Glencoe Science

Biology

Interactive Classroom

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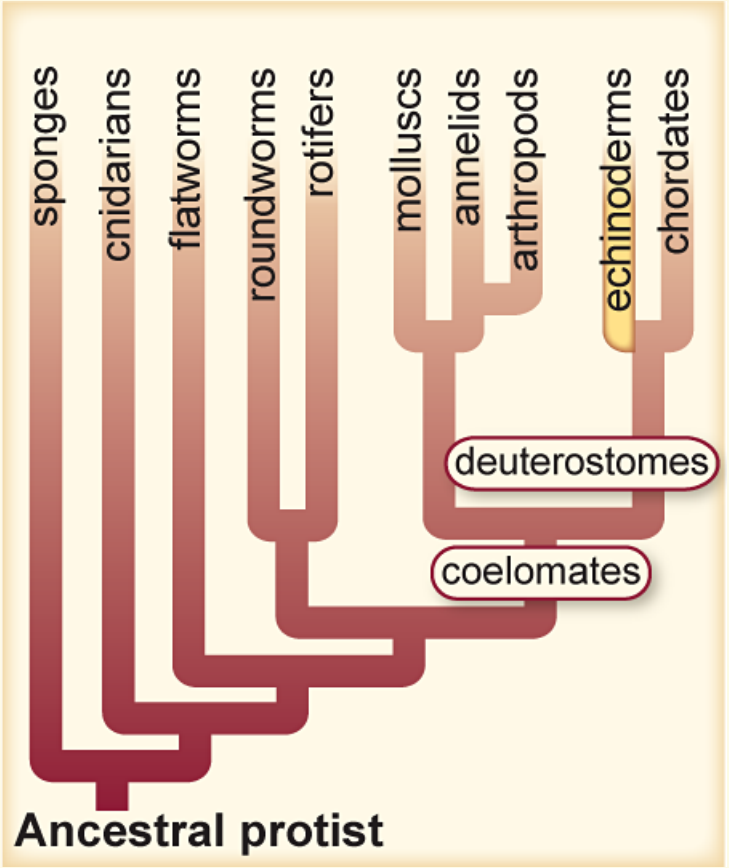
Chapter 27 Echinoderms and Invertebrate Chordates

EXIT

Click on a lesson name to select.

27.1 Echinoderm Characteristics

- Echinoderms are deuterostomes.
- The approximately 6000 living species of echinoderms are marine animals.



27.1 Echinoderm Characteristics

Body Structure

- The endoskeleton consists of calcium carbonate plates covered by a thin layer of skin.
- Pedicellariae aid in catching food and in removing foreign materials from the skin.

27.1 Echinoderm Characteristics

- All echinoderms have radial symmetry as adults.
- Echinoderm larvae have bilateral symmetry.

Adult brittle star

Concepts In Motion Animation

Visualizing an Echinoderm

Click here to proceed!

27.1 Echinoderm Characteristics

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.
- Tube feet are small, muscular, fluid-filled tubes that end in suction-cuplike structures and are used in movement, food collection, and respiration.

27.1 Echinoderm Characteristics

Feeding and Digestion

- Extend their arms and trap food
- Push their stomachs out of their mouths and onto their prey
- Trap organic materials in mucus on their arms
- Scrape algae off surfaces

27.1 Echinoderm Characteristics

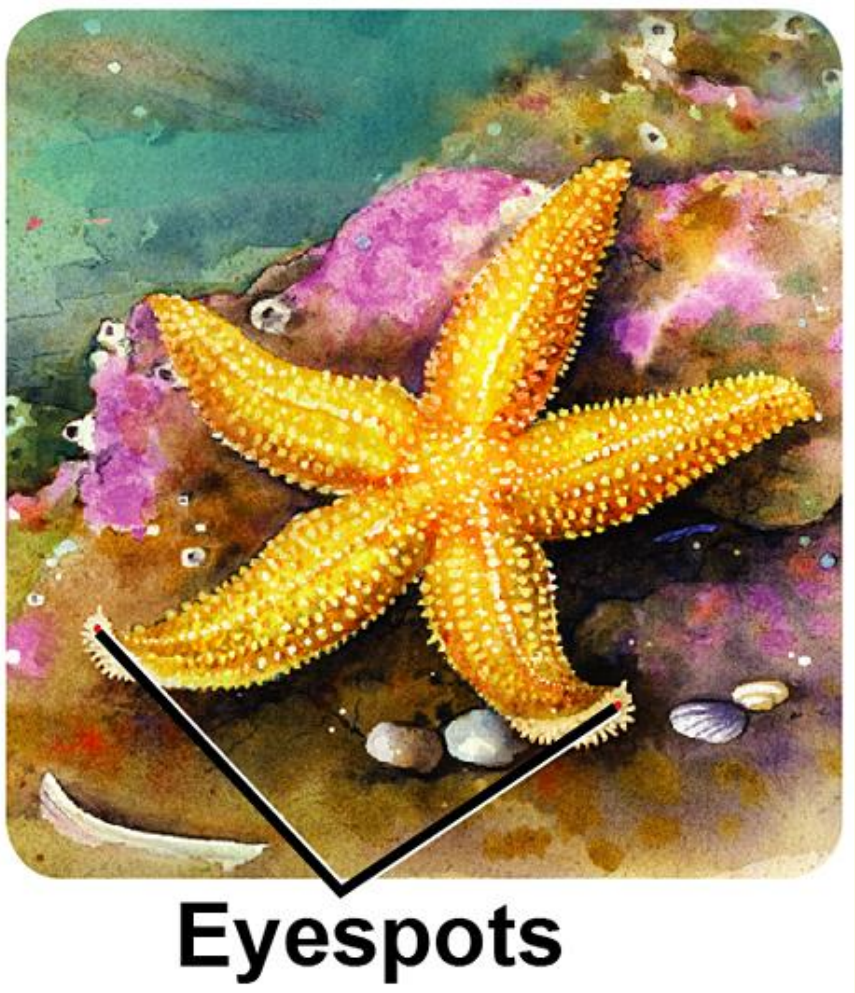
Respiration, Circulation, and Excretion

- 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.

27.1 Echinoderm Characteristics

Response to Stimuli

- Sensory neurons respond to touch, chemicals dissolved in the water, water currents, and light.



27.1 Echinoderm Characteristics

Movement

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

27.1 Echinoderm Characteristics

Reproduction and Development

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

27.1 Echinoderm Characteristics

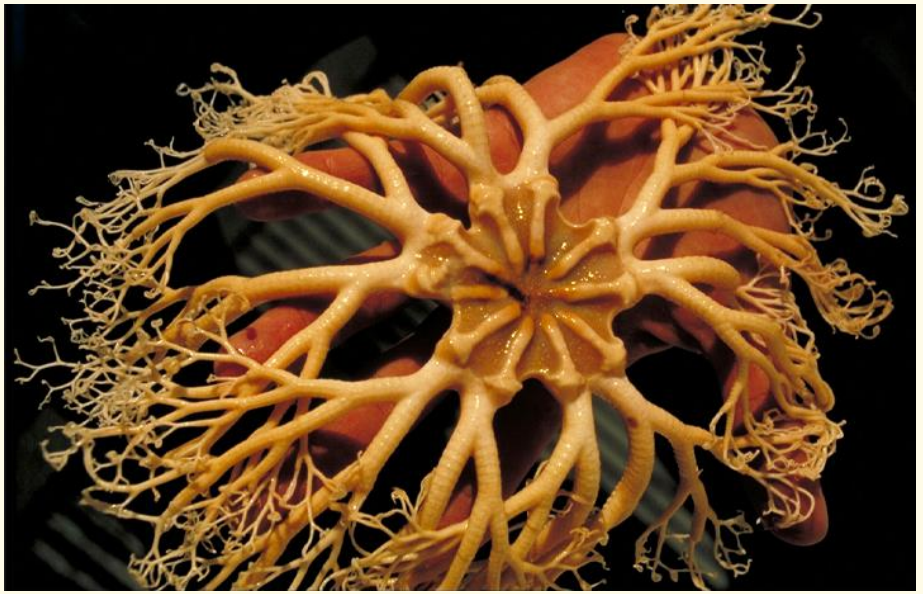
Sea Stars

- Five arms arranged around a central disk
- A single tube foot can exert a pull of 0.25–0.30N.
- Might have as many as 2000 tube feet

27.1 Echinoderm Characteristics

Brittle Stars

- Most brittle stars have five arms.
- Arms are thin and very flexible.



Brittle star

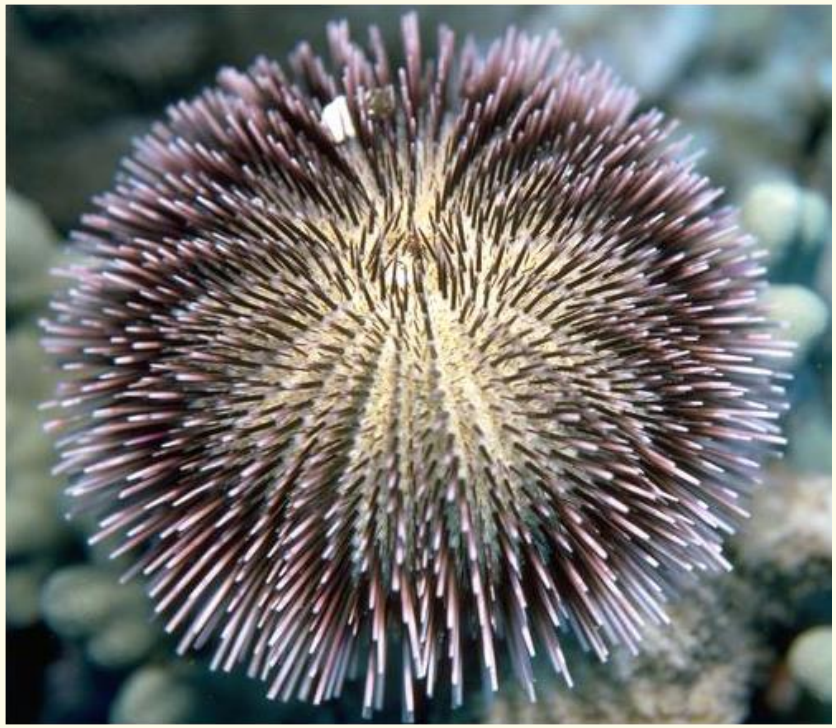
- Move by rowing themselves quickly over the bottom rocks and sediments

27.1 Echinoderm Characteristics

Sea Urchins and Sand Dollars

- Sand dollars can be found in shallow water burrowing into the sand.
- Sea urchins burrow into rocky areas.
- Tests reflect the five-part pattern of arms.
- Sea urchins can be herbivorous grazers or predators.
- Sand dollars filter organic particles.

27.1 Echinoderm Characteristics



Sea urchin

Sand dollar

27.1 Echinoderm Characteristics

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

Feather star

27.1 Echinoderm Characteristics

Sea Cucumbers

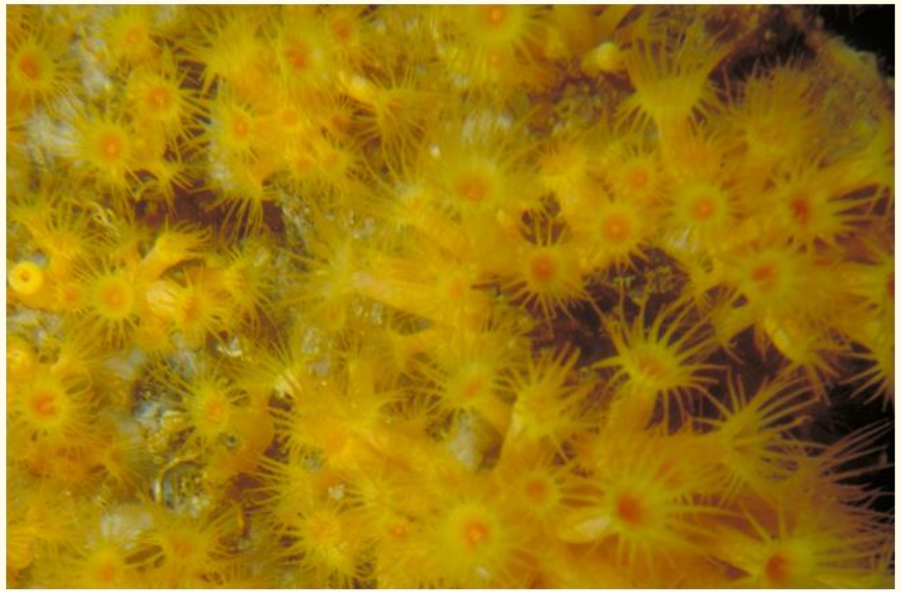
- Tube feet are modified to form tentacles which extend from around their mouths to trap suspended food particles.
- Tentacles are covered with mucus.
- When threatened, it can cast out some of its internal organs through its anus.

Sea cucumber

27.1 Echinoderm Characteristics

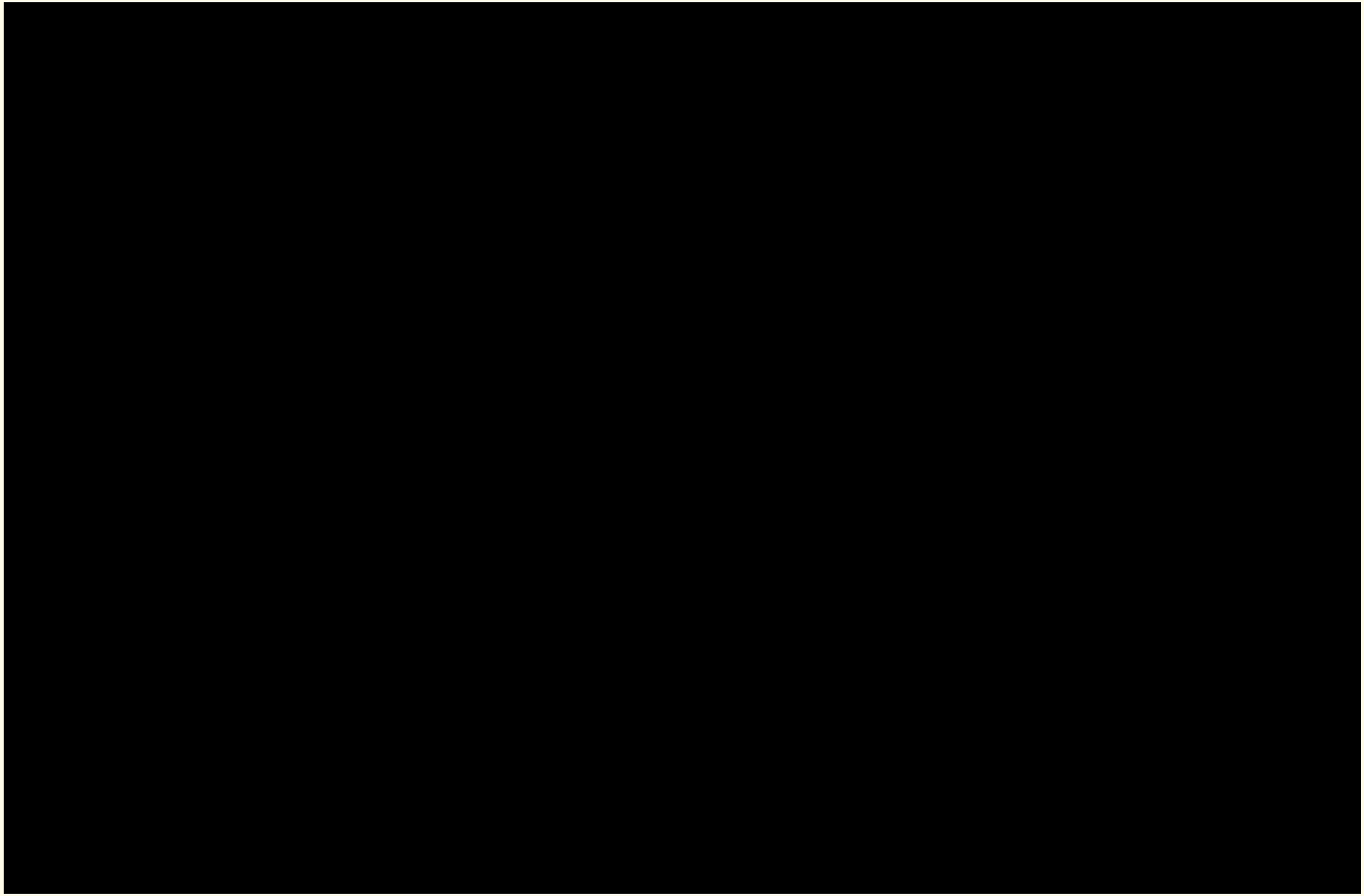
Sea Daisies

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



Sea daisies

Concepts In Motion



27.1 Echinoderm Characteristics

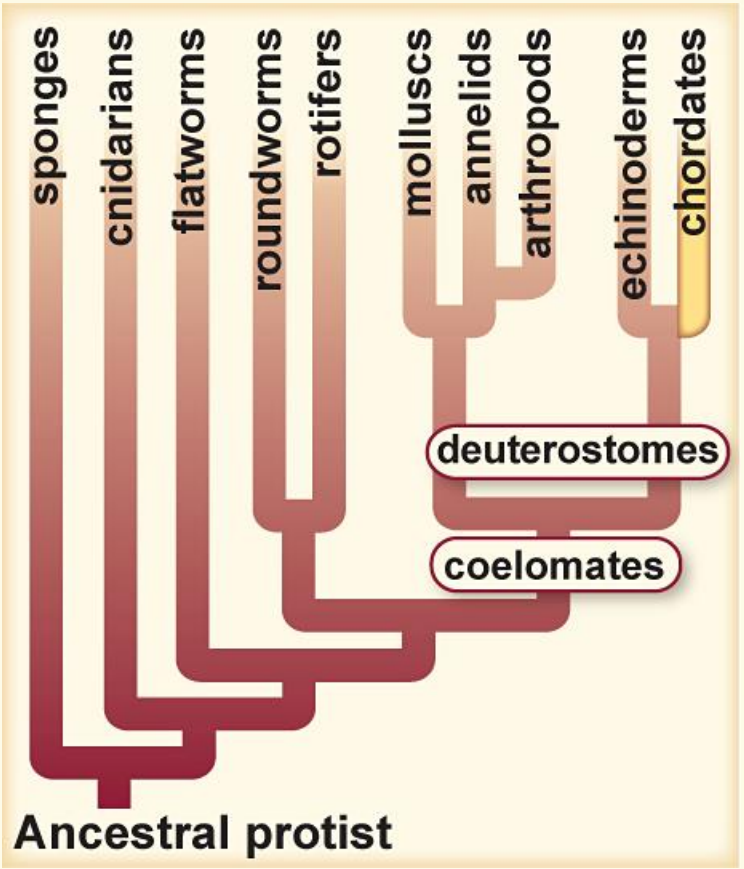
Ecology of Echinoderms

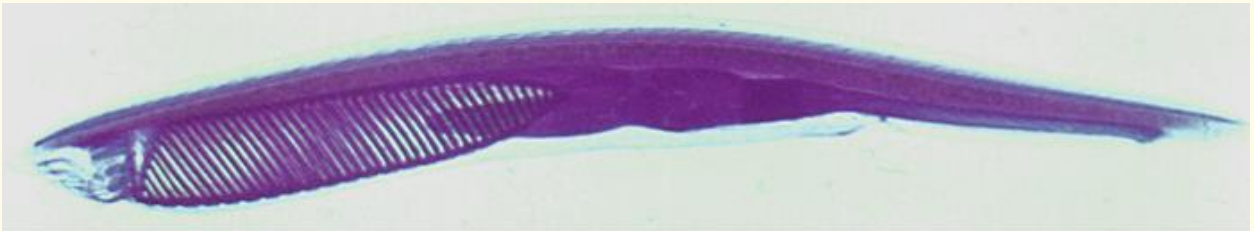
- Sea cucumbers and sea urchins are sources of food.
- Commensal relationships exist between some echinoderms and other marine animals.

27.2 Invertebrate Chordates

Invertebrate Chordate Features

- Fossil evidence and recent molecular data show that the amphioxus, or lancelet, is one of the closest living relatives of vertebrates.

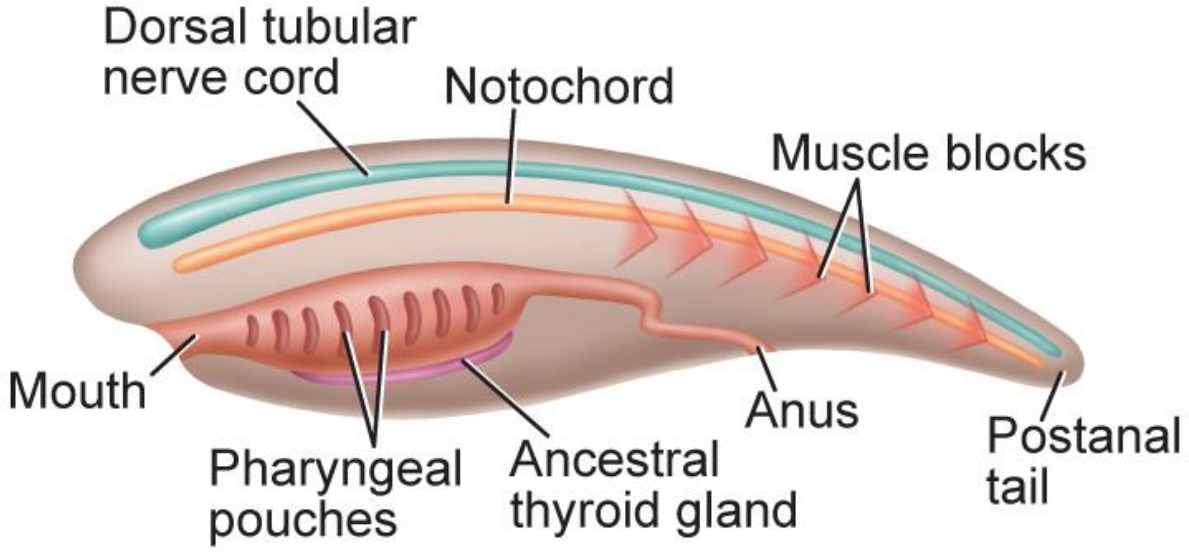




Lancelet

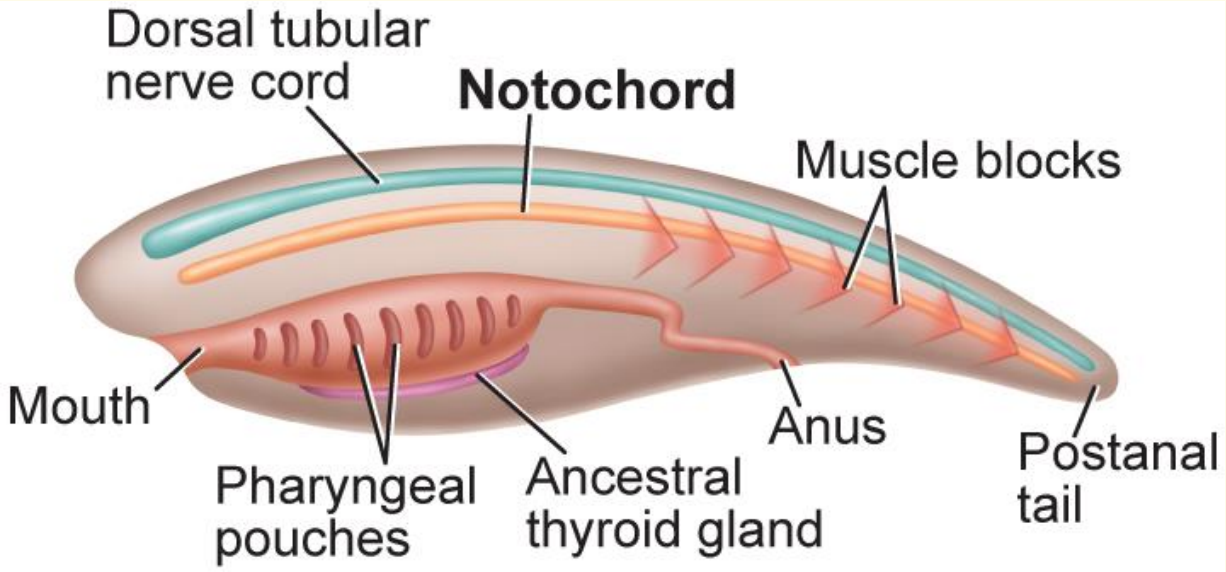
27.2 Invertebrate Chordates

- Chordates have four distinctive features.
  - A dorsal tubular nerve cord
  - A notochord
  - Pharyngeal pouches
  - A postanal tail



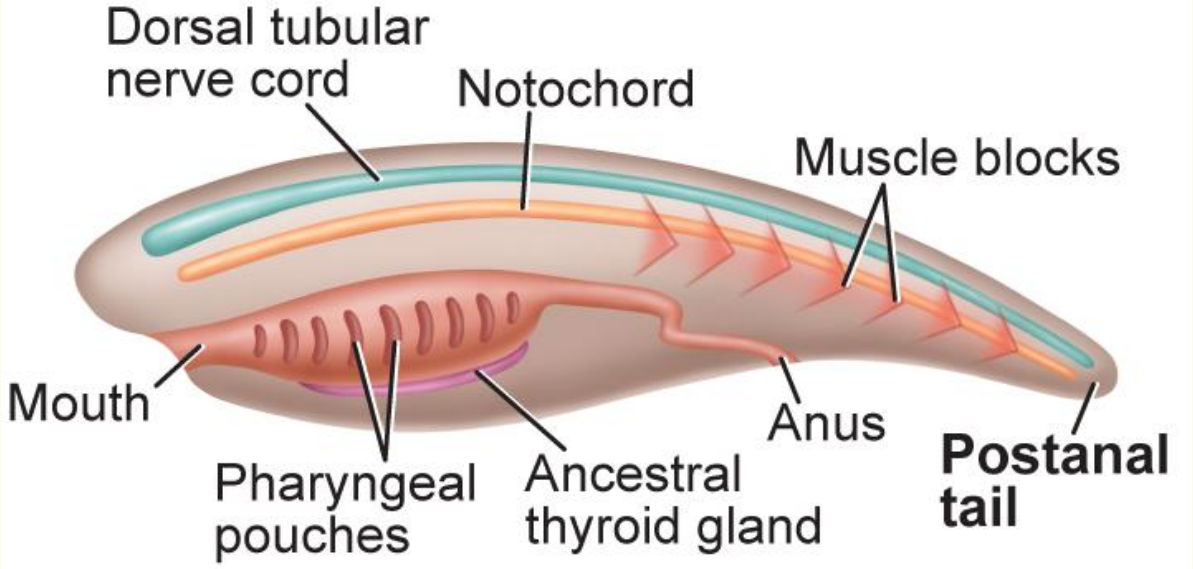
27.2 Invertebrate Chordates

- The notochord is a flexible, rodlike structure that extends the length of the body.
- A notochord made fishlike swimming possible.



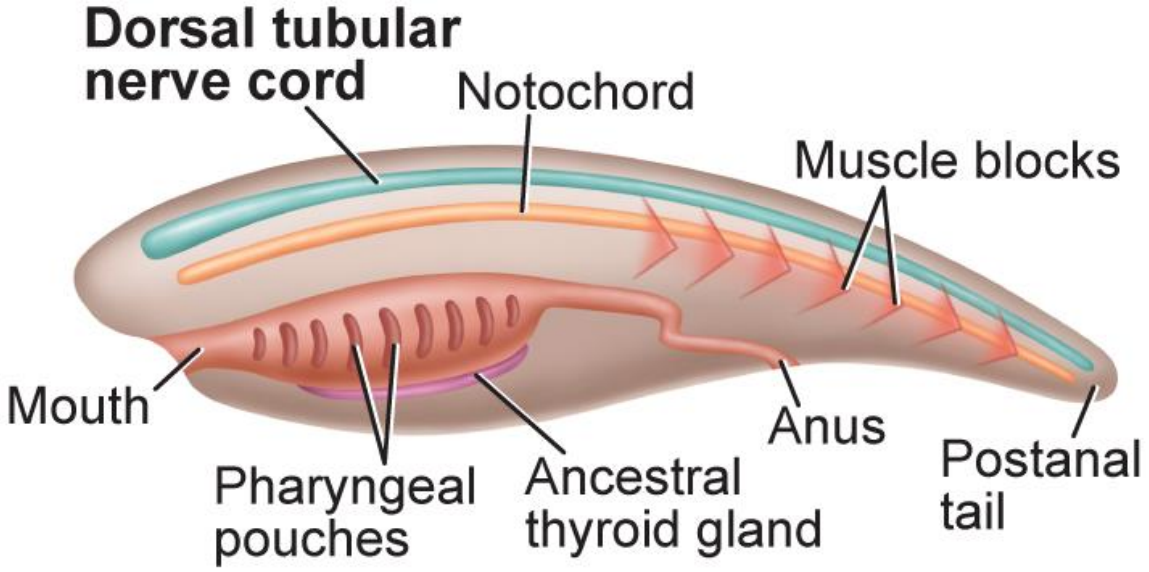
27.2 Invertebrate Chordates

- A postanal tail is a structure used primarily for locomotion and is located behind the digestive system and anus.



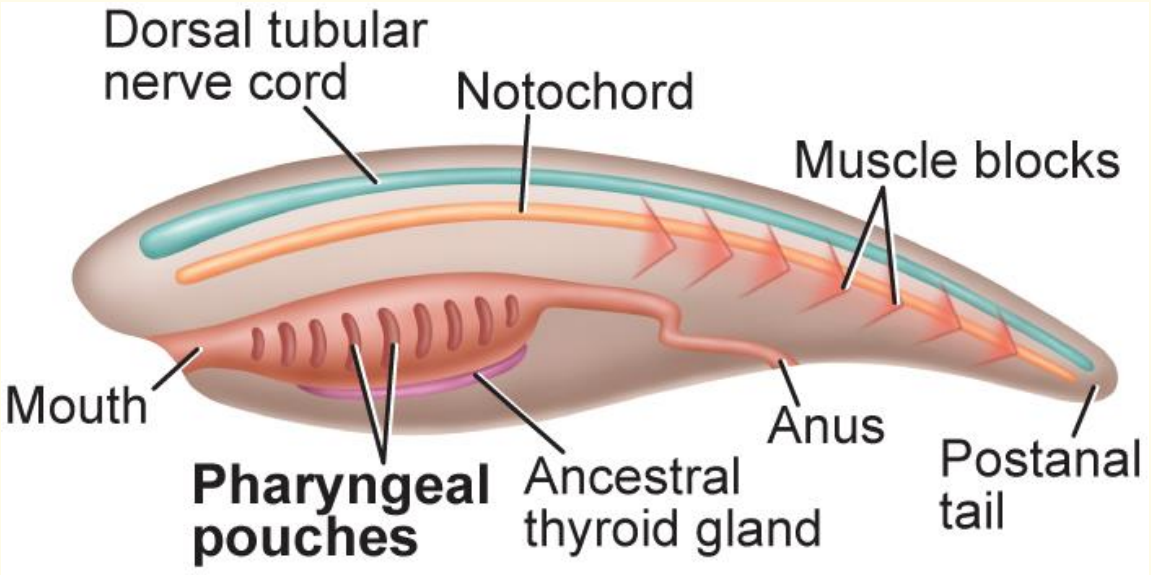
27.2 Invertebrate Chordates

- The dorsal tubular nerve cord is located dorsal to the digestive organs and is a tube shape.
- The anterior end of this cord becomes the brain and the posterior end becomes the spinal cord during development of most chordates.



27.2 Invertebrate Chordates

- Pharyngeal pouches were used first for filter feeding and later evolved into gills for gas exchange in water.
- In terrestrial chordates, pharyngeal pouches developed into the tonsils and the thymus gland.



27.2 Invertebrate Chordates

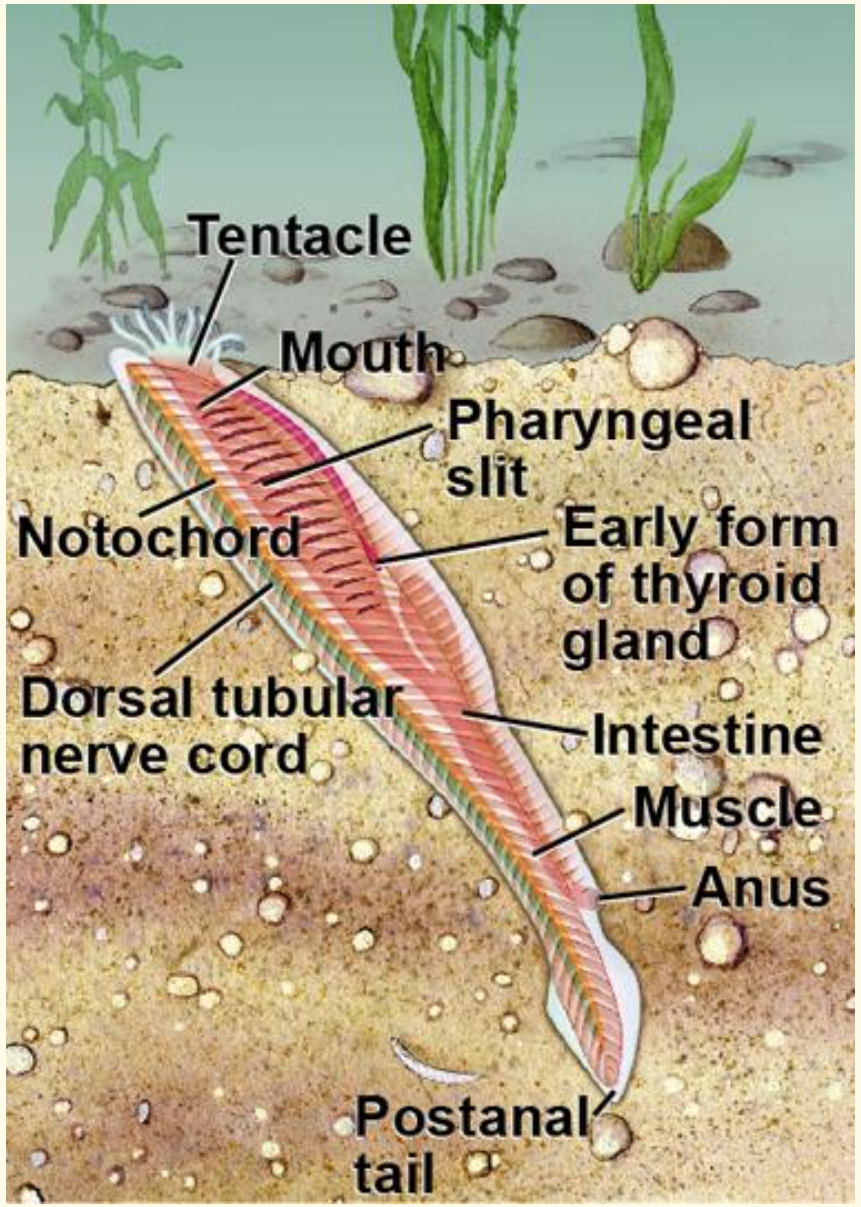
Diversity of Invertebrate Chordates

- All invertebrate chordates are marine animals.
- 23 species of lancelets
- 1250 species of tunicates

27.2 Invertebrate Chordates

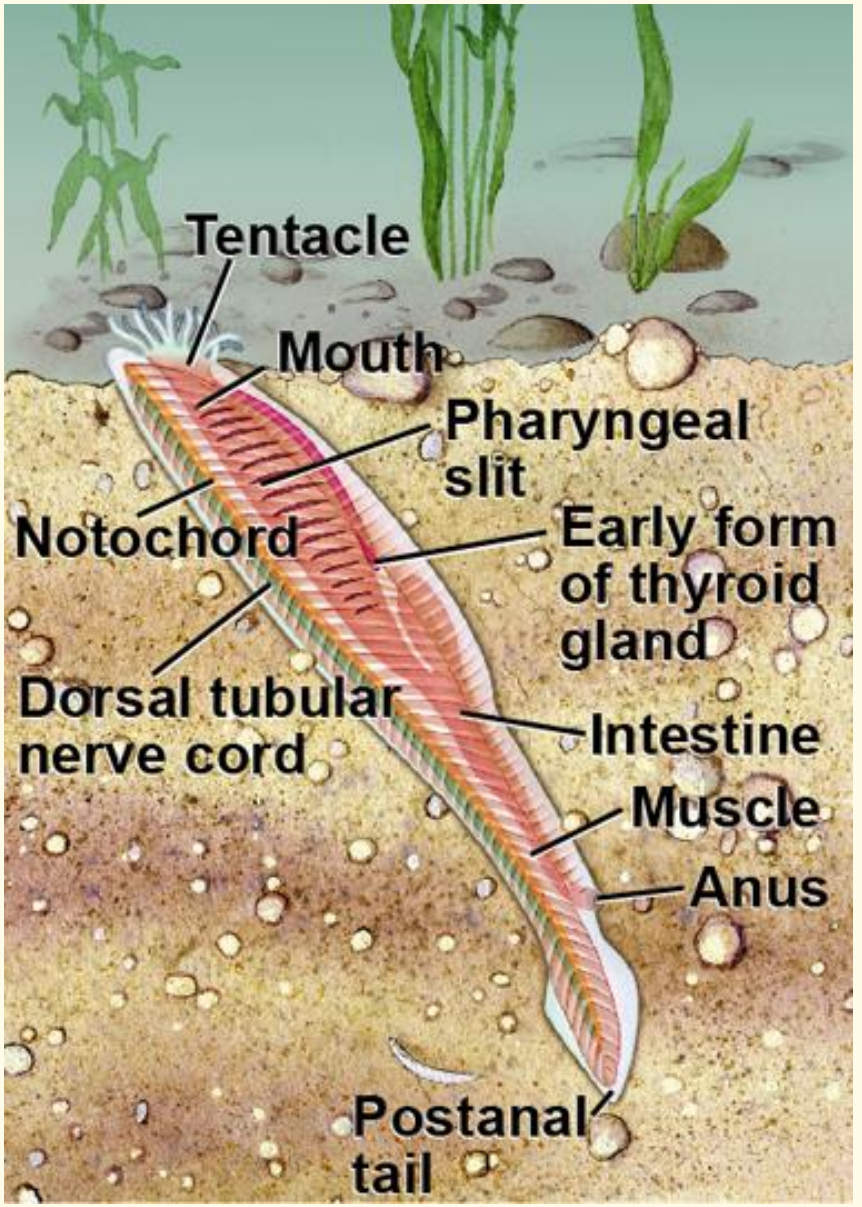
Lancelets

- Burrow their bodies into the sand in shallow seas
- Filter feeds



27.2 Invertebrate Chordates

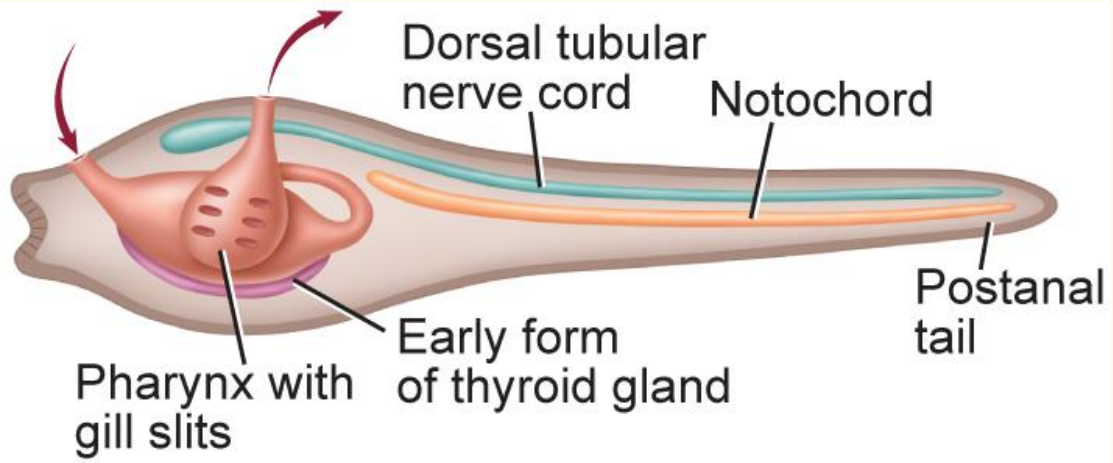
- Swim with a fishlike motion
- The nervous system consists of main branching nerves and a simple brain.



27.2 Invertebrate Chordates

Tunicates

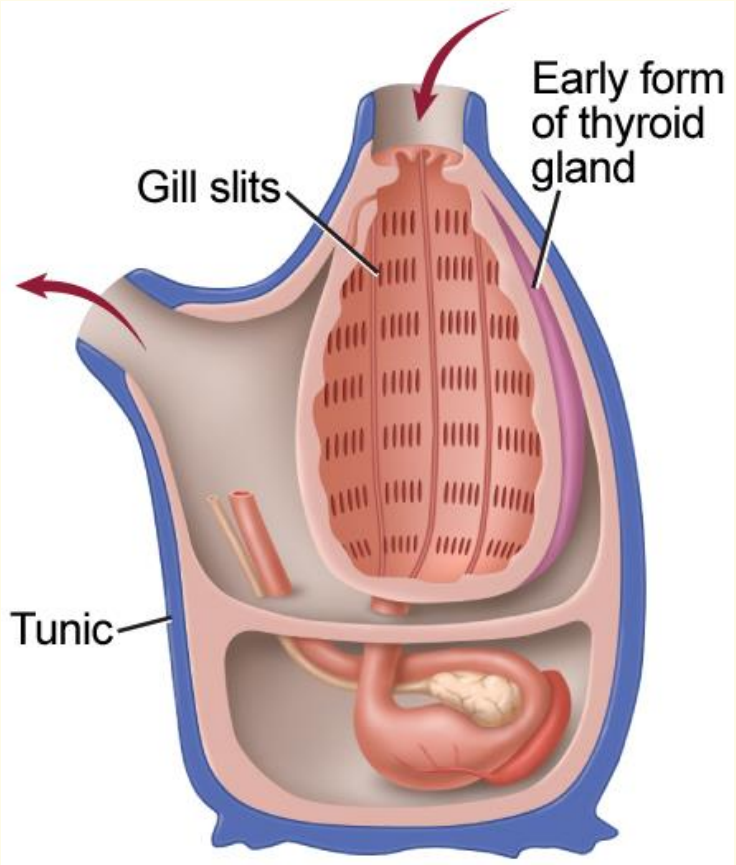
- Sessile
- Only in the larval stages do they show typical chordate features



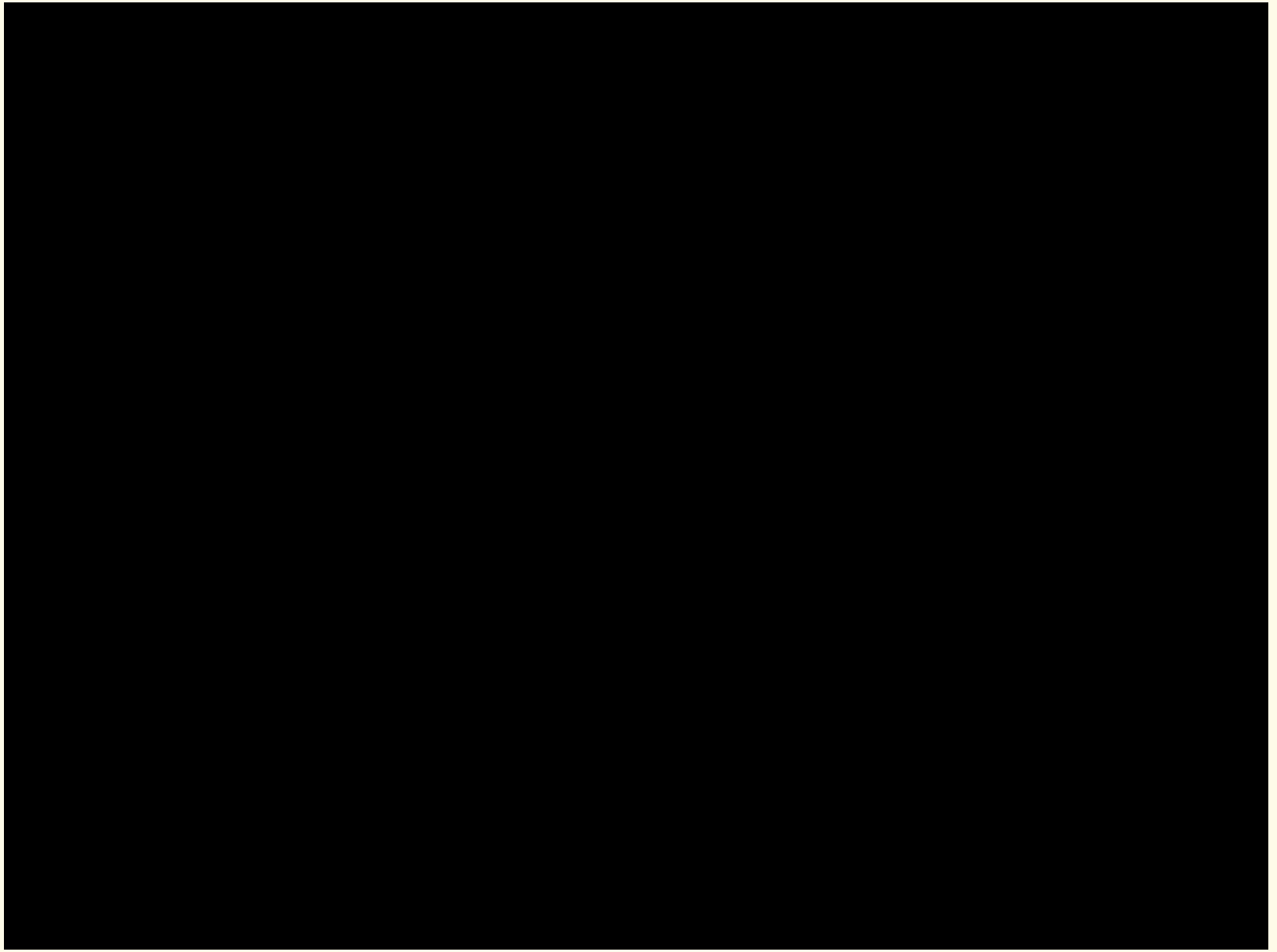
- Food particles are trapped in a mucous net and moved into the stomach where digestion takes place.

27.2 Invertebrate Chordates

- The only chordate feature that remains in the adult tunicate is pharyngeal gill slits.
- Circulation is performed by a heart and blood vessels that deliver nutrients and oxygen to body organs.



Concepts In Motion



Chapter Resource Menu

Click on a hyperlink to view the corresponding lesson.

Chapter Diagnostic Questions

CheckPoint

Which is *not* an echinoderm?

A. sea cucumber

B. sand dollar

C. cuttlefish

D. feather star

Chapter Diagnostic Questions

CheckPoint

What type of symmetry is typical of adult echinoderms?

A. radial
B. bilateral
C. asymmetry
D. planar

Chapter Diagnostic Questions

CheckPoint

How do pedicellariae function?

A. frighten predators

B. catch food

C. remove wastes

D. move the echinoderm

27.1 Formative Questions

CheckPoint

What characteristic does a starfish have that an octopus and beetle do not have?

A. a coelom

B. an endoskeleton

C. bilateral symmetry

D. segmentation

27.1 Formative Questions

CheckPoint

How are echinoderms closely related to animals that have bilateral symmetry?

A. They have a segmented coelom.

B. They have radial segmentation.

C. Their larvae have bilateral symmetry.

D. Their nervous system is advanced.

27.1 Formative Questions

CheckPoint

What is the term for the fluid-filled tubes that enable echinoderms to move and get food?

A. hydroradial apparatus

B. madreporite assemblage

C. radial-canal junction

D. water-vascular system

27.1 Formative Questions

CheckPoint

Why are sea urchins and sea cucumbers called bioturbators?

A. They create water currents.

B. They have spiral bodies.

C. They move in circles.

D. They stir up sediment.

27.2 Formative Questions

CheckPoint

What feature does a lancelet and a tunicate lack?

A. a backbone

B. a dorsal nerve cord

C. a notochord

D. a postanal tail

27.2 Formative Questions

CheckPoint

What develops at the anterior end of the dorsal tubular nerve cord in most chordates?

A. a brain
B. a notochord
C. a postanal tail
D. a spinal cord

27.2 Formative Questions

CheckPoint

What feature is unique to chordates?

A. a postanal tail

B. segmentation

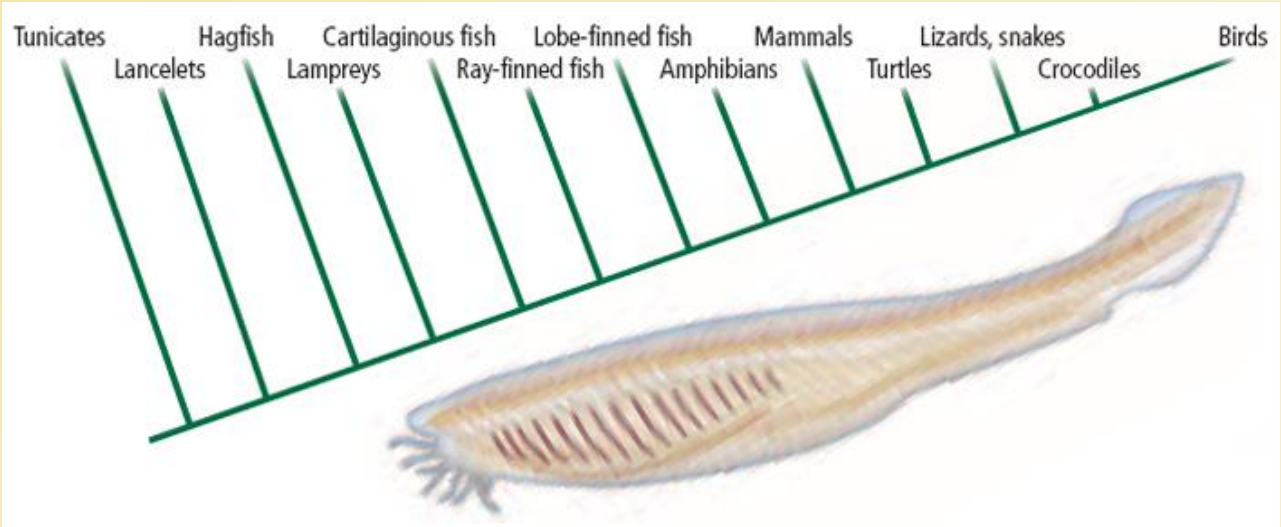
C. deuterostome development

D. an endoskeleton

27.2 Formative Questions

CheckPoint

Which animals on the cladogram are believed to be the first vertebrates?



27.2 Formative Questions

CheckPoint

A. tunicates

B. lancelets

C. hagfish

D. lampreys

Chapter Assessment Questions

CheckPoint

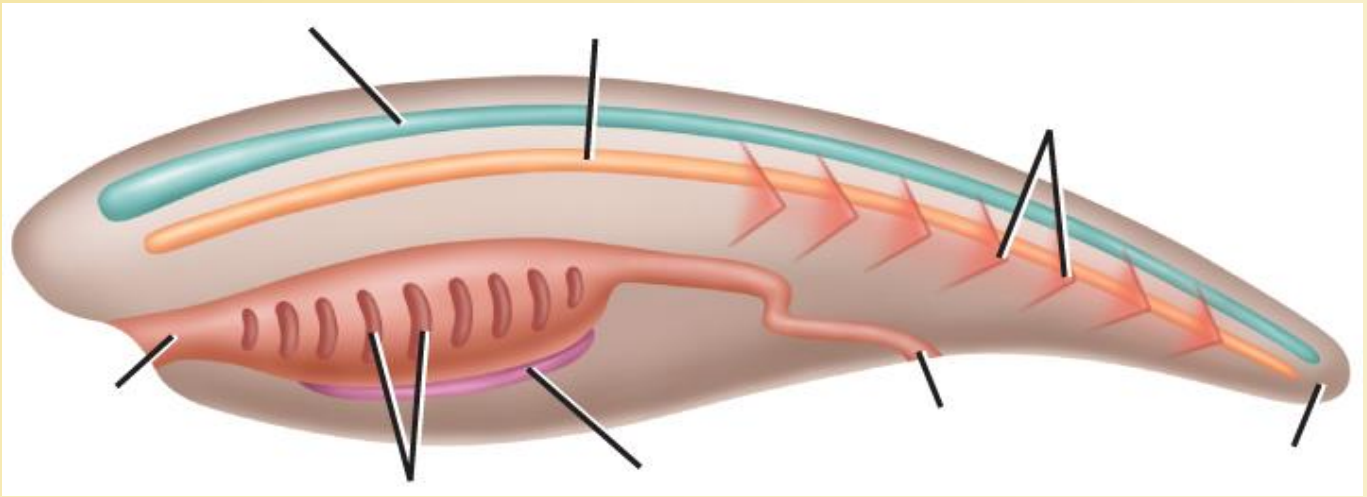
Explain the benefit of regeneration in echinoderms.

Answer: Many echinoderms can drop off an arm when they are attacked. This allows them to flee while the predator is distracted. Others can expel part of their internal organ systems when threatened, which would also deter predators.

Chapter Assessment Questions

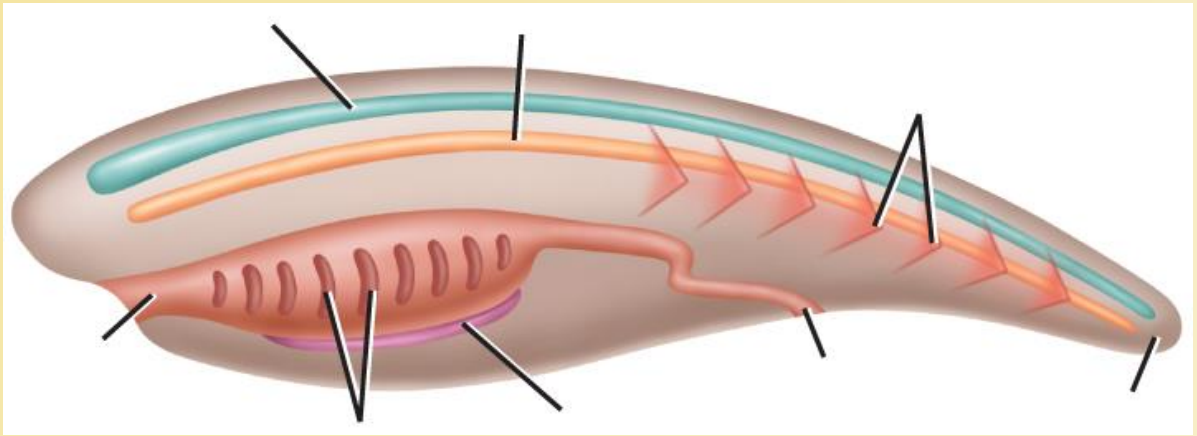
CheckPoint

Which structure of the chordate allows for side-to-side movements?



Chapter Assessment Questions

CheckPoint



A. dorsal tubular nerve cord

B. notochord

C. pharyngeal tubes

D. postanal tail

Chapter Assessment Questions

CheckPoint

Which structure is the strainer-like opening to the water-vascular system?

A. ampulla

B. tube feet

C. pedicellariae

D. madreporite

Standardized Test Practice

CheckPoint

What is believed to be a characteristic of the ancestor of echinoderms?

A. an exoskeleton

B. bilateral symmetry

C. radial symmetry

D. protostome development

Standardized Test Practice

CheckPoint

What aspect of echinoderm ecology is still under debate?

A. their affect on marine ecosystems

B. their usefulness as food sources

C. the affect they have on other populations

D. the cause of their population explosions

Standardized Test Practice

CheckPoint

What enables a sea star to open the shells of a clam?

A. canal rings

B. hydraulic suction

C. hydrostatic muscles

D. radial pressure

Standardized Test Practice

CheckPoint

What is the general arrangement of an echinoderm's nervous system?

A. a cephalized brain and nerve cord

B. a nerve cord with branching ganglia

C. a nerve net composed of nerve cells

D. a nerve ring with branching neurons

Standardized Test Practice

CheckPoint

Which characteristic in vertebrates is evidence for their aquatic ancestry?

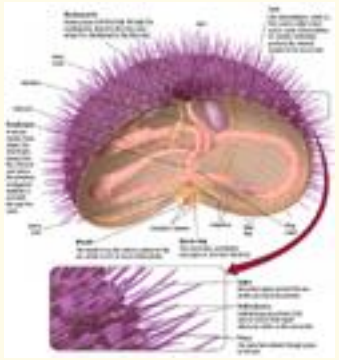
A. a dorsal nerve cord

B. a postanal tail

C. pharyngeal pouches

D. ventral notochords

Glencoe Biology Transparencies



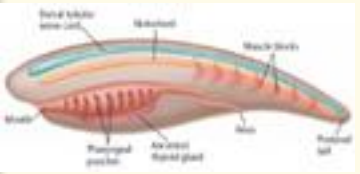
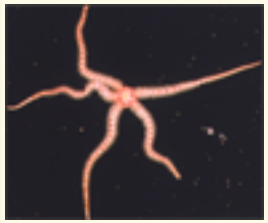
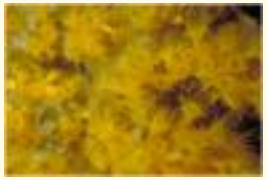


Image Bank

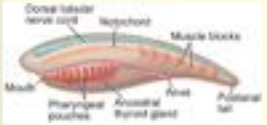

Ancestral protist

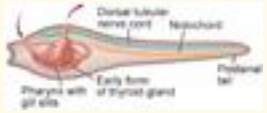


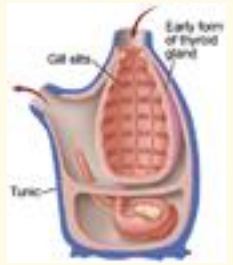

Eyespots




Ancestral protist






Gill slits
Tunic

Vocabulary

Section 1

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

Vocabulary

Section 2

- chordate
- invertebrate chordate
- notochord
- postanal tail
- dorsal tubular nerve cord
- pharyngeal pouch

Animation

Concepts In MOtion

- Visualizing an Echinoderm
- Tunicate