

12. Phylum ECHINODERMATA ("spiny skin")

"I salute the echinoderms as a noble group especially designed to puzzle the zoologist."--Libbie Hyman

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Ph. Echinodermata (≈7000 species)	Cl. Crinoidea (feather stars, sea lillies)
Cl. Asteroidea (sea stars, sea daisies)	Cl. Echinoidea (sea urchins, sand dollars)
Cl. Ophiuroidea (brittle stars, basket stars)	Cl. Holothuroidea (sea cucumbers)

Recap: Major themes in the evolution of arthropods

TOP TEN areas to explore and appreciate about echinoderms

10. **Pentamerous** radial symmetry, convergent evolution of an oral/aboral body axis
9. Complex surface features: **papulae, pedicellariae, podia, paxillae, spines, madreporite**
8. The echinoderm endoskeleton: **stereom** composed of high magnesium **calcareous ossicles**
7. Use of muscles for direct locomotion and indirect operation of **ampullae** and **tube feet**
6. Diffuse nervous system (**nerve ring** and **net**) reflecting 5-part duplication of body axes
5. Roles of multiple coelomic compartments, including the unique **water vascular system**
4. Physiological function, habitat restriction, and ecological roles of **mutable connective tissue**
3. Reorganization of the body plan among classes, including secondary bilateral symmetry
2. Differences in respiratory structures among classes, including **respiratory trees**
1. Phylogenetic position among **deuterostomes**, relationship to chordates (and vertebrates)

GOALS

After studying from lecture notes and the associated reading, you should be able to:

- Identify how each of the classes of echinoderms has transformed the basic body plan
- Explain why echinoderms are described as having pentamerous radial symmetry, and why one class has evolved to show secondary bilateral symmetry
- Describe the location and prevalence of ossicles in the body walls of different classes
- Explain the structure and functions of the endoskeleton, including how sea urchins grow larger in size, and how growth differs from other phyla enclosed within a hard outer covering
- Describe in detail structure & function of the water vascular system in asteroids and echinoids
- Explain uses of different muscle systems in: articulated locomotion of ophiuroids and crinoids, movement of spines and pedicellariae; operation of the hydraulic system that drives the motion of tube feet, and creation of suction at the tips of some (not all) tube feet
- Describe the location and function of three separate coelomic compartments in echinoderms
- Describe the general form of the gut in asteroids and echinoids, and how their form may be related to differences in diet between the two classes
- Explain the function and importance of mutable connective tissue, what role it places in different classes, and why this feature might restrict echinoderms to marine habitats
- Describe at least two examples of convergence between the holothuroids (which are deuterostomes) and protostome coelomate worms in terms of body form, symmetry, and feeding