

# Phylum Echinodermata

Bio 1413: General Zoology Lab  
(Ziser, 2008)

[Exercise 16; p 247]

## Identifying Characteristics of the Phylum

- radial (pentamerous) symmetry in adult; larva is bilaterally symmetrical
- unique water vascular system
- all marine
- deuterostomes
- endoskeleton of calcium carbonate ossicles
- dioecious
- free swimming bipinnaria larva
- well developed regenerative abilities (asexual reproduction)
- extensive and diverse fossil record with many extinct classes

## Cell Types and Characteristic Structures

- endoskeleton composed of numerous **ossicles**, separate or fused to form a **test**
- water vascular system: **madreporite**, stone canal, circular canal, radial canals (usually along ambulacral grooves), **tube feet**
- pedicellariae**
- dermal gills (=papulae)**

## Body Organization

- adult radially symmetrical, usually with five part (pentamerous) symmetry, or multiples of 5's
- no distinct head or brain (no cephalization)
- circulatory system greatly reduced and replaced, in function, by water vascular system

## Classification

- Class Crinoidea (sea lilies):** flowerlike with central calyx and branching arms; some sessile and attached to substrate by stalk
- Class Echinoidea (sea urchins, sand dollars):** skeleton of fused plates forming "test", body covered with moveable spines
- Class Holothuroidea (sea cucumbers):** endoskeleton greatly reduced or absent, softbodied animals elongated or wormlike with circle of tentacles at oral end
- Class Asteroidea (starfish):** "star-shaped" with tapering arms and with flexible skeleton of many separate calcareous plates

**Class Ophiuroidea (brittle stars):** starshaped but with distinct central disc and thin arms lacking tube feet

**Lab Activities:**

1. The Common Starfish (p248): *Asterias* **preserved** *Asterias*  
external anatomy: p 249; know: **central disc, arms, oral & aboral surfaces, madreporite, spines, pedicellariae, dermal branchiae, ambulacral groove, tube feet, spines, mouth**  
  
internal anatomy: p 251; know: **coelom, pyloric stomach, pyloric ceca, cardiac stomach, gonads, nerve ring, radial nerves, eyespots, madreporite, stone canal, ring canal, radial canals, ampullae, tube feet**
  
2. cross section of starfish arm (p 253 & fig 16-4): **slide:** starfish ray, cs  
know: **coelom, gonads (if visible), pyloric caecum, ambulacral groove, radial canal, radial nerve, tube feet, ossicles**
  
3. A Brittle Star, Class Ophiuroidea (p 253) **preserved** specimens  
external anatomy only: **central disc, arms, ossicles & plates, madreporite plate, bursal slits, mouth**
  
4. A Sea Urchin, Class Echinoidea (p256) **preserved** urchins & sand dollars  
external anatomy only: **test, spines, pedicellariae, tube feet, ambulacral region, mouth, Aristotle's Lantern**  
  
compare the general shape and structures of a sea urchin with those of a sand dollar
  
5. A Sea Cucumber, Class Holothuroidea (p 259) **preserved** sea cucumbers  
external anatomy; know: **mouth, tentacles, tube feet, sole**  
  
internal anatomy; know: **coelom, pharynx, stomach, intestine, cloaca, anus, muscle bands gonad, respiratory tree**

**Demonstrations:**

- Echinoderm Development
  - a. **Bipinnaria Larva** **slide:** bipinnaria larva  
-be able to recognize the **bipinnaria larva** as the main larval form of echinoderms  
-note that it is bilaterally symmetrical
  
  - b. **Young starfish** **slide:** young starfish, wm.  
-the young starfish is the radially symmetrical postlarval stage of echinoderms that forms directly from the bipinnaria larva

-note the development of the endoskeleton and the ambulacral grooves in the arms

- The Classes of Echinoderms

**illustrations, dried & preserved specimens, fossils**

-be able to distinguish between the different classes and to classify the various fossil and extant specimens available

**Notebook Suggestions:**

- How, specifically, do members of each class differ from each other in anatomy; ie. what structures are unique to each class or absent in each class.
- How do echinoderms differ from the annelid-mollusc-arthropod group?
- Draw a pedicellaria
- Draw tube feet

**Disposal:**

\*Dispose of dissected starfish in “scraps” bucket

\*DO NOT discard other specimens, return brittle stars, sea urchins and sea cucumbers to proper dish or tray