SUBJECT	ZOOLOGY
PaperNo. And Title	II AnimalDiversity-II
Module No. and Title	**Aves**
Module tag	DBF-ZOO-AVES
Key words	Archiornithes,Neornithes

Dr.Laxmi Chandrakant Mushan

Associate Professor

DBF Dayanand College of Arts and Science Solapur

Class-Aves

Learning outcome:

- Group animals on the basis of their morphological characteristics/ structures.
- Develop critical understanding how morphological change due to change in environment helps drive evolution over a long period of time.

Develop understanding on the diversity of birds and their flight mechanism.

Table of contents

Introduction

The class Aves includes the birds. They have become highly modified due to an aerial life and show many differences from reptiles.

Aves General characters:

- Body is boat shaped and divisible into head, neck and tail.
- Skin is thin and dry except oil glands on tail. It is covered by an epidermal horny exoskeleton of feathers all over and of scales on the feet.
- Endoskeleton is fully ossified but they are delicate and light due to air cavities and sacs or spongy nature.
- The skull has single occipital condyle and large cranial cavity.

- There are two pairs of limbs. Forelimbs are modified into wings for flight and bear 3 digits each.
- The hindlimbs are large, strong and adapted for perching, walking or swimming.
- Mouth has wide gap. Alimentary canal leads into a cloaca.
- Lungs are spongy and continued into airsacs.
- Heart is four chambered. Brain is large.
- Eyes are well developed with large pectin. They have sclerotic ossicles. Sense of smell is usually poor.
- Kidneys are metanephric. Urinary bladder absent. Ureters open into cloaca.
- Sexes are separate, fertilization is internal birds are oviparous.
- Eggs are large, calcarious shell membrane and needs incubation.
- Birds are homiothermic animals.

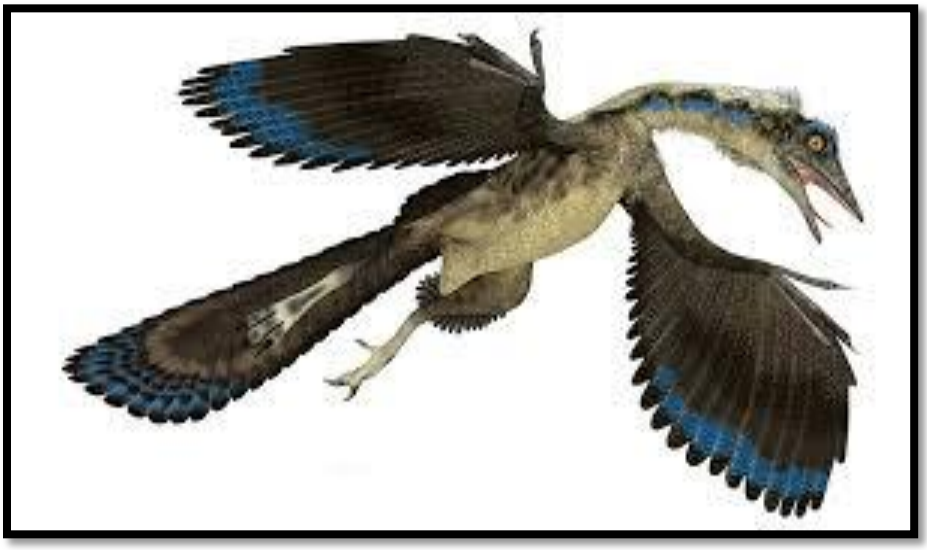
Classification of Aves upto orders

- The class Aves is divided into 2 subclasses: Archaemithes (i.e. ancient bird) and Neomithes (i.e. new modern birds).

Subclass 1. Archaeomithes:

- The bird were primitive and now extinct.
- They are connecting link between reptiles and birds.
- Both jaws had teeth in sockets. Wings had 3 digits with claws and feathers.
- Bones were solid and no air spaces. Tail was long having many vertebrae.
- Vertebrae were amphicoelous. There was no pygostyle.

- Example: Archaeopteryx



Subclass 2. Neomithes:

- This subclass includes all extinct and living birds.
- Jaw lack teeth. Tail short, phygostyle present.
- Carpels and metacarpels fuse to form a carpometacarpus.
- Forelimb form wings having three digits without claws. Sternum is well developed.
- The subclass divided into superorders.

Superorder 1. -Palaeognathae (Ratitae).

- They are called flightless or running birds.
- Wings are reduced, feathers are primitive, they are curly.
- Sternum is raft shaped with no keel. Tail vertebrae are free.
- Hindlimbs are long and strong.
- Oil gland is usually lacking.
- Male and female has a copulatory organs.

- The superorder Palaeognathae is divided into 5 orders.

Order 1 Struthioniformes:

- Only 2 toes 3rd and 4th on each foot.
- Head , neck and legs are sparsely feathered.
- Neck is very long. Pubic symphysis is present.
- Feathers plume-like, body heavy, tail is short.
- Hind limbs are long powerful adapted for running.
- Ex: Struthio (Ostrich).

Order 2. Rheiformes (Rheas):

- Hindlimbs are powerfull with 3 digits having claws.
- Slow running birds.
- Head and neck are partly feathered. Feathers are without aftershaft.
- Clavicle are absent.

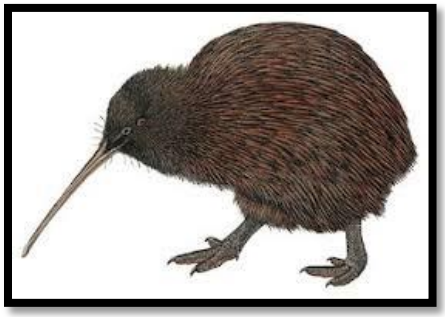
Ex: Rhea.

Order 3: Casuariiformes:

- Three toes on each foot. Neck and body are densly feathered.
- Feathers have aftershaft which is almost equal to the main shaft.
- Example: Dromaeus.

Order 4. Apyterygiformes (Kiwis).

- Beak is long and slender with terminal nares.
- There are four toes to each foot.
- Feathers are hair-like without airshaft.
- Ex: Apteryx (Kiwi).



Order 5: Tinamiformes:

- Wings are capable of flight.
- Sternum has keel.
- Small pygostyle is present.
- Ex: Tiamus.

Superorder 2. Impennae (Penguins).

- Feathers are small scale-like and densely cover the entire body.
- Forelimbs (wings) are modified into paddles or flippers for swimming.
- Thick layer of fat under the skin to prevent loss of heat. No air sacs.
- Feet are strongly webbed and have four toes, all directed forward.
- They are gregarious.
- Body sleak and streamlined adapted for swimming and diving.

Order : Sphenisciformes: Ex: Aptenodyte

Super order 3: Neognathae (Carinatae).

- Wings are well developed. Barbs of feathers bear interlocking hooks.
- Sternum has long keel. Clavicle and interclavicle is fused to for furcula.
- Tail is small with pygostyle. Oil gland is present. Feet and beak are variously modified. They are all flying birds.
- This superorder is divided into 21 orders.

Order 1: Gaviformes:

- Neck is long. They are aquatic birds.
- Feet are short and present at the end of the body.
- Toes are fully webbed. These birds are strong fliers, good divers and picivorous.
- Ex: Gavia

Order 2: Podicipitiformes:

- They are freshwater birds and cosmopolitan.
- Legs are placed far back on the body. Toes are lobate, tail with tuft of downy feathers.
- They are good divers , feed on aquatic animals and build floating nests.

- Ex: Podiceps . 

Order 3: Procellariiformes.

- They are marine birds.
- Wings are long and narrow.
- Hallux is vestigial or lacking.
- Feathers are compact and oily. Ex: Diomedia.

Order 4: Pelecaniiformes:

- They are aquatic.
- All four toes are included in the web.
- Beak is long with gape to catch and swallow struggling prey.
- They are good divers and feed on fish.

- Ex: Pelecanus.

Order 5: Ciconiiformes (Herons, storks)

- Beak and legs are long. Vestigeal web or lacking except Flemings. Nests in colonies and they are good fliers. These birds feed on fish and aquatic animals in marshes and mudflats.
- Ex: Ardea (Gery heron).

Order 6: Anseriformes (Ducks, Geese)

- Aquatic birds and cosmopolitan.

  Beak flat, covered with cornified epidermis containing special tactilereceptor. Transverse horny ridges or lamellae on the margins of beak.

  Legs are short, toes webbed, tail small.

Ex: Anser .

Order 7: Falconiformes (Kites, Hawks).

- They are diurnal birds of prey found all over the world. Beak strong, hooked for tearing the prey. Toes bear sharp curved claws for catching and carrying the prey. Predaceous bird. Ex: Milvus (Kite).

Order 8: Galliformes (Fowl, Turkeys).

- Beak short, feet are large and adapted for scratching and running.
- They are terrestrial and palatable, usually graminivorous but also insectivorous.
- Many are gregarious and several have domesticated. Their flight is powerful but short.

- Ex: Gallus (Domestic fowl).

Order 9: Gruiformes (coots, cranes).

- Habitants of marshy places. Adapted for running ,swimming and diving.
- They are flightless birds. Ex: Fulica (Coot)

Order 10: Charadriiformes.

- They occur all over the world. They are shore dwellers or waders. Toes are usually webbed a base. Feathers dense and firm.
- Legs are usually long, wings strong.

Ex: Larus (Browm headed gull).

Order 11. Columbiformes (Pigeons and Doves).

- Beak short, slender bears case on the base.
- Tarsus shorter than the toes. Crop is large and secretes ‘Pigeons milk’. Ex: Columba .

Order 12: Psittaciformes (Parrots).

- Beak curved, adopted to husk the fruits and to tear dead bark, it is stout, sharp edged. Upper beak articulated with frontal bone of skull.

- Feet adapted for grasping. These birds are gregarious.

  Ex: Psittacula.

Order 13: Cuculiformes (Cuckoos).

- Beak is of moderate size.

- Zygodactylus feet. But not used for grasping. Tail is long.

  Ex: Eudynamis (Koel).

Order 14: Strigiformes (Owl)

- Head is large and rounded. Eyes are large, immovable , directed forwards, each surrounded by a ring or radiating feathers.

- Beak is short and hooked, claws are stout and sharp. Nocturnal and predator birds, prey is swallowed entirely .

- Ex: Tylo (Barn Owl).

Order 15: Caprimulgiformers (Nightjars).

- Beak is small and delicate. Mouth is wide and often bordered by sensory , bristle like feathers.
- Plumage soft and loose. Legs are weak, they are nocturnal insectivorous birds.

Ex: Caprimulgus

Order 16: Apodiformes

- Beak is small, weak but long and slender in humming bird.

- Legs are very short. Insectivorous and catch prey during flight. They fly fast.

Ex: Micropus. 

Order 17: Coliiformes (Mousebirds)

- They are confined to Africa.
- First and fourth toes are reversible.
- Tail is very long. They feed on fruits and insects.
- They creep on the tree branches using beak and peculiar feet.
- Ex: Colius

Order 18: Trogoniformes

- Beak is short, stout and bristles at the base.
- Feet are small and weak.
- Plumage is soft and loose.
- Ex: Trogon

Order 19: Corecaciiformes

- Third and fourth toes are fused at the base.
- Such feet are called Syndactylous.

Beak is strong.

Ex: Halcyon

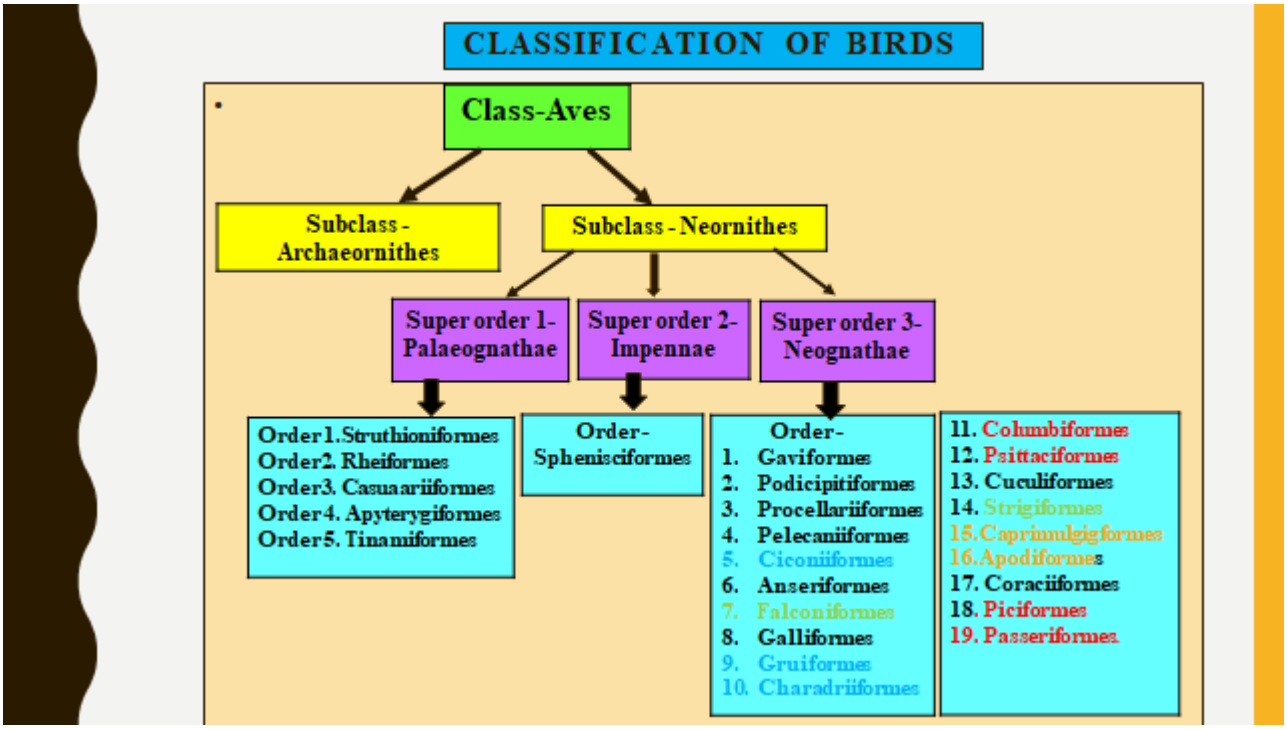
Order 20: Piciformes (Woodpecker).

- Birds have zygodactylous feet.
- Beak is stout and strong.
- Insectivorous birds.
- Ex: Brachypternus.

Order 21: Passeriformes.

- Feet are adapted for perching with hallux facing back, other toes in front.
- Toes are neither reversible nor fused.
- Beak is small.
- Youngs are naked at hatching.
- Ex: Passer (House sparrow).

Summary



Links:

https://docs.google.com/presentation/d/1sOITz5J9QbF99GTreP6u1Gp3Mxs8MoYS/edit#slide=id.p1

Explore more:

• Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.

• Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press

. • Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw- Hill.

Assessment

Units	Out-of –class activity Details of Activity	In-class activity Details of Activity	Assessment
1.1	Students should observe the specimens	Discussion on the topic Check the level of understanding through Question – answer session	Question – answer session
1.2	Students should classify the specimen Students should observe characters and identify birds	Discussion on the topic Check the level of understanding through Question – answer session Help students to apply the knowledge	Question to write in detail classification with examples