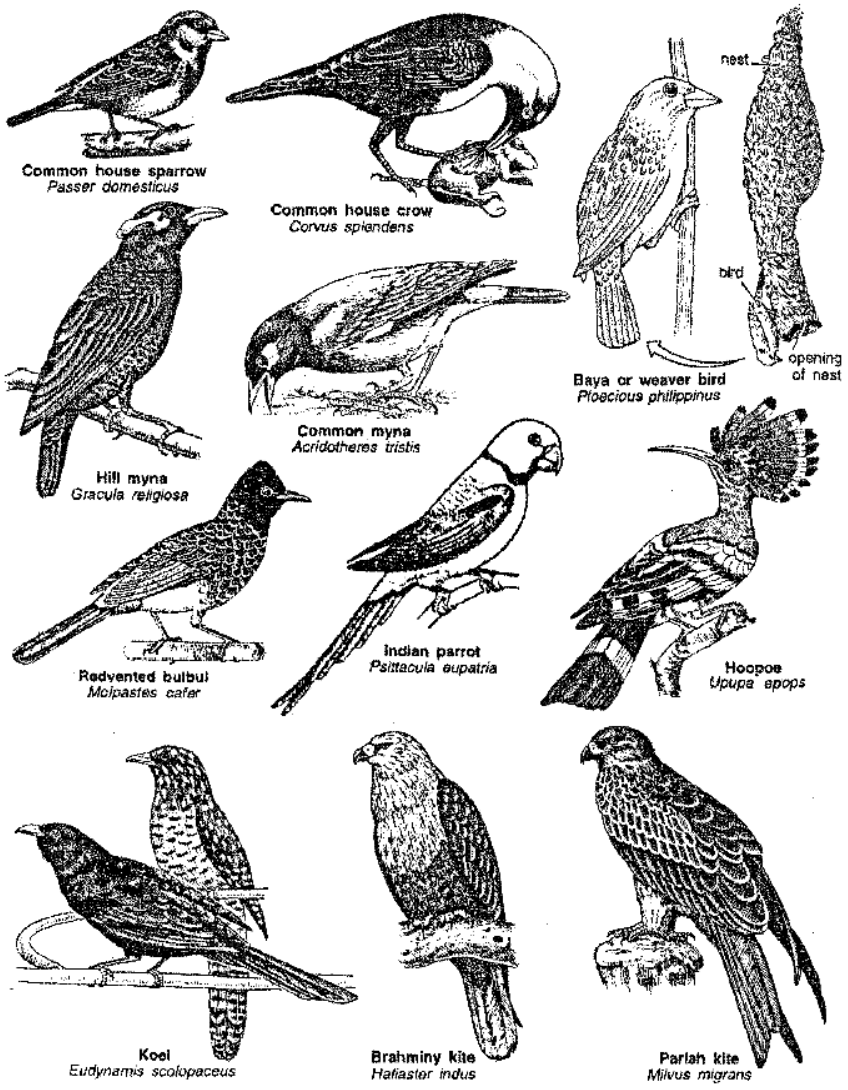

Fig. 1. Some common Indian birds.

References:

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