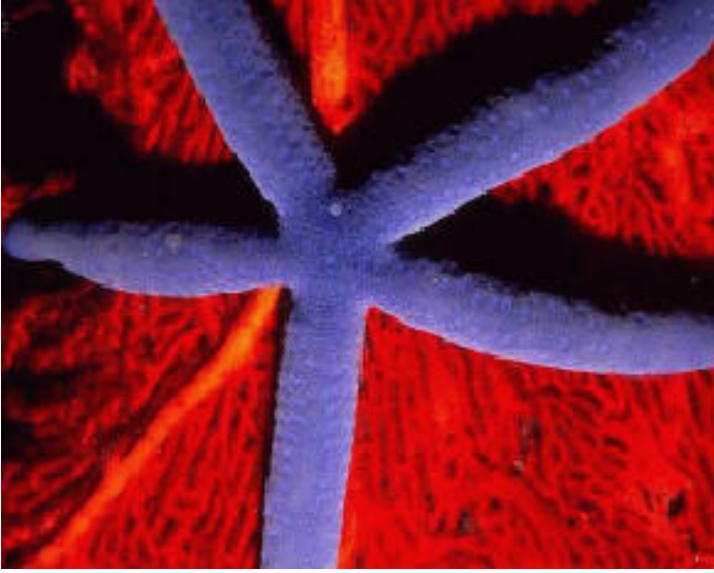


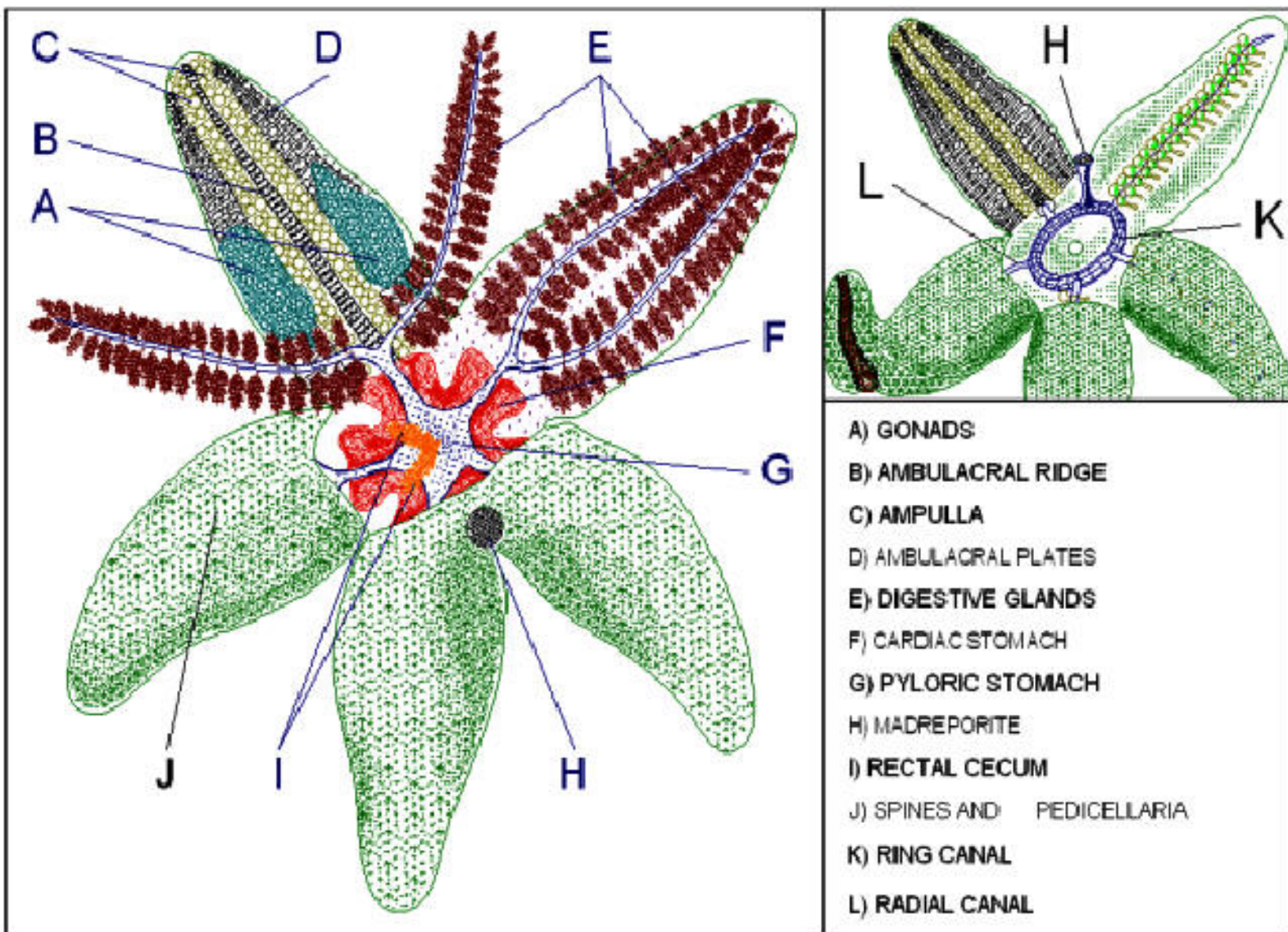
# Echinoderms

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Echinoderms are exclusively marine animals based on a pentaradial body plan. Included in this phylum are the familiar sea stars ("starfish"), brittle stars, sand dollars, sea urchins, crinoids and sea cucumbers.

- **Class Asteroidea.** Members of this class have a **central disk** from which (usually) five **arms** (or **rays**) radiate. These free-moving echinoderms are the starfish with whom you are probably most familiar. Most asteroids are scavengers or carnivores and many specialize on mollusks, especially bivalves (clams and oysters). Sea stars typically locate their prey through chemical senses. They attach to the valves with their tube feet and exert a steady tension on the shell to open it. With a steady pull by the sea star, the clam's adductor muscles fatigue and the shell gapes. When this happens, the sea star everts its stomach and slips it into the gap between the clam's two shells and dumps digestive enzymes into the mantle cavity of the clam. This liquefies the contents so the sea star can suck it back up (sea stars are on a constant diet of clam chowder). Although radiate in their body plan, asteroids and other members of this phylum begin their development as bilateral larvae. The symmetry of the adult animal is therefore secondarily derived and is probably related to their slow-moving lifestyle.





**Figure 1.** The large figure depicts the organs that are exposed when the aboral surface is removed from a common sea star. The inset shows deeper structures revealed when the digestive organs and gonads are removed. Refer to the text for a functional description of the organs.

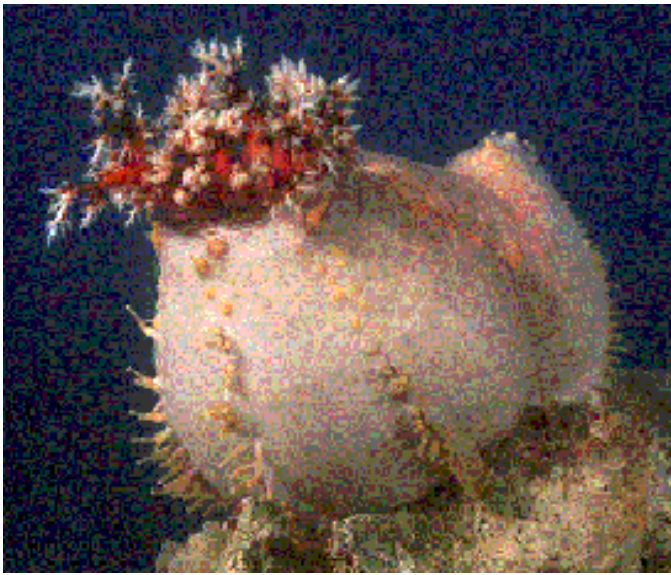
- **Class Ophiuroidea.** Ophiuroids are commonly known as basket stars and serpent or brittle stars. Some texts combine the asteroids and ophiuroids as a single class (Stelleroidea) and assign each to the level of subclass (Subclasses Asteroidea and Ophiuroidea). Ophiuroids differ from sea stars in having a more circular central disc with the arms more sharply set off. They are the most active and motile members of this phylum and lack an ambulacral groove. The tube feet, although present, are not used in locomotion.



- **Class Echinoidea.** Echinoids are commonly known as sea urchins, sand dollars, sea biscuits and heart urchins. The arms are fused and wrapped to form a case (the test). Examine a dried sea urchin test from which the spines have been removed. What evidence of their relationship to the five-armed sea stars can be seen in the arrangement of their dermal plates (results section)? The test of sea urchins is nearly spherical in shape and is surrounded by movable spines that aid in locomotion and defense (the ball-and-socket joints of the spines can be seen on the dried test). In some species (*Diadema*) the spines are long, thin, and needle-like. The mouth is surrounded by five movable teeth (Aristotle's lantern). This structure scrapes algae from the surface of rocks (most urchins are grazers). Sea urchins are commonly classified as regular echinoids (because of their spherical bodies). Irregular echinoids (heart urchins and sand dollars) are flattened (as an adaptation for burrowing).



- **Class Holothuroidea.** Holothuroids are a group of sac-like echinoderms commonly known as "sea cucumbers". Like the echinoids, sea cucumbers lack arms, but evidence of their pentaradial origins can still be seen in the arrangement of podia on the animal's sides. The oral end of the animal has a crown of highly-branched tentacles. The tentacles are sticky and used to collect particles either suspended in the water or from deposits in the substrate. Some can burrow.



- **Class Crinoidea.** The crinoids are the most primitive of the living classes of echinoderms. During the Paleozoic era (225-570 million years before present) they were a dominant life form, but now there are only about 500 species. Crinoids may be either stalked and sessile (sea lilies) or motile and non-stalked (feather stars). The rays are highly branched and some animals can over 200 arms. Each arm also has lateral extensions (pinnules) that make feather-like in appearance. Crinoids use these feathery arms to sweep suspended particles from the water (they are all suspension feeders).

