



**Education Dept.**  
Georgia Aquarium  
225 Baker Street NW  
Atlanta, GA 30313  
404.581.4198

## Echinoderms (Phylum Echinodermata)

### What is an echinoderm?

The word "echinoderm" comes from the Greek language and means "spiny skin". Echinoderms include animals such as sea stars, brittle stars, feather stars, sea urchins, sand dollars, and sea cucumbers. All echinoderms have the following in common:

- Habitat: all echinoderms are marine, and they range from the warm waters of the tropics to cold polar waters. They are also **benthic** organisms, dwelling on the sea floor.
- Skeletons composed of bony plates called ossicles.
- **Radial symmetry:** 5 body sections of equal size arranged around a central axis.
- A water vascular system which allows them to move water throughout their bodies to expand and contract their many tube feet. By coordinating the movements of these **tube feet**, echinoderms can "walk". Some also use their tube feet to catch prey or to bring food to their mouths.
- A **diffuse nervous system**, a relatively simple network of nerves without a brain, that allows the animal to feel its way as it moves.

Echinoderms are divided into five separate classes based on their specific characteristics. The class Asterozoa includes sea stars, Ophiurozoa are the brittle stars and basket stars, Echinozoa are the sea urchins and sand dollars, Crinozoa are the feather stars, and Holothurozoa are the sea cucumbers.

### Asterozoa (sea stars)



Though many people refer to these animals as "starfish", scientists prefer to call them sea stars since they are not actually fish. Sea stars have triangular arms (generally five, though some species may have more) that point outward from the center of their body. These arms sometimes break off and sea stars may grow new arms to

replace them. A few species will actually grow a new animal from the limb that was severed. Sea stars have tube feet along the undersides of the arms, extending out from the mouth. These feet are used for movement and also to catch prey, such as shellfish, urchins, and sometimes other sea stars. A sea star can use its tube feet to pull apart the shell of a mussel, and can expel its stomach through its mouth to digest the animal inside its own shell.

### Ophiurozoa (brittle stars and basket stars)

Brittle stars are similar to sea stars, but their arms are long, thin, and covered with spines and their central disks are rounded. Their five arms are covered with bony plates that only allow lateral movement. They are called brittle stars because their arms break off very easily. Like sea stars, brittle stars can regenerate lost limbs. Brittle stars are generally detritivores, feeding on organic debris and plankton. Some species may prey on small animals and can evert their stomachs.

Basket stars have five arms which are subdivided into multiple branches. These branches form a net which the basket star uses to catch plankton, its main food source. The basket star then uses tube feet and very small spines to move the food along its arms toward its mouth.

Echinozoa (sea urchins, heart urchins and sand dollars)

The echinoids are divided into two groups: the "regular" echinoids are the sea urchins, the "irregular" echinoids are the heart urchins and sand dollars. All of the echinoids have their five sections fused into one body and are mainly detritivores.

Sea urchins have spherical bodies covered in long spines for protection. They use tube feet for movement. They may also use tube feet to catch prey, though they mainly eat algae and organic debris. Sea urchins have an arrangement of five teeth, called "Aristotle's Lantern", around their mouths that they use to scrape food from the sea floor.

Heart urchins and sand dollars have a five-part sculptured design on the top of their bodies. The irregular echinoids do not have true tube feet. Instead, they are covered in short, dense spines, which they use for burrowing into the sea floor where they feed on organic material. Sand

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dollars have an Aristotle's Lantern arrangement around their mouths, heart urchins do not.

### **Crinoidea (feather stars)**

Feather stars are often called "living fossils", because they are the oldest of the echinoderms and their structure has changed very little over time. They have five main arms, each of which may fork into several arms. Each arm has many short spine-like appendages on each side, giving the animal a feathery appearance. These feathery arms sweep the water for plankton, the crinoid's main source of food. Their thin arms break off easily, as in the brittle stars, and may regenerate. Feather stars can swim by moving their many arms and can also walk on small appendages called cirri, located on the underside of their bodies.

### **Holothuroidea (sea cucumbers)**



The sea cucumber's five body sections are not readily visible from the outside, instead they are part of the animal's internal structure. Its ossicles are microscopic and are set into its leathery body wall, and it has no external arms or spines. The sea cucumber does have normal tube feet on the bottom of its body and modified tube feet on its back. Because the sea cucumber does not have protective spines or large bony plates, it has developed special defense mechanisms. Many sea cucumbers contain chemicals that are toxic, and may have very bright colors to warn predators not to eat them. Many are also capable of self-evisceration. When attacked by a predator, the sea cucumber may expel its internal organs through its anus. This may satisfy the predator, or confuse it long enough to allow the sea cucumber to escape. The sea cucumber will then regenerate its organs.

### **Glossary**

**benthic:** refers to the sea floor environment. Benthic animals live on or in the sea floor.

**cirri:** small appendages on the underside of a feather star, which allow the animal to walk along the sea floor.

**detrivore:** an animal that eats detritus, or organic debris.

**diffuse nervous system:** the decentralized system of nerves, without a brain, that spreads throughout an

echinoderm's body, allowing it to sense its environment from all sides

**ossicles:** small bony plates which make up the skeleton of an echinoderm and give the animal its spiny appearance.

**radial symmetry:** a symmetrical arrangement of body parts around a central axis.

**self-evisceration:** the process by which a sea cucumber expels its internal organs.

### **Resources**

University of Michigan, Nov 1, 2006  
[animaldiversity.ummz.umich.edu/site/accounts/information/Echinodermata.html](http://animaldiversity.ummz.umich.edu/site/accounts/information/Echinodermata.html)

Monterey Bay Aquarium, Nov 1, 2006  
[www.mbayaq.org](http://www.mbayaq.org)

Oceanic Research Group, Nov 1, 2006  
[www.oceanicresearch.org](http://www.oceanicresearch.org)

Singapore Zoological Gardens Docents,  
Nov 1, 2006  
[www.szgdocent.org/resource/ff/f-reef6d.htm](http://www.szgdocent.org/resource/ff/f-reef6d.htm)

### **Books**

Humann, Paul and Ned DeLoach. Reef Creature Identification: Florida, Caribbean, and Bahamas. New World Publications, Inc.: Jacksonville, FL, 2003.