Ctenophore Structures and their Functions

Exploring Ctenophore Structures and their Functions
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Summary
All organisms are specially adapted to their environment. These adaptations often serve multiple functions all revolving around survival (individual and species)—protection, feeding, and mating. In this *Under the Scope* module, students will explore the structures and adaptations of the ctenophore, or comb jelly.

Activity Use
This activity can be used as a part of any unit on biology, structure/function, adaptations, ecology, and more.

Grade Level
Middle school, but adaptable to elementary and high school

Lesson Time
45 minutes

Essential Question
What structures does a ctenophore, also known as a comb jelly, have that help it survive and fill its niche in the marine food web?

Objectives
After completing this activity, students will be able to:

- Name at least three structures of the comb jelly
- Describe the function of at least three comb jelly structures
- Explain how the special structures of a comb jelly help it fit into the ocean food web

Vocabulary
adaptation, ctene, bioluminescence, lobe, predator, tentacle, locomotion, niche

Introduction (for teacher background/presentation or student reading)

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Adaptations
Over evolutionary time, through the process of natural selection, organisms become more and more adapted to their specific environment and a role in that environment, or niche. With each generation, the more "fit" offspring has adaptations that lead to less difficult survival—better able to find food, water, shelter, and a mate, with which it will pass those genes and beneficial adaptations on to the next generation.

If you carefully examine an organism, you will observe those adaptations that allow it to successfully accomplish basic life needs: countershading in fish (lighter coloration on the bottom, darker on the top); a bird's beak (adapted for opening seeds versus catching fish versus ripping flesh); or a plant's leaves (thick and waxy versus thin and rough).

Ctenophores
Ctenophores, also knowns as "comb jellies" or "sea walnuts," are an important phylum in the global ocean, serving as a critical middle step in the food web between smaller zooplankton and larger fishes. Ctenophores are gelatinous like sea jellies ("jellyfish"), but lack their stinging cells. Instead, they use sticky cells called colloblasts to capture prey. These colloblasts are typically found at the ends of the comb jelly's tentacles. Their "jelly" is mostly water and serves as an internal skeleton, supporting their body.

Ctenophores get their name from their ctenes, which are tiny comb-like projections set up in rows along the animal that it uses for moving, or locomotion. While most ctenophores are colorless and translucent, some are bioluminescent, giving off biologically produced light—usually green or blue. This is different than the sometimes-seen rainbow coloration along the ctenes, which is not light directly produced by the animal, but instead is light refracted from the sun, a lamp, etc. off of the ctenes and to our eye.

Learning Activity
After learning about each of the comb jelly's structures, look at the magnified ctenophore and the structure thumbnail images (https://www.underthescope.udel.edu/images/ctenophores), and complete Table 1 below.

Table 1. Ctenophore structures, their function(s), human equivalents, and descriptions/drawings.

Structure/ Adaptation	Function	Human equivalent	Describe or draw what it looks like
ctenes			
bioluminescence			
gut			
lobes	feeding & locomotion		
tentacles with colloblasts			
jelly			
mouth			
apical sense organ		eyes; brain; inner ear	

Thinking & Discussion Questions
Answer the following questions based on the activity.

1. Is there any redundancy (repetition of the same function) in the structures? If so, which ones?
2. Which of the observed structures do you think is the most important to the comb jelly's survival? Why?
3. What if ctenophore's ctenes took a "sick day" and did not function. Would the ctenophore make it through the day?
4. Are there any structures that you think the comb jelly could live its life without? Why?
5. If you could add any structure/adaptation to the comb jelly, what would it be? Why would you add it? Are there consequences to the food web from the addition of the structure/adaptation?
   For example, adding the stinging cells of a sea jelly ("jellyfish") to a blue crab would make it an even better predator/scavenger. As a result, if blue crabs catch too much prey, they might run out of food.

Assessment
Performance: Did the student actively participate in the discussion portions of the activity, clearly demonstrating a grasp of the material? Was the student engaged during the activity?
Product: Did the student answer the activity questions correctly and coherently, and provide evidence for their answers? Was the table completed appropriately?

Extensions

1. Explore the other organisms in the MAGNIFY IT! tab (https://www.underthescope.udel.edu/images). Move the magnifier over the organism, try to identify similar and different structures/adaptations (to the Ctenophore), and then research each structures' function.
2. Catch and view a plankton sample from your local environment under the microscope. Identify the organisms' structures and adaptations, and then research the structures'/adaptations' function.