UG CBCS Semester-II (Chordata)

Pisces

The superclass *Pisces* (L., *piscis,* fish) of the truly jawed vertebrates (Gnathostomata) includes all the fishes which are essential aquatic forms with paired fins for swimming and gills for respiration.

General Characters of Superclass Pisces

1. Aquatic, marine or freshwater, herbivorous or carnivorous, cold-blooded, oviparous or ovoviviparous vertebrates.
2. Body usually spindle-shaped, streamlined and differentiated into head, trunk and tail. A neck is absent.
3. Locomotion by paired pectoral and pelvic fins along with median dorsal and caudal fins, supported by true dermal fin rays. Muscular tail used in propulsion.
4. Exoskeleton of dermal scales, denticles or bony plates covering body surface.
5. Endoskeleton cartilaginous or bony. Jaws are hinged. Notochord more or less replaced by true vertebrae.
6. Muscles arranged into segments called myotomes, with separate dorsal and ventral parts.
7. Alimentary canal with definite stomach and pancreas and terminates into cloaca or anus.
8. Respiration by gills. Gill-slits 5 to 7 pairs, naked or covered by an operculum.
9. Heart 2-chambered (1 auricle, 1 ventricle) and venous or single circuit. Sinus venosus, renal and portal systems present. Erythrocytes nucleated. Poikilothermous.
10. Kidneys mesonephric. Excretion ureotelic.
11. Brain with usual 5 parts. Cranial nerves 10 pairs.
12. Paired nasal sacs do not open into mouth. Tympanic cavity and ear ossicles lacking. Internal ear with 3 semicircular canals. Lateral line system well developed.
13. Sexes separate. Gonads typically paired. Gonoducts open into cloaca or independently.
14. Fertilization internal or external. Female oviparous or ovoviviparous. Eggs large with much yolk. Extraembryonic membranes absent. Development usually direct without or with little metamorphosis.

Classification of Superclass Pisces

About 40,000 species of fishes are known. Various workers have provided different schemes of their classification. However, no classification has been universally accepted because of the confusion due to staggering numbers of fishes and great diversity in their shape, size, habits and habitat. Mueller (1844) was pioneer who gave first scientific classification of lower vertebrates. He divided fishes into six subclasses viz., 1. Dipnoi, 2. Teleostei, 3. Ganoidae, 4. Elasmobranchi 5. Marshipobranchi and 6. Leptocardii.

He included cyclostomes in Marshipobranchi and Cephalochordates in Leptocardii. Subsequently, cyclostomes were separated and placed in a class Myzontes by Agassiz. Later, noteworthy additions were made by workers like Boulenger (1904), Regan (1906), Jordan (1923) and Goodrich (1930). Perhaps the earliest best-known scheme of classification was provided by Berg (1940) who recognized seven classes of fishes as follows:

Class 1. Pterichthys
Class 2. Coccostei (extinct)
Class 3. Acanthodii (fishes)
Class 4. Elasmobranchii
Class 5. Holocephah

Class 6. Dipnoi (living)

Class 7. Teleostomi (fishes)

Subclass 1. Crossopterygii

Subclass 2. Actinopterygii

Romer (1959) included Elasmobranchii and Holocephalii as subclasses - into a single class *Chondrichthyes* for all cartilaginous fishes. Similarly, he put all bony fishes (Dipnoi, Teleostomi) under a single class *Osteichthyes,* which he divided into two subclasses: Sarcopterygii and Actinopterygii. Parker and Haswell (1960) have farther combined all the extinct jawed fishes under a single class: *Placodermi* or *Aphetohyoidea.* This simple division of superclass Pisces only into three classes—Placodermi, Chondrichthyes and Osteichthyes—has been followed more of less by all the eminent authors.

Table 1. **Comparison of Chondrichthyes and Osteichthyes.**

Characteristic	Chondrichthyes (cartilaginous fishes)	Osteichthyes (bony fishes)
1. Habitat	Mostly marine	Both marine and freshwater
2. Shape	Usually dorso-ventrally flattened	Usually bilaterally flattened
3. Caudal fin	Heterocercal	Homocercal or diphycercal
4. Pelvic fins	Usually posterior. In male form claspers for transferring sperms into genital tract of female	Usually anterior, sometimes posterior. Claspers absent. Whenever present not formed by pelvic fins
5. Mouth opening	Ventral on head. Large and crescentic	Terminal on head. Variable in shape and size
6. Gill openings	Usually 5 pairs of naked gill slits. No operculum	5 pairs of gill-slits covered by a lateral flap of skin called operculum, so that a single gill opening on either side
7. Spiracles	Usually 1st gill slit become spiracles which open just behind eyes	Spiracles are lacking
8. Cloaca	Between two pelvic fins lies midventrally common cloacal opening for alimentary, urinary and genital products	Cloaca absent. Anus and urinary and genital apertures open separately
9. Exoskeleton	Separate dermal placoid scales	Overlapping dermal cosmoid, ganoid, cycloid or ctenoid scales
10. Endoskeleton	Wholly cartilaginous	Mostly bony
11. Jaw suspension	Hyostylic	Hyostylic and autostylic
12. Stomach	Typically J-shaped	Shape variable. Absent in some
13. Intestine	Short and with an internal fold or scroll valve in lumen	Long and without scroll valve
14. Rectal gland	Present	Absent
15. Liver	Generally has 2 lobes	Generally has 3 lobes
16. Type of gills	Lamellibranch with long interbranchial septum	Filiform with reduced interbranchial septum
17. Air (swim) bladder	Absent	Usually present
18. Conus arteriosus	Present in hert	Absent
19. Afferent branchial vessels	5 pairs from ventral aorta to gills	Only 4 pairs
20. Efferent branchial vessels	9 pairs	4 pairs
21. Brain	Primitive with larger olfactory lobes & cerbrum and smaller optic lobes and cerebellum	Advanced with smaller olfactory lobes and cerbrum and larger optic lobes and cerebellum
22. Restiform bodies	Present in brain	Absent
23. Ductus endolymphaticus	Open on top of head	Do not open to exterior
24. Retina	Lacks cones	Cones present
25. Accommodation of eye	Lens moved forward by protractor lentis muscle	Lens moved back by retractor lentis muscle
26. Ampullae of Lorenzini	Present	Absent
27. Male genital duct	Connected to anerior genital part of kidney	Not connected with kidney
28. Oviducts	Not connected to ovaries	Connected to ovaries
29. Urinary and genital apertures	United and urinogenital apertures lead into common cloaca	Separate and open independently to exterior
30. Fertilization	Internal	External in water
31. Eggs	Few, large with much yolk	Numerous, small with less yolk
32. Development	Internal in ovoviviparous types. Externally inside egg cases in oviparous types	Usually external without an egg case

References:

Kotpal RL (2009-2110). Modern Text Book of Zoology: Vertebrates (Animal Diversity – II). Rastogi Publications, India.