

The origin of animals

It is believed that the common ancestor of animals might have resembled modern *choanoflagellates*; *protists* that are the closest living relatives of animals.

Choanoflagellates are aquatic filter-feeders that are found all over the world in both marine and fresh water. They form an important link in the carbon cycle, consuming bacteria and algae and in turn consumed by larger zooplankton. **They are the closest known sister group to animals** and they may help us to understand how animals evolved.

Choanoflagellates are unicellular; however, some species can form simple colonies. Colonies are physically connected to each other, but do not have any differentiation of tissues. Individual cells can break free from the colony and the colony can continue fully functioning in its absence.

The feeding cells of sponges (**collar cells = choanocytes**), closely resemble the morphology of choanoflagellates. These special cells have flagella trapping food particles (similar to choanoflagellates) and either digest the particles or shuttle the food to other cells within the multicellular organism.

Note that: Sponges are the simplest animal group.

Animal body plans

- Zoologists sometimes categorize animals according to a **body plan**; a set of morphological and developmental traits.
- **An evolutionary grade** is a group of species *whose members* share key morphological or physiological traits (such as body plan). A grade is not necessarily a *clade*, or monophyletic group.

Note: Clade is a group of organisms that consists of a common ancestor and all its lineal descendants on the "tree of life".

Body Plan - Symmetry

- Animals can be categorized according to the symmetry of their bodies, or lack of it (**asymmetrical**).
- Some animals have **radial symmetry**.
- Two-sided symmetry is called bilateral symmetry.
- Animals with **bilateral symmetry** have:
 - A **dorsal** (top) side and a **ventral** (bottom) side
 - A right and left side (lateral)
 - **Anterior** (head) and **posterior** (tail) ends
 - **Cephalization**, the development of a head. (**Brain...**)

Body Plan - Tissues

- Animal body plans also vary according to the organization of the animal's tissues.
- **Tissues** are collections of specialized cells isolated from other tissues by membranous layers. A tissue is an ensemble of similar cells from the same origin that carry out a specific function together. **Organs** are then formed by the functional grouping of multiple tissues.

Embryonic Germ Layers

Diploblastic animals have ectoderm and endoderm.

Ectoderm is the germ layer *covering* the embryo's surface.

Endoderm is the *innermost* germ layer and lines the *developing digestive tube*, called the ***archenteron***.

Triploblastic animals also have a ***middle mesoderm*** layer; these include all bilaterians.

Body Cavities

Most triploblastic animals possess a body cavity.

- A *true body cavity* is called **coelom** and is derived from *mesoderm*. The triploblastic animals that possess a true coelom is called **Coelomates**.
- A pseudocoelom is *a body cavity derived from the mesoderm and endoderm*. Triploblastic animals that possess a pseudocoelom are called **pseudocoelomates**.
- Triploblastic animals that *lack a body cavity* are called **acoelomates**.

Cleavage: protostome or deuterostome development (in Coelamates)

In **protostome** development, cleavage is **spiral and determinate**. In determinate cleavage, **each cell is destined to form a specific part of the embryo**. Damage to or destruction of any of these cells results in malformation of an organism.

In **deuterostome** development, cleavage is **radial and indeterminate**. With indeterminate cleavage, each cell in the early stages of cleavage have **similar developmental potencies**; when isolated each cell is capable of producing an entire embryonic body.

Protists

Kingdom Protista is a polyphyletic group that includes very heterogeneous group of eukaryotes.

The taxonomy of protists is still in debate and currently, the protists are classified into 3 main groups, **animal-like**, **plant-like** and **fungus-like**.

This informal grouping does not reflect evolutionary relationships; it is only based on organisms' mode of reproduction, method of nutrition and motility.

The animal-like protists are known as the **Protozoa**, the plant-like protists are the **algae**, and the fungus-like protists are the **slime moulds** and **water moulds**

Fungus like protists grow in damp, nutrient-rich environments and absorb food through their cell membranes, similar to fungi.

Like fungi, they are also heterotrophs, however, **they don't have chitin cell walls.**

Animal like protists: Protozoa

Protozoa (from Greek words *proton* = "first" and *zoia* = "animals"; singular= protozoan) are animal like microorganisms classified as unicellular eukaryotes.

Because many are animal-like, being motile and having heterotrophic nutrition, this assemblage was treated **in the past**, as a single phylum within the Animal Kingdom- **the phylum Protozoa**.

They are now placed within the **kingdom Protista**. Protozoa is now used as a convenient common name for unicellular, motile protists.

Invertebrates

Life Without a Backbone

- **Invertebrates** are animals that lack a backbone. They account for 95% of the known animal species. They live in terrestrial and aquatic habitats. Some of them are swimmers or dwellers in aquatic sediments or soil. Evolution of invertebrate species have lead to a great diversity in body forms.

Phylum Porifera: Sponges

- Sponges are sedentary animals from the phyla **Calcarea** and **Silicea**. They live in both fresh and marine waters (Most are found in the ocean).
- They **do not** have true tissues and organs.
- They are **sessile** organisms.
- Their bodies are full of pores and their skeleton is made of spicules or spongin fibers (depends on the species).
- Sponges are divided into classes according to the type of spicule they have – 5,000 species identified!

- Cnidarians are carnivores that use **tentacles** to capture prey. Their tentacles are armed with **cnidocytes**; they are unique cells that function in defense of these organisms and for the capture of prey.
- **Nematocysts** are special organelles within cnidocytes that eject a stinging thread.