

## CC5: Diversity of Chordates

### Unit1: Introduction to Chordates

#### ➤ General Characteristics and outline classification of phylum Chordata

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**It is a large phylum of animals that includes the vertebrates together with the sea squirts and lancelets. They are distinguished by the possession of a notochord at some stage during their development.**

- Kingdom: Animalia
- Clade: ParaHoxozoa
- Clade: Bilateria
- Clade: Nephrozoa
- Super phylum: Deuterostomia
- Phylum: Chordata [Haeckel, 1874 ]

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- The **ParaHoxozoa** are a proposed basal Diploblast / Eumetazoa clade as sister of the Ctenophora. It consists of the Triploblasts / Bilateria as well as the Placozoa and Cnidaria.
  - The Parahoxozoa group was defined based on the presence of several gene (sub)classes (HNF, CUT, PROS, ZF, CERS, K50, S50-PRD), as well as Hox/ParaHox-ANTP from which the name of this clade originated. It was later proposed [8][9] and contested [Feuda *et al.* 2017] that a gene of the same class (ANTP) as the Hox/ParaHox, the NK gene and the Cdx Parahox gene, is also present in Porifera. Nevertheless, the Parahoxozoa as originally defined without Porifera may be a monophyletic clade, and is continued to be used as such.

[Feuda, Roberto; Dohrmann, Martin; Pett, Walker; Philippe, Hervé; Rota-Stabelli, Omar; Lartillot, Nicolas; Wörheide, Gert; Pisani, Davide (2017). "Improved Modeling of Compositional Heterogeneity Supports Sponges as Sister to All Other Animals". *Current Biology*. 6 (24): 3864–3870.e4. doi:10.1016/j.cub.2017.11.008. PMID 29199080].

- Nephrozoa is a major clade of bilaterians, divided into the protostomes and the deuterostomes, containing almost all animal phyla and over a million extant species. Its sister clade is the Xenacoelomorpha [Cannon *et al.* 2016]. The coelom, the excretory organs, and nerve cords developed in the Nephrozoa.

[Cannon, Johanna Taylor; Vellutini, Bruno Cossermelli; Smith, Julian; Ronquist, Fredrik; Jondelius, Ulf; Hejnol, Andreas (2016). "Xenacoelomorpha is the sister group to Nephrozoa". *Nature*. 530 (7588): 89–93. doi:10.1038/nature16520. PMID 26842059.]

## **Chordate characters:**

- A chordate (/kɔːrdeɪt/) is an animal constituting the phylum Chordata ([kɔːr'data]). During some period of their life cycle, chordates possess a notochord, a dorsal nerve cord, pharyngeal slits, an endostyle, and a post-anal tail: these five anatomical features define this phylum. Chordates are also bilaterally symmetric; and have a coelom, metameric segmentation, and a circulatory system.
- The Chordata and Ambulacraria together form the superphylum Deuterostomia. Chordates are divided into three subphyla: Vertebrata (fish, amphibians, reptiles, birds, and mammals); Tunicata (salps and sea squirts); and Cephalochordata (which includes lancelets). There are also extinct taxa such as the Vetulicolia.
- Hemichordata (which includes the acorn worms) has been presented as a fourth chordate subphylum, but now is treated as a separate phylum: hemichordates and Echinodermata form the Ambulacraria, the sister phylum of the Chordates. Of the more than 65,000 living species of chordates, about half are bony fish that are members of the superclass Osteichthyes.
- Chordate fossils have been found from as early as the Cambrian explosion, 541 million years ago. Cladistically (phylogenetically), vertebrates – chordates with the notochord replaced by a vertebral column during development – are considered to be a subgroup of the clade Craniata, which consists of chordates with a skull. The Craniata and Tunicata compose the clade Olfactores.
- **Chordates form a phylum of animals** that are defined by having at some stage in their lives all of the following anatomical features: [Rychel and others, 2006] a **notochord**, a **dorsal neural tube**, a **Pharyngeal slits**, a **Post-anal tail** and an **endostyle**.
- A **notochord**, a fairly stiff rod of cartilage that extends along the inside of the body. Among the vertebrate sub-group of chordates the notochord develops into the spine, and in wholly aquatic species this helps the animal to swim by flexing its tail.
- A **dorsal neural tube**. In fish and other vertebrates, this develops into the spinal cord, the main communications trunk of the nervous system.
- **Pharyngeal slits**. The pharynx is the part of the throat immediately behind the mouth. In fish, the slits are modified to form gills, but in some other

chordates they are part of a filter-feeding system that extracts particles of food from the water in which the animals live.

- **Post-anal tail.** A muscular tail that extends backwards behind the anus.
- **An endostyle.** This is a groove in the ventral wall of the pharynx. In filter-feeding species it produces mucus to gather food particles, which helps in transporting food to the esophagus. [It also stores iodine, and may be a precursor of the vertebrate thyroid gland.]

[Ruppert, E. (January **2005**). "Key characters uniting hemichordates and chordates: homologies or homoplasies?". *Canadian Journal of Zoology*. 83: 8–23. doi:10.1139/Z04-158. Archived from the original on 9 December 2012. Retrieved 22 September 2008.]

Rychel, A.L.; Smith, S.E.; Shimamoto, H.T. & Swalla, B.J. (March **2006**). "Evolution and Development of the Chordates: Collagen and Pharyngeal Cartilage". *Molecular Biology and Evolution*. 23 (3): 541–549. doi:10.1093/molbev/msj055. PMID 16280542.]