Shape of Life
The Story of the Animal Kingdom

Chordates Fact Sheet

Incredible Biodiversity

The phylum **Chordata** is made up of a wide variety of organisms. **Vertebrates** (animals with a backbone) are the largest group of chordates. Two interesting groups of **invertebrates** described below are also included in this phylum. What unites these incredibly diverse organisms?

A human observes a western skink. These are just two of the more than 65,000 known species of vertebrates on Earth. Surprisingly, there are also invertebrate chordate species.
Photo by Harmony Lawrence, Pixabay

All chordates have five distinctive structures at some stage in their life:

- ### A Notochord

  A **notochord** is a flexible, rod-like structure made of cartilage. The notochord provides support for the body. All chordates have a notochord in at least one stage of their development.

- ### A Dorsal Nerve Cord (Tube)

  The **dorsal nerve cord** lies above the notochord. Dorsal means upper or back side. Branches of nerve tissue from the nerve cord go to muscles and organs. In organisms with a brain, the nerve cord relays signals from the brain to these other structures. The dorsal nerve cord is found in all chordates at each stage of their lives.

- ### Bilateral Symmetry

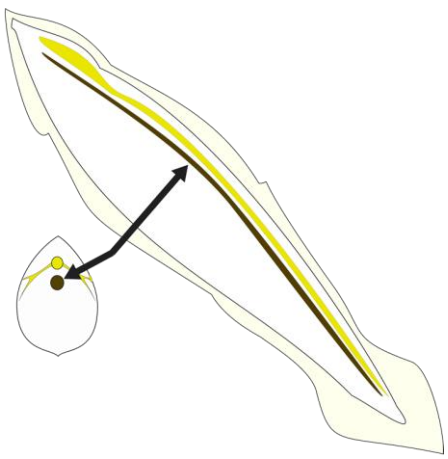
  The left and right sides of their bodies are mirror images of each other.

- ### Pharyngeal (Gill) Slits

  The **gill slits** are a series of openings between the **pharynx** (throat) and the outside. Gill slits may be used for feeding or gas exchange. In some chordates, such as humans, gill slit-like pouches are only present during their embryonic stage. In other chordates, they are present in the adult organisms.

- ### Post-Anal Tail

  All chordates have a tail located further back from the anus. It may help with locomotion, balance, or signaling danger. The tail is prominent in some species and minimal in others.

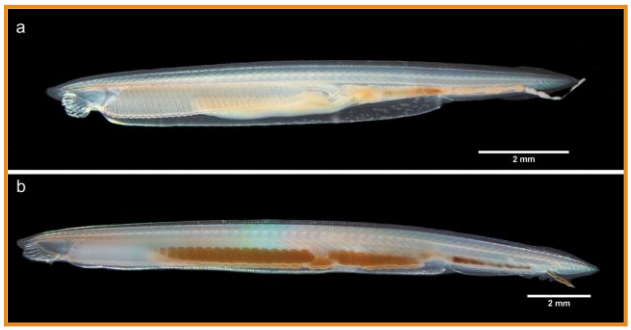


The notochord is shown as a dark-colored line inside a model of a marine animal. The nerve cord is shown as a light-colored line above the dark-colored line.
Adapted from Piotr Michał Jaworski, Wikimedia Commons

There are Three Chordate Subphyla:

1. Subphylum Cephalochordata (Lancelets)

Animals classified as **Cephalochordata** are commonly called **lancelets**. They are small, narrow fish-like invertebrates. They have a notochord throughout their life cycle. They also have roughly 100 pharyngeal (gill) slits. The gill slits are used to filter water for food. They have a very small brain and simple sensory organs (e.g. eyes).



Lancelets, also called amphioxus: An immature organism is shown above (a) and an adult organism is shown below (b).
Photo by Claudia Lucía et al., Wikimedia Commons

2. Subphylum Tunicata (Tunicates or Urochordates)

The **Tunicata** subphylum contains invertebrate groups of marine species. They use their gill slits to filter water to feed and include:

Purple sea squirt (a tunicate)
Photo by Nhobgood, Wikimedia Commons

- ### Sea Squirts (Ascidians)

  Sea squirts are sac-like organisms found around the world, most often in shallow water. They are **sessile** (fixed in place) as adults. But most species can swim freely during their larval stage using a long tail. At this stage they have a body form like that of a tadpole. As larvae, they exhibit the four key identifying characteristics of chordates.

- ### Larvaceans (Appendicularia)

  Larvaceans are gelatinous deep sea marine organisms that resemble tadpoles. They swim freely throughout their lives. They extract **plankton** by creating "houses" of mesh-like mucous around their bodies. These houses can be a meter in diameter. The tail of larvaceans contains a notochord and a dorsal nerve cord.

Giant larvacean (tadpole-like animal) with "house"
Photo © 2016 MBARI

- ### Salps

  Salps are free swimming and look like small, transparent barrels. Like other tunicates, they filter plankton. They are found throughout the world, most commonly in the plankton-rich waters of the Southern Ocean. They can form chains of hundreds of individuals, called **aggregates**. Larval salps have a notochord running down their back.

Salp aggregate
Peter Southwood, Wikimedia Commons

3. Subphylum Vertebrata

Vertebrates (amphibians, birds, fishes, mammals, and reptiles) have a notochord as embryos. The embryonic notochord becomes the discs in the spine (backbone). In vertebrates, the dorsal nerve cord is called the spinal cord. It is protected by the spine.

Fishes and amphibians have gill slits in the form of gills that exchange gases. Gill slit-like pouches are only present in the embryonic stage of most land-based chordates, like mammals. In aquatic species, like fish, the tail is used for locomotion. In some species, such as humans and frogs, it is barely present in mature stages.

Salmon evolved a powerful tail that lets them migrate thousands of miles to hunt. They return to their home stream to spawn.
Photo by Bureau of Land Management, Creative Commons

How did Vertebrates Become so Diverse?

During evolution vertebrates' genomes duplicated twice. This allowed for more genetic diversity that created more complex animals. The additional DNA let them evolve structures such as those listed below that helped them spread across the Earth.

- Fish were the first animals with bony jaws.
- The evolution of flexible jaws in vertebrates allowed them to become powerful predators and increase their body size.
- Skulls protect soft brains that have become larger.
- The evolution of stronger limbs (legs) helped vertebrates to spread over land.

Birds, mammals, and reptiles are just a few of the diverse branches of vertebrate chordates on the evolutionary tree of life.
Photo by AndreyC from Pixabay

Learn More with Shape of Life Videos

- "Chordates: We're All Family": shapeoflife.org/video/chordates-we're-all-family
- "Chordate Animation: Amphioxus to Vertebrate Body Plan": shapeoflife.org/video/chordate-animation-amphioxus-vertebrate-body-plan
- "Human Body Plan": shapeoflife.org/video/human-body-plan