Phylum Echinodermata

[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