

Echinodermata vs Mollusca

Georgia Standards of Excellence:

- **SZ1.** Obtain, evaluate, and communicate information to derive the phylogeny of animal taxa using informative characteristics.
 - **B.** Analyze and interpret data to explain patterns in structure and function and construct a classification of representative animal taxa including: Porifera, Cnidaria, Platyhelminthes, Nematoda, Annelida, Mollusca, Arthropoda, Echinodermata, and Chordata.

Next Generation Science Standards:

- **MS-LS4-2.** Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
- **HS-LS4-1.** Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

Learning Objective:

- Students will identify anatomical features of sea cucumbers and nudibranchs.

Essential Question:

- What physiological and morphological features contribute to distinguishing a sea cucumber from a nudibranch?

Key Vocabulary:

- Gastropods
- Cerata
- Morphological
- Rhinophores
- Echinodermata
- Mollusca
- Ossicles
- Water Vascular System

Materials:

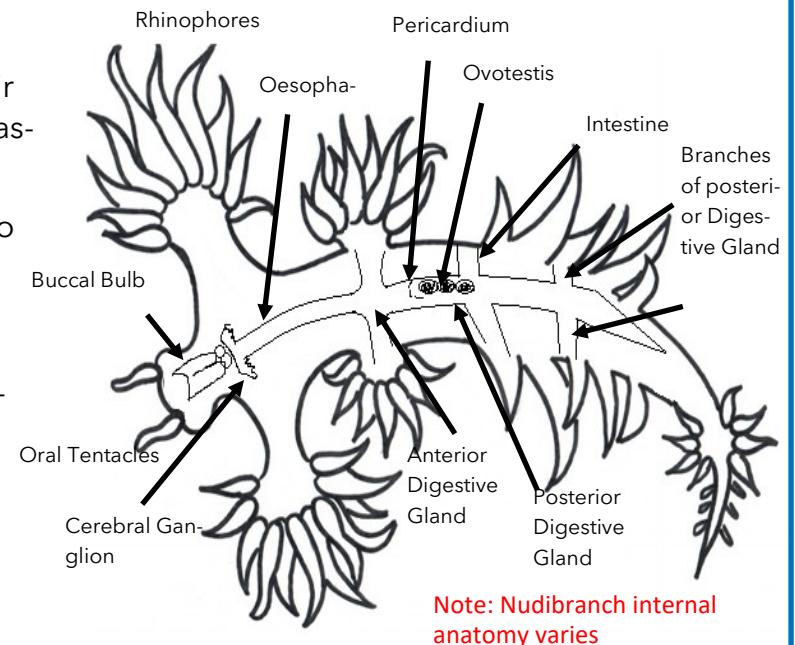
- Sea Cucumber or Nudibranch Worksheet
- Writing Utensil



Echinodermata vs Mollusca

Nudibranch Background Information:

- Many people think nudibranchs, sea slugs and sea cucumbers are all the same. Nudibranchs are indeed a type of sea slug, but sea cucumbers have no relation to other two. Nudibranchs fall into the *Gastropoda* class, having similarities with terrestrial snails and slugs as well as some marine shelled animals, like the whelk.
- Most nudibranchs do not have gills, but breathe through their skin. Some species have gills on their backs.
- There are two main types of nudibranchs: Dorid nudibranchs look fairly smooth, with a tuft of feather-like gills toward the back of the animal that are used to breathe. Aeolid nudibranchs instead breathe with organs called cerata covering their backs.
- Nudibranchs prey upon only one to two kinds of organisms. The most common of these are sponges, *bryozoans* and *cnidarians*. Nudibranchs steal the toxins or stinging cells from the prey to use as their own defense. **This is not true of all sea slugs and many species of sea slugs produce their own toxins, just not nudibranchs.**
 - They need this defense, because they move very slowly along the ocean floor. They move around by way of a broad, flat muscle on their underside called a foot, a common morphological characteristic of gastropods.
 - “Nudibranchs have poor vision and can only discern light and dark, so they must sense the world through two highly sensitive tentacles called rhinophores located on top of their heads. These rhinophores tend to stick out and serve as a nice lure for hungry fish; fortunately, most nudibranchs have the ability to completely withdraw their rhinophores into a receptacle in their skin whenever they sense danger” (Britnell 2019).
- Nudibranchs are found all over the world in practically every variety of water from deep ocean to tidal pools, cold water to tropical. They do not get very large often only reaching 2cm and large ones reaching 11 inches in length.

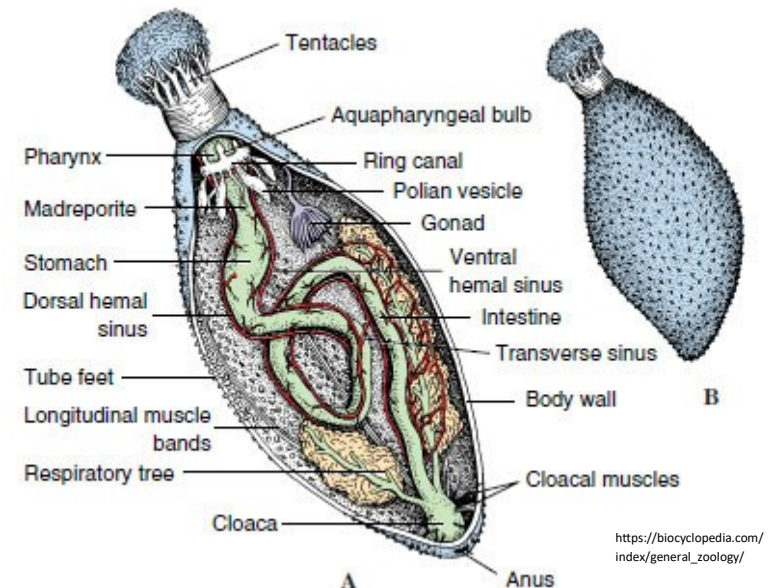




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Sea Cucumber Background Information:

- Sea cucumbers may look similar to nudibranchs, but they are in an entirely different class called *Holothuroidea*, even a different phylum, *Echinodermata* instead of *Mollusca*. The *Echinodermata* phylum also includes sea urchins and sea stars.
- “Sea cucumbers do not have gills and instead use a respiratory tree connected to the anus. The body wall is usually leathery, with microscopic ossicles or bone like structures embedded in it, although a few species have large ossicles forming a dermal armor” (Biocyclopedia).
- “Sea cucumbers are scavengers that feed on small food items in the benthic zone (seafloor), as well as plankton floating in the water column. Algae, aquatic invertebrates and waste particles make up their diet. Unlike nudibranchs, sea cucumbers do not receive stingers or toxins from their diet. Not all sea cucumbers even have toxins. They have tentacles typically 10-30 surrounding their mouth to gather food” (NWF).
- Sea cucumbers have two methods of locomotion, tube feet or tube feet and muscular contractions. The tube feet are a part of a water system that pumps water through the body called the water vascular system. The water vascular system is a common trait of echinoderms to pump water to their feet for locomotion, as well as food and waste transportation and respiratory processes.
- Sea cucumbers have two types of defense mechanisms. Evisceration: they expel some internal organs from their anus and flee. These organs regrow quickly. Cuvierian tubules: tubes in the respiratory system that can be expelled to become sticky and contain toxins.
- Like nudibranchs, sea cucumbers are found all over the world in practically every marine environment including the Mariana trench. They live and move along on the sea floor.
- On average sea cucumbers are 4 to 11 inches in length, although the smallest is just about 3 mm in length and the largest can reach 9 ft. in length.





Echinodermata vs Mollusca

Activity Instructions:

1. Cover the background information with students, emphasizing anatomical features and descriptions differentiating the two animals.
2. Use the images below as a comparison example between nudibranchs and sea cucumbers.
3. Distribute the worksheets and have students complete the questions by use of the background information and the images provided.

Sea cucumber:

This is commonly called a sea pig. It has large tube feet on either side and tentacles around the mouth.



Nudibranch:

This is commonly called a sea bunny. It has two rhinophores near the front, cerata at the back and a foot for movement.



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Evaluate:

Students correctly filled out the worksheet and identified distinguishing anatomical features or indicators between the two animals.

Drawings of should be similar to the images provided in background information. NOTE: Sea Cucumbers has a more detailed drawing, only listing a few is acceptable.

Extensions:

1. Have students look at the pictures and determine if it is a nudibranch or sea cucumber.
2. Have student share reasoning for determination.

Answer Key:

Sea Cucumber: 1. Warty Sea Cucumber, 4. Pineapple Sea Cucumber, 7. Leopard Sea Cucumber

Nudibranch: 2. Opalescent Nudibranch, 3. Sea Lemon, 5. Blue Glaucus, 6. Spanish Dancer, 8. Red-lined Nudibranch

References:

"Feature: Nudibranchs". Oceana. Accessed August 21, 2020. <https://eu.oceana.org/en/feature-nudibranchs>

Birtnell, Jett and Katheryn. "What is a nudibranch? Meet the 'high fashion models' of the ocean depths". March 12, 2019. Canadian Geographic. <https://www.canadiangeographic.ca/article/what-nudibranch-meet-high-fashion-models-ocean-depths>

"A Collage of Nudibranch Colors". Smithsonian: Ocean. Accessed August 25, 2020. <https://ocean.si.edu/ocean-life/invertebrates/collage-nudibranch-colors>

Fulton-Bennett, Kim. "Five New Species of Sea Slugs Found in the Ocean Depths". December 12, 2018. MBARI. <https://www.mbari.org/five-new-nudibranchs/>

"Animals A-Z". Monterey Bay. Accessed August 21, 2020 <https://www.montereybayaquarium.org/animals/animals-a-to-z>

"Sea Cucumbers". National Wildlife Federation (NWF). Accessed August 19, 2020. <https://www.nwf.org/Educational-Resources/Wildlife-Guide/Invertebrates/Sea-Cucumbers>

"Class Holothuroidea". Biocyclopedia. Accessed August 20, 2020. https://biocyclopedia.com/index/general_zoology/class_holothuroidea.php

Sea Cucumber or Nudibranch Worksheet

This animal can get up to 16 inches in length. It eats small organisms and is found from 100- 1,300 feet down. It has no known toxins for defense.



What phylum does this animal belong to?

What is this animal?

List out notable anatomical features and draw arrows to them or any indicators of distinction:

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Using the background information, draw and label some of the potential internal features of this animal below:

Sea Cucumber or Nudibranch Worksheet

This animal was 3 inches in length. It is a heterotroph tertiary consumer, found at over 5,500 feet down off the coast of Central California.



What phylum does this animal belong to?

What is this animal?

List out notable anatomical features and draw arrows to them or any indicators of distinction:

Using the background information, draw and label some of the potential internal features of this animal below:

Sea Cucumber or Nudibranch Worksheet

This animal was an estimated 2 cm in length. It was found near a dead grey whale at about 1,200 feet. It is a carnivore with its specific diet not yet known.



What phylum does this animal belong to?

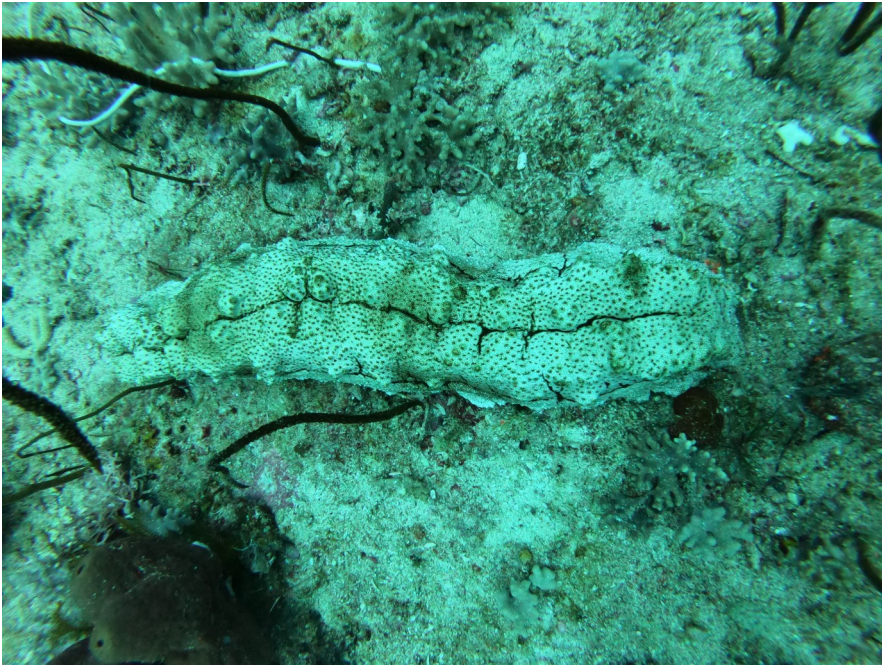
What is this animal?

List out notable anatomical features and draw arrows to them or any indicators of distinction:

Using the background information, draw and label some of the potential internal features of this animal below:

Sea Cucumber or Nudibranch Worksheet

This animal's average length is 27 inches. It was found in Indonesia at about 60 feet down. Takes up the dirt to eat small organic matter of any kind.



What phylum does this animal belong to?

What is this animal?

List out notable anatomical features and draw arrows to them or any indicators of distinction:

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Using the background information, draw and label some of the potential internal features of this animal below:

WORKSHEET KEY

What phylum does this animal belong to?

Echinodermata

What is this animal?

Sea Cucumber (Johnson's Sea Cucumber)

List out notable anatomical features and draw arrows to them or any indicators of distinction:

Size too large for Nudibranch

Tube Feet

Image: Monterey Bay Aquarium



What phylum does this animal belong to?

Mollusca

What is this animal?

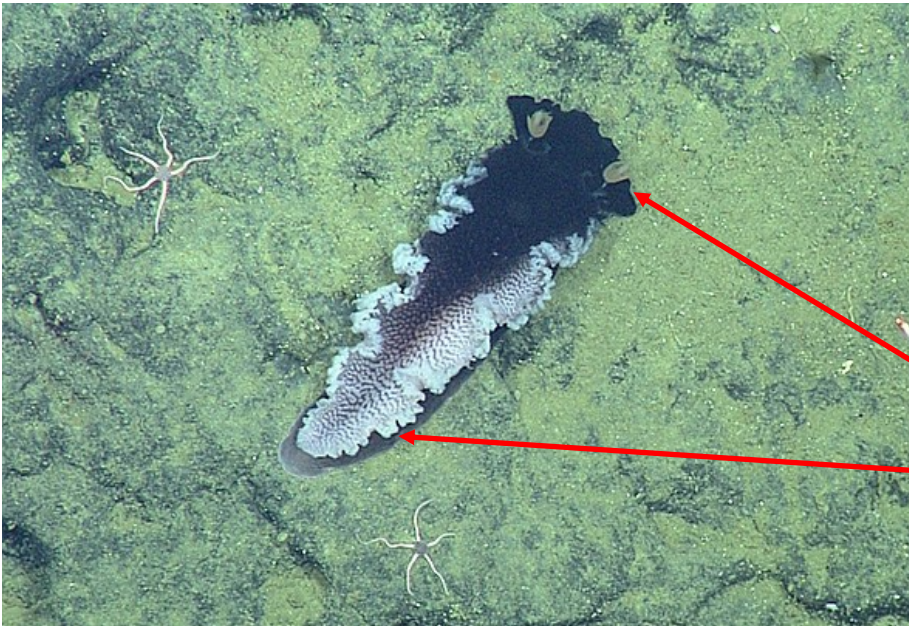
Nudibranch (*Tritonia nigrigris*)

List out notable anatomical features and draw arrows to them or any indicators of distinction:

Rhinophores

Foot

Image: MBARI 2018



WORKSHEET KEY

What phylum does this animal belong to?

Mollusca

What is this animal?

Nudibranch (*Aeolidia libitinaris*)

List out notable anatomical features and draw arrows to them or any indicators of distinction:

Cerata covering back

Rhinophores

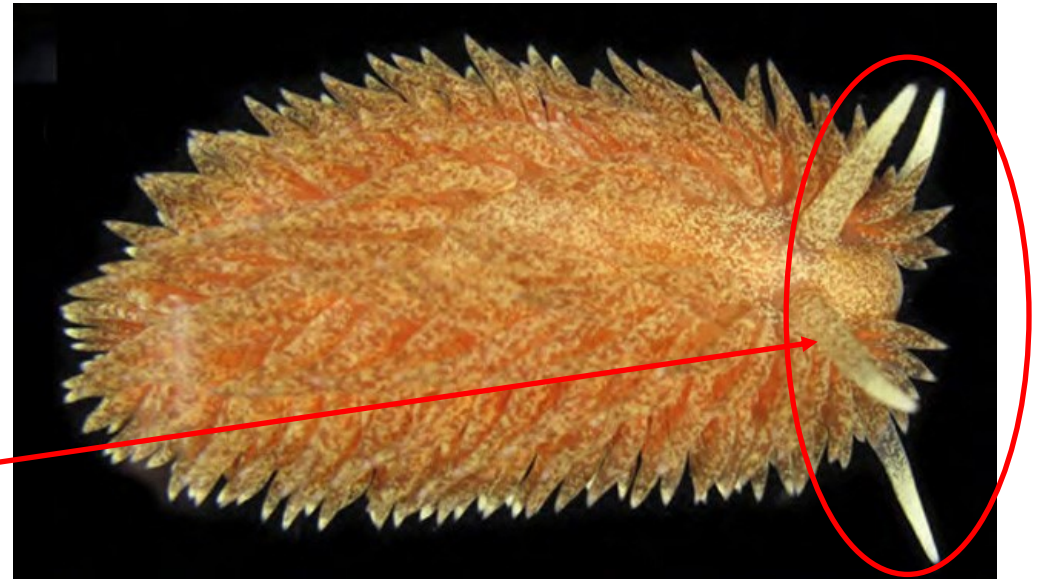
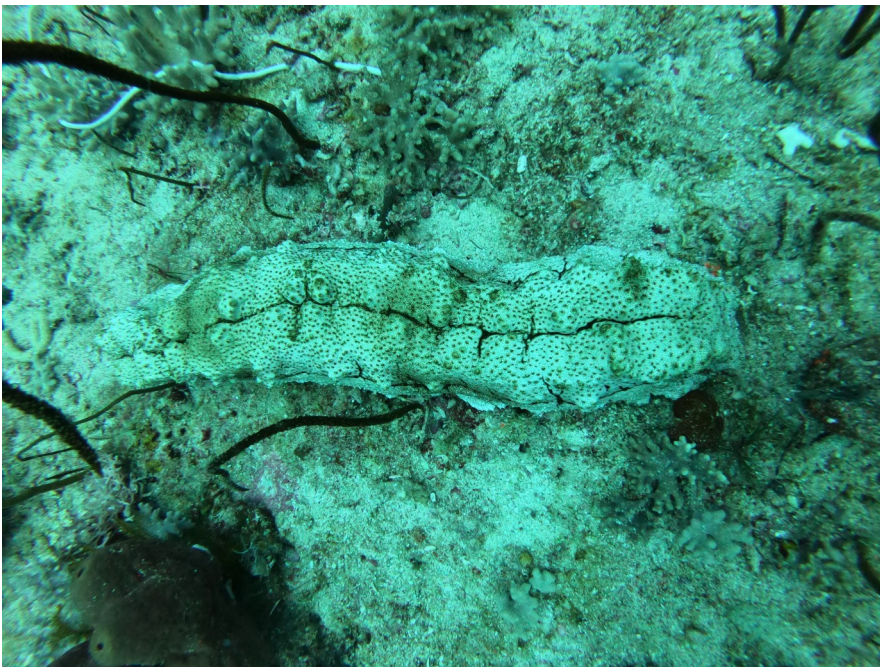


Image: MBARI 2018



What phylum does this animal belong to?

Echinodermata

What is this animal?

Sea Cucumber (*Thelenota Anax* or Amberfish sea cucumber)

List out notable anatomical features and draw arrows to them or any indicators of distinction:

No visible features, but lacks rhinophores or cerata. Size is too large to be a Nudibranch

Image courtesy of Stephen Hartter

Extension Exercise



Extension Exercise

5.



Image: Shutterstock/S.Rohrlach

6.



https://oceana.org/sites/default/files/styles/lightbox_full/public/31.jpg?itok=UjjoDbsK

7.



NPS photo - Peter Craig

8.



NOAA