

Classification of phylum Chordata with its characters:

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The chordates form a large heterogeneous group of members differing widely from one another in many respects. Due to great diversity in chordate forms, different schemes of classification have been proposed by a number of taxonomists from time to time. The classification followed is simplified and is a synthesis of most recent classifications. Table 1.2 gives an outline classification of the phylum Chordata.

TABLE 1.2. OUTLINE CLASSIFICATION OF PHYLUM CHORDATA.				
Phylum Chordata	Group Acrania or Protochordata (Lower Chordata)	Subphylum *Hemichordata Subphylum Urochordata Subphylum Cephalochordata	Classes 1. Enteropneusta 2. Pterobranchia 1. Ascidiacea 2. Thaliacea 3. Larvacea 1. Leptocardii	
	Group Craniata or Euchordata (Higher Chordata)	Subphylum Vertebrata	Division Agnatha	
			Division Gnathostomata	Superclass Pisces
				Superclass Tetrapoda
			1. Ostracodermi 2. Cyclostomata 3. Placodermi 4. Chondrichthyes 5. Osteichthyes 6. Amphibia 7. Reptilia 8. Aves 9. Mammalia	Anamniota (Lower Vertebrata) Amniota (Higher Vertebrata)

*Subphylum Hemichordata is now considered to be an invertebrate group.

Phylum Chordata:

Widely diversified (differing) in size, habits and habitat, bilaterally symmetrical, metamerically segmented, triploblastic, coelomate deuterostomes. All the chordates possess a supporting skeletal rod or notochord, a hollow dorsal nerve cord and paired gill-slits at some stage of their life history which may persist, change or disappear in adults. Cambrian to Recent. About 50,000 species.

Phylum Chordata can be divided into two groups:

A. Acrania (Protochordata) and

B. Craniata (Euchordata) which show contrasting characters.

Group A. Acrania (Protochordata):

(Gr., a = absent; kranion = head or Gr., protos = first; chorde = cord). All are marine, small, primitive or lower chordates. No cranium, jaws, vertebral column, paired appendages. About 2,000 species. The Acrania is divided into three subphyla- Hemichordata, Urochordata and Cephalochordata.

Subphylum I. Hemichordata:

Gr., hemi = half; chorde = cord). Body divided into 3 regions- proboscis, collar and trunk. Notochord doubtful, short confined to proboscis and non-homologous with that of chordates.

Class 1. Enteropneusta:

(Gr., enteron = gut; pneustos = breathed). Body large and worm-like. Gill-slits numerous and paired. Alimentary canal straight. Acorn or tongue worms. Enteropneusts include 3 families, 15 genera and 70 species.

Examples- Balanoglossus, Saccoglossus, Ptychodera.

Class 2. Pterobranchia:

(Gr., pteron = feather; branchion = gill). Body small and compact. Gill-slits one pair or none, never U-shaped. Alimentary canal U-shaped. Pterobranchs include 2 orders, 3 genera and 20 species.

Examples- Cephalodiscus, Rhabdopleura.

Class 3. Planctosphaeroidea:

Transparent, round and specialised tomaria larva possessing extensively branched ciliary bands. Alimentary canal L-shaped. Planctosphaera pelagica is a representative of this class. This form is supposed to be specialised tomaria larva of some unknown hemichordate.

Class 4. Graptolita:

The fossil graptolites (e.g., Dendrograptus) were abundant in Ordovician and Silurian periods. These are often considered as an extinct colonial class of Hemichordata. Their tubular chitinous skeleton and colonial habits show an affinity with Rhabdopleura.

Subphylum II. Urochordata or Tunicata:

(Gr., oura = a tail; L., chorda = cord). Notochord and nerve cord in tail only in minute free-swimming tadpole larva. Adult sac-like, covered with tunic (test) often transparent; usually no notochord nerve cord reduced to ganglion; no coelom, segmentation or nephridia.

Class 1. Ascidiacea:

Sessile tunicates with scattered muscles in tunic. Solitary, colonial or compound. Gill-slits many; tunic well developed, permanent. Ascidiaceans or sea squirts. Include 3 orders, 12 families, 37 genera and 1,200 species.

Examples- Herdmania, Ciona and Molgula.

Class 2. Thaliacea:

Free-swimming or pelagic tunicates with circular muscle bands in tunic. Salpians and chain tunicates. Include 3 orders, 5 families, 9 genera and 30 species. Examples- Salpa, Doliolum, Pyrosoma.

Class 3. Larvacea or Appendicularia:

Tiny transparent, free-floating. Adults retain many larval features including tail. Only two gill-slits. Tunic not persistent. Include 2 orders, 2 families, 5 genera and 3 species.

Examples- Oikopleura, Appendicularia.

Subphylum III. Cephalochordata:

(Gr., kephale = head; L., chorda = cord). Notochord and nerve cord present throughout life along entire length of body. Include 1 class, 1 family, 2 genera and 30 species.

Class Leptocardii:

Body fish-like, segmented with numerous gill-slits. Free-swimming and burrowing. Lancets.

Examples- Branchiostoma (= Amphioxus), Asymmetron.

TABLE 1.3.**CONTRASTING CHARACTERS OF PROTOCHORDATA AND EUCHORDATA.**

Group A. Acrania (Protochordata)	Group B. Craniata (Euchordata) or Higher Chordata
1. Exclusively marine, small-sized chordates.	1. Aquatic or terrestrial, mostly large-sized vertebrates.
2. Appendages, head and exoskeleton absent.	2. Usually 2 pairs of appendages, well-developed head and exoskeleton present.
3. Coelom enterocoelic, arising from embryonic archenteron.	3. Coelom schizocoelic, arising by splitting mesoderm.
4. Notochord persistent. Skull, cranium and vertebral column absent.	4. Notochord covered or replaced by vertebral column. Skull and cranium well developed.
5. Pharynx having permanent gill-slits or gill-clefts. Endostyle present.	5. Pharyngeal gill-slits or gill-clefts persist or disappear. Endostyle absent.
6. Heart without chambers when present. Red blood corpuscles (RBCs) absent in blood.	6. Heart made of 2, 3 or 4 chambers. Blood contains RBCs.
7. Kidneys protonephridia.	7. Kidneys meso- or metanephridia.
8. Sexes separate or united. Reproduction asexual as well as sexual. Gonoducts usually absent.	8. Sexes separate. Only sexual reproduction Gonoducts always present.
9. Development indirect with a free-swimming larval stage.	9. Development indirect or direct, with or without a larval stage.

Group B. Craniata:

Aquatic or terrestrial, usually large-sized, higher chordates or vertebrates with distinct head, a vertebral column, jaws and brain protected by a cranium or skull. The craniata includes a single subphylum Vertebrata.

Subphylum IV. Vertebrata:

(L., vertebratus = backbone). Notochord supplemented or replaced by a vertebral column or backbone comprising of overlapping vertebrae. Body divisible into head, neck, trunk and tail. Usually dioecious. Vertebrata is the largest chordate subphylum including about 45,000 species.

The Subphylum Vertebrata is divided into two Superclass:

1. Agnatha and

2. Gnathostomata having contrasting characters given in Table 1.4.

TABLE 1.4. CONTRASTING CHARACTERS OF AGNATHA AND GNATHOSTOMATA.

Division I. Agnatha	Division II. Gnathostomata
1. True jaws absent.	1. True jaws present.
2. Paired appendages absent.	2. Paired appendages (pectoral and pelvic) present.
3. Internal ear with 2 semicircular canals.	3. Internal ear with 3 semicircular canals.
4. Notochord persistent in adults.	4. Notochord persists or replaced by vertebrae.

Superclass I. Agnatha:

(Gr., a = not; gnathos = jaw). lawless fish-like vertebrates without true jaws and paired limbs.

Class 1. Ostracodermi:

(Gr., ostrakon = shell; derma = skin). Several extinct orders of ancient primitive heavily armoured. Palaeozoic, world's first vertebrates, collectively called the ostracoderms.

Examples – Cephalaspis, Pteraspis, Birkenia, Thelodus.

Class 2. Cyclostomata:

(Gr., cyclos = circular; stoma = mouth). Body eel-like, long, cylindrical, skin smooth; without scales, jaws and lateral fins. Mouth rounded and suctorial. Gills 5 to 16 pairs. Heart 2-chambered. Parasites and scavengers. About 50 species.

Examples- Lampreys (Petromyzon) and hagfishes (Myxine).

Superclass II. Gnathostomata:

(Gr., gnathos = jaw; stoma = mouth). Jawed vertebrates having true jaws and paired limbs.

Gnathostomata has been further divided into two superclasses:

1. Pisces and

2. Tetrapoda.

All the fishes and fish-like aquatic gnathostomes in the superclass Pisces, whereas all the four-footed terrestrial gnathostomes in the superclass Tetrapoda.

Superclass 1. Pisces	Superclass 2. Tetrapoda
1. Exclusively aquatic gnathostome vertebrates.	1. Aquatic or terrestrial. Some arboreal and aerial.
2. Paired limbs, if present, as fins.	2. Paired pentadactyle limbs present.
3. Median fins present.	3. Median fins absent.
4. Skin usually moist and scaly.	4. Skin usually dry not cornified (without scales).
5. Respiration aquatic, by gills.	5. Respiration aerial, by lungs.
6. Sense organs functional in water.	6. Sense organs function in air.

Superclass 1. Pisces:

(L., piscis = fish). Fishes or fish-like aquatic forms with paired as well as median fins, gills and scaly skin.

Class 1. Placodermi:

Several extinct orders of primitive earliest jawed fishes of Palaeozoic with bony head shield. Placoderms. A full-sized functional gill-arch precedes hyoid arch.

Examples – Climatius, Dinichthys.

Class 2. Chondrichthyes:

(Gr., chondros = cartilage; ichthys = fish). Mostly marine. Cartilaginous endoskeleton. Skin with minute placoid scales. Gill-slits not covered with operculum. Mouth and 2 nostrils ventral. Males with claspers. Cartilaginous fishes. Approximately 600 species.

Examples-: Scoliodon (dogfish), Chimaera (ratfish).

Class 3. Osteichthyes:

(Gr., osteon = bone; ichthys = fish). Freshwater and marine. Bony endoskeleton. Skin having various types of scales (cycloid, ctenoid) other than placoid. Gill-slits covered with operculum. Males without claspers. Bony fishes. Approximately 20,000 species.

Examples – Labeo (rohu), Protopterus (lungfish), Hippocampus (sea horse).

Superclass 2. Tetrapoda:

(Gr., tetra = four; podos = foot). Land vertebrates with two pairs of pentadactyle limbs, cornified skin with lungs.

Class 1. Amphibia:

(Gr., amphi = both; bios = life). Larval stage usually aquatic and breathes by gills. Adults typically terrestrial and respire by lungs. Living forms with moist glandular skin, no external scales. Typically 2 pairs of limbs, nostrils connecting mouth cavity. Heart 3-chambered. Amphibians. Approximately 2,500 species. Examples- Rana (frog), Bufo (toad), Ambystoma (salamander).

Class 2. Reptilia:

(L., reptilis = covering). Terrestrial and aquatic tetrapods. Skin dry covered by ectodermal horny scales or scutes. Limbs typically 4, each with 5 clawed toes. Skeleton bony. Heart incompletely 4-chambered. Cold blooded. Respiration by lungs. Approximately 7,000 species.

Examples- Hemidactylus (wall lizard), Uromastix (spiny-tailed lizard), Naja (cobra), Sphenodon (tuatara), Crocodilus (crocodile).

Class 3. Aves:

(L., avis = bird). Body covered with feathers. Forelimbs modified as wings usually adapted for flight. Hindlimbs for walking, perching or swimming. No teeth in beak. Heart 4-chambered. Lungs compact, with air-sacs. Warm blooded. Birds. About 9,000 species.

Examples- Struthio (African ostrich), Columba (pigeon), Gallus (fowl).

Class 4. Mammalia:

(L., mamma = breast). Body usually covered with hair. Skin with various glands. Female with mammary glands which secrete milk for suckling the young. Heart 4-chambered. Warm blooded, air breathing vertebrates. Mammals. Approximately 4,500 species.

Examples- Echidna (spiny anteater), Macropus (kangaroo), Rattus (rat).
Homo (man).