Invertebrate Classification - Advanced

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Invertebrate Classification - Advanced

With so many differences, how do you classify an invertebrate?

Sponges, jellyfish, worms, snails, and squids. These are just a few of the many types of invertebrates. But there are lots more. In fact, most animals are invertebrates, so their classification is very important.

Classification of Invertebrates

There are over 30 phyla dedicated to invertebrates. All but one of the animal phyla are exclusively invertebrates. The phylum Chordata is divided into three subphyla, two of which are made up of invertebrates. The third subphylum, Vertebrata, includes the vertebrate animals. In addition, there are a great many invertebrate species that are extinct. Evidence of their existence is found only in the fossil record. The major exclusively invertebrate phyla that are still in existence today are the following:

<table>
<thead>
<tr>
<th>Phylum (includes)</th>
<th>Notable Characteristics</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porifera (sponges)</td>
<td>multicellularity, specialized cells but no tissues, asymmetry, incomplete digestive system</td>
<td>sponges</td>
</tr>
<tr>
<td>Cnidaria (jellyfish, corals)</td>
<td>radial symmetry, true tissues, incomplete digestive system</td>
<td>jellyfish</td>
</tr>
</tbody>
</table>
The organization of invertebrates into each of these phyla is based on their evolutionary relationships to each other. Within each phyla, the organisms share certain traits and a certain level of structural organization. Generally, this organization becomes increasingly complex as invertebrate species diverged and new phyla were formed. The details of this increased complexity will be discussed in the Invertebrates: Evolution (Advanced) concept. In this concept we will summarize the types of organisms found within each phylum and briefly list the features that distinguish them from species of other phyla. Each of these phyla is further discussed in later concepts.

**Porifera and Cnidaria**

The phylum porifera contains the earliest invertebrates: the sponges. Sponges lack true tissues. Instead of tissues, sponges have specialized cells that carry out functions such as digestion and reproduction. Sponges are both extremely simple organisms and very well-adapted in an evolutionary sense. They have been around in a similar form for well over 600 million years. The phylum cnidaria includes jellyfish, hydrozoans, and corals. They are radially symmetrical and have true tissues. Many cnidarian species are critical members of the vast coral reefs found in tropical marine regions. An example of a sponge species is shown in Figure below.
Platyhelminthes and Nematoda

Flatworms make up the phylum platyhelminthes. They develop from three embryonic cell layers called germ layers and exhibit bilateral symmetry. Both flatworms and the roundworms of the phylum nematoda include many parasitic species, a number of which are infectious to humans or livestock. These two phyla therefore have an enormous impact on the health and economy of humans. Unlike flatworms, roundworms have an incomplete body cavity and a complete digestive tract. Figure below shows examples of a non-parasitic flatworm and a parasitic roundworm species.
Annelida and Arthropoda

Annelida consists of segmented worms, such as the familiar earthworm and leeches. They exhibit a closed circulatory system, a nervous system with a primitive brain, and a specialized digestive system. The closed circulatory system pumps blood throughout the length of the worm's body. Annelids generally have a well-developed body cavity, an excretory system, and a nervous system with a primitive brain.

Arthropoda is an extremely large phylum consisting of over 80% of all species alive on earth today. They include insects, arachnids, and crustaceans. Arthropods have segmented bodies with jointed appendages and an open circulatory system with several hearts. Some species within the phylum arthropoda were the first animals to leave the aquatic environment of their ancestors and venture onto land. Arthropods have a tough exoskeleton made of a complex carbohydrate called chitin, and some species have gills for gas exchange. Arthropods also have an excretory system and a nervous system with a primitive brain. Members of the phyla annelida and arthropoda are shown in Figure below.

Mollusca and Echinodermata

The phylum Mollusca is a highly diverse phylum that includes clams, octopi, and squids. One distinguishing characteristic of mollusks is the presence of a muscular foot called a mantle that can be used for locomotion. Many mollusks have a solid exoskeleton made of calcium carbonate. The exoskeleton is secreted by the mantle. Another unique feature of mollusks is a specialized feeding structure called the radula that is located within the mouth. The radula contains teeth made of chitin that are used to chew or scrape food. One class of mollusks that includes the squid and octopus has the most highly evolved nervous system of all invertebrates.

Echinodermata is considered the closest related phylum to Chordata. Like chordates, echinoderms have a type of embryonic development in which the opening for the anus is formed prior to the opening that becomes the mouth. The characteristic feature of
Echinoderms is a spiny surface. They have an internal skeleton made of calcium spines that lies underneath a thin ectodermal layer of tissue. Another interesting trait of echinoderms is that they are bilaterally symmetrical in their juvenile stages but then develop into radially symmetrical adults. In addition, echinoderms have a vascular system that pumps water instead of blood. Echinoderms include sea stars (starfish), sea urchins, and sand dollars. Examples of mollusks and echinoderms are shown in Figure below.

This figure shows some of the more common and familiar mollusks. [Figure4]

Summary

- There are over 30 phyla dedicated to invertebrates.
- Major invertebrate phyla that you should know include porifera, cnidaria, platyhelminthes, nematoda, mollusca, annelida, arthropoda, and echinodermata.

Review

1. Which phylum contains the earliest invertebrates?
2. Which two phyla have an enormous impact on human health?
3. How large is the arthropoda phylum?
4. Which phylum of invertebrates is the closest related to chordates?
2. USGS Bee Inventory and Monitoring Lab, Smabs Sputzer. https://www.flickr.com/photos/usgsbiml/9991036704, https://www.flickr.com/photos/10413717@N08/6935317800/. CC BY 2.0, CC BY 2.0
4. (Snail) macrophile; (Scallop) Dann Blackwood/US Geological Survey; (Squid) Courtesy of NOAA. (Snail) http://commons.wikimedia.org/wiki/File:Common_snail.jpg; (Scallop) http://commons.wikimedia.org/wiki/File:Placopecten_maggianicus.jpg; (Squid) http://commons.wikimedia.org/wiki/File:Lycoteuthidae_sp.jpg. (Snail) CC BY 2.0; (Scallop) Public Domain; (Squid) Public Domain