Section 1: Echinoderm Characteristics

**MAIN IDEA**

Echinoderms are marine animals with spiny endoskeletons, water-vascular systems, and tube feet; they have radial symmetry as adults.

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<tbody>
<tr>
<td>What I Know</td>
<td>What I Want to Find Out</td>
<td>What I Learned</td>
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</table>
Essential Questions

• What are the characteristics common to echinoderms?
• How do the water-vascular system and tube feet adaptations enable echinoderms to be successful?
• What distinguishes the classes of echinoderms from each other?
Vocabulary

Review
• endoskeleton

New
• pedicellaria
• water-vascular system
• madreporite
• tube foot
• ampulla
Echinoderms are Deuterostomes

- Echinoderms are deuterostomes – a major transition in the phylogeny of animals.
- The approximately 6000 living species of echinoderms are marine animals.
Body Structure

- Characterized by spiny endoskeleton
- The endoskeleton consists of calcium carbonate plates covered by a thin layer of skin.
- The skin contains pedicellariae, small pincers that aid in catching food and in removing foreign materials from the skin.
- Echinoderms have radial symmetry as adults.
- Larvae have bilateral symmetry.
Visualizing an Echinoderm

Animation

FPO

Add link to animation from page 794 (Figure 3) here.
Body Structure

Water-vascular system

- The water-vascular system is a system of fluid-filled, closed tubes that work together to enable echinoderms to move and get food.
  - The opening to the water-vascular system is called the madreporite, which draws water into the body.
  - Water moves through a series of canals to the tube feet – tubes with suction-cuplike structures at the end, which echinoderms use for movement, food collection, and respiration.
  - At the opposite end of the tube foot is a muscular sac called the ampulla, which expands and contracts to extend the tube foot.
Body Structure

Feeding and digestion

• Echinoderms have a variety of feeding strategies beyond tube feet.
  • Sea lilies and feather stars extend their arms to trap food.
  • Sea stars can push their stomachs out of their mouths and coating their prey in digestive enzymes.
  • Brittle stars trap organic matter in mucus on their arms.
  • Sea urchins use teethlike plates to scrape algae off rocks.
Body Structure

Respiration, circulation, and excretion

• Echinoderms use tube feet for respiration.
• Oxygen diffuses from the water through the thin membranes of the tube feet.
• Circulation takes place in the body coelom and the water-vascular system.
• Excretion occurs by diffusion through thin body membranes.
Body Structure

Response to stimuli

- Have both sensory and motor neurons
- Sensory neurons respond to touch, chemicals dissolved in the water, water currents, and light.
- Many echinoderms can also sense the direction of gravity.
Body Structure

Movement

• The structure of the endoskeleton is important for determining the type of movement an echinoderm can undertake.
  • Swimming
  • Crawling
  • Burrowing
Body Structure

Reproduction and development

- Most echinoderms reproduce sexually.
- Echinoderms can regenerate lost body parts.
Echinoderm Diversity

Reproduction and development

- Living classes of echinoderms include:
  - Asteroidea, the sea stars
  - Ophiuroidea, the brittle stars
  - Echinoidea, the sea urchins
  - Crinoidea, the sea lilies and feather stars
  - Holothuroidea, the sea cucumbers
  - Concentricycloidea, the sea daisies
Echinoderm Diversity

Sea stars

- Five arms arranged around a central disk
- Found in shallow coastal waters and tide pools
- Important marine predator
Echinoderm Diversity

Brittle stars

- Arms are thin and very flexible, without suckers on tube feet.
- Move by rowing themselves quickly over the bottom rocks and sediments.
- Feed on small particles suspended in the water.
Echinoderm Diversity

Sea urchins and sand dollars

- Sea urchins burrow into rocky areas.
- Can be herbivorous grazers or predators.
- Sand dollars can be found in shallow water burrowing into the sand.
- Filter organic particles.
Echinoderm Diversity

Sea lilies and feather stars

- Sessile for part of their lives.
- Can detach themselves and move elsewhere
- Capture food by extending their tube feet and arms into the water where they catch suspended organic materials
Echinoderm Diversity

Sea cucumbers

- Some tube feet are modified to form tentacles to trap suspended food particles.
- Only echinoderm to have respiratory organs in the form of respiratory trees, which also function in excretion
- When threatened, it can cast out some of its internal organs through its anus.
Echinoderm Diversity

Sea daisies

- Less than 1 cm in diameter
- Disc-shaped with no arms
- Tube feet are located around the edge of the disc
Classes of Echinoderms

Interactive Table

FPO

Add link to concepts in motion interactive table from page 797 (Table1) here.
Ecology of Echinoderms

Echinoderm benefits

• Sea cucumbers and sea urchins are sources of food.
• Important in ecosystem balances, especially in controlling algal growth.
• Bioturbators – stir up sediments on the ocean floor, suspending nutrients into the water column
Ecology of Echinoderms

Echinoderm harm

- When populations grow overly large, sea stars or sea urchins can disrupt ecosystems
- Can destroy habitats such as coral reefs and kelp forests
Review

**Essential Questions**

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**Vocabulary**

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• water-vascular system
• madreporite
• tube foot
• ampulla