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## **Introduction**

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|  | I am sure that many of you, if not all of you, have been to the tide pools sometime in your lives. When exploring the variety of organisms there - have you ever wondered what those prickly rounded balls are? or what they are here for? why are they located where they are? Well… |

**Basics**

Sea Urchins fall into the class-echinoderm. They are marine invertebrate animals of the phylum Echinodermata. This is because of their external skeleton of calcareous plates just under the skin, no head. They have unique water-vascular systems with tube feet. Echinoderms are radially symmetrical, they lack specialized excretory organs, and reproduce sexually. Echinoderms have extensive powers of regeneration of lost or injured parts. All of the members live on the sea floor. Other members of this class include, seastars, brittle stars, sand dollars, sea cucumbers, and crinoids.

There are many types of sea urchins. Green, red, rock-boring, heart, purple, and more. But for this research I am basing most of my information on the purple sea urchin, found along the Pacific Coast.

Sea urchins are oval-ball-shaped bodies covered with long, movable spines. They are domed above and flattened beneath. The adult size can get as large as 4" wide, and 1 3/4" high. Their color is a vivid purple, although juveniles are a greenish color. Close-fitting skeletal plates lie under the animal's skin and form a shell called the test. This test protects the animal's soft body that is hidden underneath.

**Movement/Food Source**

Like the seastars, urchins make auxiliary use of their movable spines, crawling about by depressing the forward spines and pushing with the backward spines. They can also move by using its tentacle like tube feet, which have suction disks at the ends. In this process they move in slow series of wavy rhythms. Locomotion is relatively slow, since the fixed algae on which the urchin feeds are not famous for their speed of retreat. Movable jaw parts, forming a structure called, from its design, "Aristotle's Lantern", cut the seaweed into portions small enough for ingestion in the urchin's huge, coiled intestine. Not only are urchins herbivores, but are scavengers also, and will apparently eat almost anything they can manage, including dead fish that might be washed in by the waves. Its mouth, which is located on the underside of its body, has five movable teeth, which help the animal scrape this food off the rocks. Although they love to eat algae, the burrows that some of them live in, are often found grazed bare of all the algae growth. Therefore, they must somehow extract sufficient plankton and fragments of algae form the water flowing past their caves. By what means they would capture these is not altogether clear - though possibly they are able to extend some of their tube-feet as the heart-urchin does from its burrow in the sand.

**Protection**

Urchins and seastars have three kinds of protecting appendages: spines, tube feet, and pedicellariae. Adding to their threatening appearance, the movable spines are the most conspicuous of the three. When an urchin's test or shell is prodded with a sharp instrument, the spines converge toward the point touched so as to offer a strictly mechanical defense. However, if a blunt instrument is used, the spines turn away from the point of attack in order to give the pedicellariae free play. These peculiar appendages are thin, flexible stalks armed with three jaws apiece; each jaw is provided with a poison gland and a stiff sensory hair. When a predator is injected, it may possibly die, but more often just be bothered and leave. If a human is attacked by one, or gets a spine stuck in him, the worst that may occurs, is a sharp stinging near the puncture. Although the urchin can maintain a stout defense with its pedicellariae against the attack of a predatory seastar, if the attack is continued for a long enough time, the urchin is likely to succumb because of the loss of its weapons, since each pedicellaria is sacrificed after inflicting a wound. Sea urchins might also use their tube feet to cover themselves with old shells and seaweed in order to hide from seastars and other predators. They are often found grouped in colonies; this is also a predatory mechanism. If a predator starts to attack a sea urchin, other surrounding sea urchins attack the predator, sticking it with their poisonous pedicellariae.

**Reproduction**

Urchins reproduce much like the seastar. By pouring out eggs and sperm into the water for a chance fertilization; the embryonic development of the free-swimming stages is also very similar. The sexes are separate, and the extrusion of eggs and sperm has been observed in February and March along the coast. Since the chance of survival, let alone fertilization, urchins release millions of sperm and eggs to increase their chances.

**Location**

The purple sea urchin will commonly be found with at least half of its bristling bulk sunk into an excavation in the rock. It is found on rocky shores with moderately strong surf; from the low-tide line to water 160 meters in depth. On the Pacific coast they are more plentiful on and among the rocks than in sandy shores. They live in enormous colonies in some places, and literally honeycomb in the rocks with small cavities in which they are secure from the pounding surf or destruction by the larger fishes. It is difficult to understand the way in which they excavate the pits in the rock which seems harder than their own teeth and spines. For more than a hundred years the methods of producing these excavations has been a subject of controversy, but it is generally agreed now that Fewkes stated the situation correctly in 1890. He believed that the teeth and spines of the animals, aided by motions produced by waves and tides, were sufficient to account for the pits, however hard the rock and however breakable the urchins' spines, for the spine, of course, would be continually renewed by growth. Sometimes an urchin will be found that has imprisoned itself for life, having gouged out a cavity larger than the entrance hole made when it was young (or, more probably, made buy another urchin, since it seems probably that these holes may be formed by successive generations of urchins). Holes abandoned by urchins may provide refuge for all sorts of nesters , such as dunce-cap limpet, small chitons, and liken.

**Why I Chose This Topic**

Perhaps, out of all the interesting information I have just presented to you about the sea urchin, I find that the location of where the sea urchins live is most interesting. Ever since my fifth grade field trip to the tide pools, I have been fascinated with the numerous and various forms of life there. Due to my busy soccer schedule on weekends, my family and I never get the chance to visit the tide pools. So when I heard about this project, I knew I wanted to do something at the tide pools. This way I would have an excuse to go. I didn't know what I wanted to do my project on specifically, so I went with my family one time to explore , and find out what I was interested in. While searching along the low tide line for little creatures, I spotted a sea urchin hidden away in a little crevice. I had never seen one before to my knowledge, and got really excited. As I looked closer for more, I saw two, then eight, and suddenly I realized that they were everywhere - literally hundreds of them. Each in its own little "cup". I was so excited and at the same time curious. Why were there so many of them? especially why there were so many of them along the low tide line versus up farther to shore, in pools???