

Features	Platyhelminthes (Flatworms)	Aschelminthes (Roundworms)	Annelida (Segmented or Ringed worms)	Arthropoda (Joint-legged animals)
<b>Grades of organization</b>	Organ & Organ system	Organ system	Organ system	Organ system
<b>Symmetry</b>	Bilateral	Bilateral	Bilateral	Bilateral
<b>Germ layers</b>	Triploblastic	Triploblastic	Triploblastic	Triploblastic
<b>Coelom</b>	Acoelomate	Pseudocoelomate	Coelomate	Coelomate
<b>Habit and habitat</b>	Mainly aquatic. Endoparasites. Some are free-living.	Aquatic and terrestrial. Free living or parasitic in plants & animals.	Terrestrial, fresh water or marine. Free living or parasitic.	Cosmopolitan
<b>Digestive system</b>	Incomplete	Complete. Tubular alimentary canal with well-developed muscular pharynx.	Complete	Complete
<b>Respiratory system</b>	Absent	Absent	<b>Cutaneous</b> respiration. Some have <b>branchial (gill)</b> respiration	<b>Gills/ book gills/ trachea/book lungs</b>
<b>Circulatory system</b>	Absent	Absent	Closed type	Open type
<b>Reproduction</b>	Asexual (fragmentation) and Sexual. Hermaphrodite. Internal Fertilization. Development is indirect (many larval stages).	Dioecious. Sexual reproduction. Internal fertilization. Development is direct or indirect.	Sexual. Earthworms & leeches are monoecious. <i>Neries</i> is dioecious. Development is indirect.	Mostly dioecious. Usually internal fertilization. Mostly <b>oviparous</b> . Development is direct or indirect.
<b>Unique features</b>	<b>Unsegmented, dorso-ventrally flattened body</b> (except tape worms). Excretion by <b>Flame cells (protonephridia)</b> . <b>Hooks &amp; suckers</b> in parasitic forms. Some absorb nutrients from the host through their body surface.	<b>Syncytial</b> epidermis. Thick cuticle. An excretory tube to remove body waste through excretory pore. <b>Sexual dimorphism</b> (females are longer than males).	True segmentation. <b>Longitudinal and circular muscles</b> help in locomotion. Locomotory organs are <b>setae</b> (in earthworm) or <b>parapodia</b> (in <i>Neries</i> ). Excretion by <b>Nephridia</b> . Paired ganglia connected by lateral nerves to a double ventral nerve cord.	<b>Jointed appendages</b> . Body has 3 regions: <b>head, thorax &amp; abdomen</b> . Body is covered by <b>chitinous cuticle (exoskeleton)</b> . Excretion by <b>Malpighian tubules</b> . <b>Sensory organs</b> are <b>antennae, compound &amp; simple eyes, statocysts (balance organs)</b> .
<b>Examples</b> ✱	<i>Taenia solium</i> (Tape worm), <i>Fasciola</i> (Liver fluke), <i>Planaria</i> (shows high regeneration capacity).	<i>Ascaris</i> (Roundworm), <i>Ancylostoma</i> (Hookworm), <i>Wuchereria</i> (Filarial worm).	<i>Pheretima</i> (earthworm), <i>Hirudinaria</i> (blood sucking Leech), <i>Neries</i> .	Spider, Scorpion, Crab, Prawn, Insects etc. <b><u>Economically important insects:</u></b> <i>Apis, Bombyx, Laccifer</i> . <b><u>Vectors:</u></b> Mosquitoes ( <i>Anopheles, Culex &amp; Aedes</i> ), Housefly etc. <b><u>Gregarious pest:</u></b> <i>Locusta</i> . <b><u>Living fossil:</u></b> <i>Limulus</i>



Features	Mollusca (Soft-bodied animals)	Echinodermata (Spiny-skinned animals)	Hemichordata
<b>Grades of organization</b>	Organ system	Organ system	Organ system
<b>Symmetry</b>	Bilateral	Radial (Bilateral in larva)	Bilateral
<b>Germ layers</b>	Triploblastic	Triploblastic	Triploblastic
<b>Coelom</b>	Coelomate	Coelomate	Coelomate
<b>Habit and habitat</b>	Aquatic. Few are terrestrial.	Exclusively marine.	Marine
<b>Digestive system</b>	Complete	Complete. Ventral mouth and dorsal anus.	Complete
<b>Respiratory system</b>	<b>Gills</b> in aq. forms and <b>pulmonary sac</b> in terrestrial forms.	<b>Dermal branchiae (skin gills or papulae)</b> and <b>tube feet</b> .	<b>Gills</b>
<b>Circulatory system</b>	Open type	Reduced and open type.	Open type
<b>Reproduction</b>	Dioecious. Oviparous. Development is indirect.	Dioecious. External fertilization. Development is indirect. Ciliated free-swimming larva.	Dioecious. External fertilization. Development is indirect.
<b>Unique features</b>	Body has <b>head, visceral mass (visceral hump)</b> & muscular <b>foot</b> . Head has <b>sensory tentacles</b> . <b>Univalve</b> or <b>bivalve</b> calcareous shell. Feather-like gills for respiration & excretion. <b>Mantle &amp; radula</b> are seen.	Body is covered with <b>spines</b> for protection. Head absent. Calcareous endoskeleton ( <b>ossicles</b> ) present. <b>Water vascular system</b> present. Excretory system absent. Shows <b>autotomy &amp; regeneration</b> .	Worm-like cylindrical body composed of an anterior <b>proboscis</b> , a <b>collar</b> and a long <b>trunk</b> . Excretion by <b>Proboscis gland</b> .
<b>Examples</b> *	<i>Pila</i> (Apple Snail), <i>Pinctada</i> (Pearl Oyster), <i>Sepia</i> (Cuttlefish), <i>Loligo</i> (Squid), <i>Octopus</i> (Devil fish), <i>Aplysia</i> (Sea Hare), <i>Dentalium</i> (Tusk shell), <i>Chaetopleura</i> (Chiton)	<i>Asterias</i> (Starfish), <i>Echinus</i> (Sea Urchin), <i>Echinocardium</i> , <i>Antedon</i> (Sea Lily), <i>Cucumaria</i> (Sea Cucumber), <i>Ophiura</i> (Brittle Star)	<i>Balanoglossus</i> (Tongue worm), <i>Saccoglossus</i>

largest phylum :- Arthropoda  
Second largest phylum - Mollusca

#### Differences between Chordata and Non-Chordata

Chordata	Non-Chordata
1. Notochord is found in the embryonic stage	Absent
2. Central nervous system is dorsal, hollow and single	Ventral, solid and double
3. Pharyngeal gill slits present	Absent
4. Ventral heart	Dorsal heart (if present)
5. A post-anal part (tail) is present	Absent

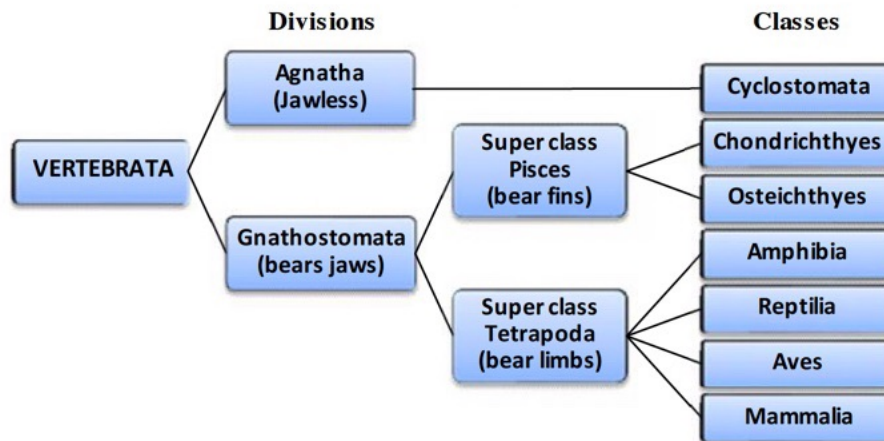




Phylum Chordata is classified into 3 subphyla: **Urochordata**, **Cephalochordata** & **Vertebrata**

PROTOCHORDATA (ACRANIATA)		
Urochordata (Tunicata)	Cephalochordata	VERTEBRATA (CRANIATA)
<ul style="list-style-type: none"> <li>• <b>Notochord</b> present only in larval tail.</li> <li>• Body is covered by <b>test</b> made up of <b>tunicin</b>.</li> <li>• Exclusively marine.</li> <li>• Hermaphrodite.</li> <li>• E.g. <i>Ascidia</i>, <i>Salpa</i>, <i>Doliolum</i>.</li> </ul>	<ul style="list-style-type: none"> <li>• Notochord from head to tail region and is persistent throughout the life.</li> <li>• Fish-like body.</li> <li>• Exclusively marine.</li> <li>• Sexes are separate.</li> <li>• E.g. <i>Branchiostoma</i> (Amphioxus or Lancelet).</li> </ul>	<ul style="list-style-type: none"> <li>• Possess notochord during the embryonic period.</li> <li>• Notochord is replaced by a cartilaginous or bony <b>vertebral column</b> in the adult.</li> <li>• <b>Ventral muscular heart</b>.</li> <li>• <b>Kidneys</b> for excretion &amp; osmoregulation</li> <li>• <b>Paired appendages</b> (fins or limbs).</li> </ul>

### CLASSIFICATION OF VERTEBRATA



### CLASS CYCLOSTOMATA

- All are **ectoparasites** on some fishes.
- Elongated body without scales and paired fins.
- 6-15 pairs of **gill slits** for respiration.
- Sucking and circular mouth **without jaws**.
- **Cartilaginous cranium** and **vertebral column**.
- Circulation is **closed** type.
- Marine, but migrate for **spawning** to fresh water. After spawning, they die. Their larvae, after metamorphosis, return to ocean.
- E.g. *Petromyzon* (Lamprey) and *Myxine* (Hagfish).

### SUPERCLASS PISCES (FISHES)

Class Chondrichthyes	Class Osteichthyes
Marine. Stream-lined body. Predaceous.	Marine & fresh water. Stream-lined body.
<b>Cartilaginous endoskeleton.</b>	<b>Bony endoskeleton.</b>
<b>Notochord</b> is <b>persistent</b> throughout life.	
Ventral mouth.	Terminal mouth.
<b>Gill slits</b> without operculum. Powerful jaws.	4 pairs of <b>gills</b> covered by <b>operculum</b> on each side.
Skin with <b>placoid scales</b> . Teeth are modified placoid scales which are backwardly directed.	Scales are <b>Cycloid</b> , <b>ctenoid</b> etc.
<b>No air bladder</b> . So, they have to swim constantly to avoid sinking.	<b>Air bladder</b> for buoyancy.
<b>Poikilotherms</b> (cold-blooded).	<b>Poikilotherms</b> (cold-blooded).
<b>Two-chambered</b> heart (one auricle and one ventricle).	<b>Two-chambered</b> heart (one auricle and one ventricle).
Sexes are separate. In males, pelvic fins bear <b>claspers</b> . Internal fertilization. Many of them <b>viviparous</b> .	Sexes are separate. Fertilisation external. Mostly <b>oviparous</b> . Development is direct.
<b>Examples</b> <i>Scoliodon</i> (Dogfish), <i>Pristis</i> (Saw fish), <i>Carcharodon</i> (Great white shark), <i>Trygon</i> (Sting ray- has poison sting), <i>Torpedo</i> (Electric ray- has <b>electric organ</b> ).	<b>Examples</b> <b>Marine:</b> <i>Exocoetus</i> (flying fish), <i>Hippocampus</i> (seahorse) <b>Fresh water:</b> <i>Labeo</i> (Rohu), <i>Catla</i> (Katla), <i>Clarias</i> (Magur). <b>Aquarium:</b> <i>Betta</i> (Fighting fish), <i>Pterophyllum</i> (Angel fish).



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Class Amphibia	Class Reptilia	Class Aves (Birds)	Class Mammalia
They live in aquatic & terrestrial habitats and need water for breeding.	Dry & cornified skin, epidermal <i>scales</i> or <i>scutes</i> .	Presence of <i>feathers</i> and <i>beak</i> . Forelimbs are modified into <i>wings</i> .	Presence of <i>m ammmary glands</i> (milk producing glands).
Body has head & trunk. Some have tail. <i>Moist skin</i> without scales. Most have 2 pairs of limbs.	Snakes and lizards shed their scales as <i>skin cast</i> . Limbs- 2 pairs (if present). Crawling mode of locomotion.	Dry skin without glands except the <i>oil gland</i> at the base of the tail. Hind limbs have <i>scales</i> and are modified for walking, swimming or clasp tree branches. Long, hollow, pneumatic bones.	Skin with <i>hair</i> . 2 pairs of limbs for walking, running, climbing, burrowing, swimming or flying.
<i>Tympanum</i> represents ear.	<i>Tympanum</i> represents ear.	<i>Tympanum</i> represents ear.	External ear ( <i>Pinnae</i> ).
<i>3-chambered</i> heart (2 auricles + 1 ventricle).	<i>3-chambered</i> heart (but a septum partially separates ventricle). Heart is <i>4-chambered</i> in <i>crocodiles</i> .	<i>4-chambered</i> heart.	<i>4-chambered</i> heart.
<i>Poikilotherms</i>	<i>Poikilotherms</i>	<i>Homoiotherms</i>	<i>Homoiotherms</i>
Alimentary canal, urinary & reproductive tracts open into a <i>Cloaca</i> which opens to exterior.	Well-developed alimentary canal.	Digestive tract has additional chambers, the <i>crop</i> & <i>gizzard</i> .	Well-developed alimentary canal. Dentition is <i>Heterodont</i> , <i>thecodont</i> & <i>diphyodont</i> .
Respiration is by <i>gills</i> (in larva), <i>lungs</i> & <i>skin</i>	Respiration by <i>lungs</i> .	Double respiration. <i>Air sacs</i> connected to lungs.	Respiration by <i>lungs</i> .
Sexes are separate. External fertilisation. <i>Oviparous</i> . Development is indirect.	Internal fertilisation. <i>Oviparous</i> . Development is direct.	Internal fertilisation. <i>Oviparous</i> . Development is direct.	Sexes are separate. Internal fertilisation. <i>Viviparous</i> (except <i>Echidna</i> and <i>Platypus</i> ). Development is direct.
<u>Examples</u> * <i>Bufo</i> (Toad), <i>Rana</i> (Frog), <i>Hyla</i> (Tree frog), <i>Salamandra</i> (Salamander), <i>Ichthyophis</i> (Limless amphibia)	<u>Examples</u> <i>Chelone</i> (Turtle), <i>Testudo</i> (Tortoise), <i>Chameleon</i> (Tree lizard), <i>Calotes</i> (Garden lizard), <i>Crocodilus</i> (Crocodile), <i>Alligator</i> , <i>Hemidactylus</i> (Wall lizard). <b>Poisonous snakes:</b> <i>Naja</i> (Cobra), <i>Bangarus</i> (Krait), <i>Vipera</i> (Viper) etc. <b>Non-poisonous snakes:</b> <i>Python</i> etc.	<u>Examples</u> <i>Corvus</i> (Crow), <i>Columba</i> (Pigeon), <i>Psittacula</i> (Parrot), <i>Struthio</i> (Ostrich), <i>Pavo</i> (Peacock), <i>Gullus</i> (Fowl), <i>Bubo</i> (Owl), <i>Aptenodytes</i> (Penguin), <i>Neophron</i> (Vulture) etc.	<u>Examples</u> <i>Ornithorhynchus</i> (Platypus), <i>Macropus</i> (Kangaroo), <i>Pteropus</i> (flying fox), <i>Camelus</i> (Camel), <i>Macaca</i> (Monkey), <i>Rattus</i> (Rat), <i>Canis</i> (dog), <i>Felis</i> (Cat), <i>Elephas</i> (Elephant), <i>Equus</i> (Horse), <i>Delphinus</i> (Common dolphin), <i>Balaenoptera</i> (blue whale), <i>Panthera tigris</i> (Tiger),

