Phylum Echinodermata

Starfishes, sea urchins, sea cucumbers
Echinoderms Have “Spiny Skin”

Phylum Echinodermata: Sand dollars, sea stars, and sea urchins
Echinoderms Have “Spiny Skin”

Key features:

- Deuterostomy
- Bilateral symmetry; three germ layers
- True tissues
- Multicellularity
- Radial symmetry (as adults), spiny skin, water vascular system

Branches:
- Chordates
  - Echinoderms
  - Arthropods
  - Roundworms
  - Annelids
  - Mollusks
  - Flatworms
  - Cnidarians
  - Sponges
General Characteristics

- Exclusively Marine (no terrestrial or freshwater taxa)
- Body unsegmented
- Adults with pentamerous secondary radial symmetry
- Larvae bilaterally symmetrical
- With unique water vascular system
First phylum with internal skeleton
- With dermal calcareous ossicles
- Some with spines or spicules

Digestive system complete

Respiration by dermal branchiae, tube feet, or respiratory tree

No kidneys

Dioecious

Locomotion by tube feet, and/or arms
General Characteristics

- Adults exhibit **pentamerous** radial symmetry
- Radially symmetry is secondary; larvae are bilaterally symmetrical and undergo metamorphosis to become radially symmetrical adults.
Larval Echinoderms showing bilateral symmetry

A: Bipinnaria
B: Brachiolaria
C: Ophiopluteus
D: Echinopluteus
E: Auricularia
F: Doliolaria
General Characteristics cont.

- Possess a network of canals throughout the body - **water vascular system**.
- The canals are connected to extensions called **tube feet (=podia)**, located on the oral surface.
- The water vascular system is important for locomotion, feeding, and gas exchange.

- Sexes are separate; gametes shed into the water; fertilization is external.
Water Vascular System

• On the aboral surface is the opening of the water vascular system the madreporite (=sieve plate)

• Water enters the madreporite and goes through the stone canal canal to the ring canal

• Water then passes through a radial canal extending into each arm

• All along the length of these canals are lateral canals that terminate in a bulb-like structures called ampullae equipped with tube feet

• Tube feet line the grooves on the oral surface - ambulacral grooves
How the Podia Operate

- Ampulla contract and force fluid into the podia causing it to become extended
- Suckers at the tips of the podia come into contact with the substrate and adhere to the surface
- Then the podia contract, thereby forcing water back into the ampulla, and the body is pulled forward

Sea Star Internal Body Plan
Water Vascular System

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External Anatomy

- Central disc
- Madreporite
- Anus
- Arm
- Spines
- Arms
- Mouth
- Tube feet
- Ambulacral grooves
- Sensory tentacles
Internal Anatomy
Echinoderms Have “Spiny Skin”
Feeding & Digestion

- uses feet
- eat mollusks, worms, and slow-moving animals
- enzymes help digest food
Reproduction

- each arm produces sperm & egg
- occurs externally
- **bipinnaria**: free-swimming larva that a fertilized egg develops into
- settles in the bottom and develops into an adult through metamorphosis
- reproduce asexually by regenerating lost parts
Higher Classification
Echinodermata

- Class Asteroidea – sea stars
- Class Ophiuroidea – brittle stars
- Class Echinoidea – sea urchins
- Class Holothuroidea – sea cucumbers
- Class Crinoidea – sea feathers
Asteroidea
Ophiuroidea
Holothuroidea
Crinoidea