LESSON 2 Coral Structure and Function

Lesson at a Glance

This lesson teaches about the unique structures of coral. Students will begin the lesson with a hands-on modeling activity where they will create a coral polyp. This leads the class to begin learning how coral survives in the marine environment. To better understand how corals survive in their habitat, the class will participate in a role-play activity to compare the daytime and nighttime feeding adaptations of a coral colony. Finally, students learn about how coral is adapted to protect itself from natural stresses.

Lesson Duration

Two 45-minute periods

Essential Question(s)

What are the unique structures of coral, and how do they function to help coral survive in the marine environment?

Related HCPS III Benchmark(s):

Science SC 3.3.1
Describe how plants depend on animals.

Science SC.3.4.1
Compare distinct structures of living things that help them to survive.

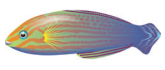
Science SC.3.5.1
Describe the relationship between structure and function.

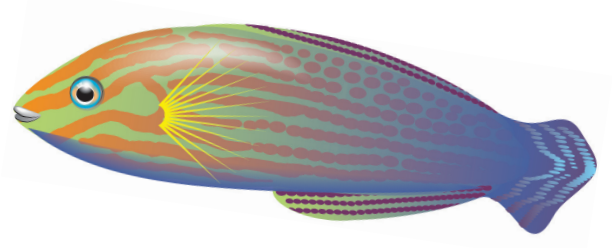
Key Concepts

- Coral is an animal with a unique polyp structure that builds a hard, rock-like skeletal base, and hosts symbiotic algae called *zooxanthellae.*
- Colonies of hard corals form coral reefs.
- During the day, zooxanthellae use sunlight to produce food for the coral and at night corals use tentacles to catch food.
- Zooxanthellae depend on coral to provide protection and nutrients.
- Coral polyps have special adaptations for defense, or protection from predators and other natural stresses found in the coral reef environment.

Instructional Objectives

- I can create a model of a coral polyp showing its major structures, and explain the function of each structure in helping the coral to survive.
- I can compare the unique structures of coral used for feeding during the day (zooxanthellae), and at night (tentacles), and describe the function of each.
- I can describe the unique colonial structure of coral reefs that help protect it from the natural stresses of the marine environment.





Assessment Tools

Benchmark Rubric:

Topic		Interdependence	
Benchmark SC.3.3.1		Describe how plants depend on animals	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Classify plants by their dependence on animals.	Describe how plants depend on animals.	Name very few ways in which plants depend on animals.	Recognize that plants depend on animals.

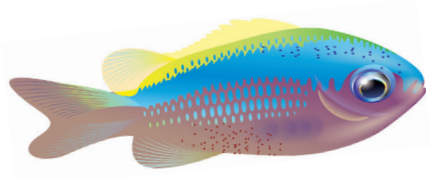
Topic		Cells, Tissues, Organs, and Organ Systems	
Benchmark SC.3.4.1		Compare distinct structures of living things that help them to survive	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Group living things by the distinct structures that help them to survive and provide justification for the grouping	Compare distinct structures of living things that help them to survive	Describe a few ways in which distinct structures of living things help them to survive	Name distinct structures of living things that help them to survive

Topic		Unity and Diversity	
Benchmark SC.3.5.1		Describe the relationship between structure and function in organisms	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Classify the structures of organisms according to their function	Describe the relationship between structure and function in organisms	Identify the relationship between structure and function in an organism	Recall that structures in organisms are related to the functions they perform

Assessment/Evidence Pieces

Coral Adaptations Student Reflection Self Assessment *(See Student Worksheet for Complete Version.)*

Rate Your Reflection:	**Poor**				**Excellent**
Identifies all structures of a coral polyp:	1	2	3	4	5
Compares day/night feeding adaptations:	1	2	3	4	5
Lists 3 stresses to coral:	1	2	3	4	5

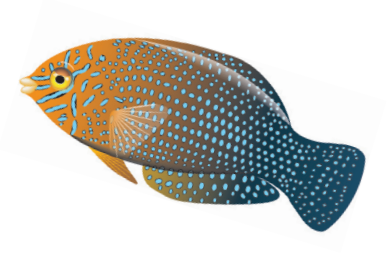


Materials Needed

Teacher	Class	Group	Student
• Popcorn (enough to complete feeding simulation) • Spray bottle with water • Method to present PowerPoint	• Hand-held magnifier lens or dissecting microscope	• None	• Disposable glove, one per student • Piece of construction paper • Crayons or colored markers • Double sided tape • Coral skeleton samples (collect on beach or from craft store)

Instructional Resources

PowerPoint Presentation: *Features of a Coral Polyp*
Student Worksheet: *Coral Structures*
Teacher Answer Key: *Coral Structures*
Student Worksheet: *Coral Adaptations Student Reflection*



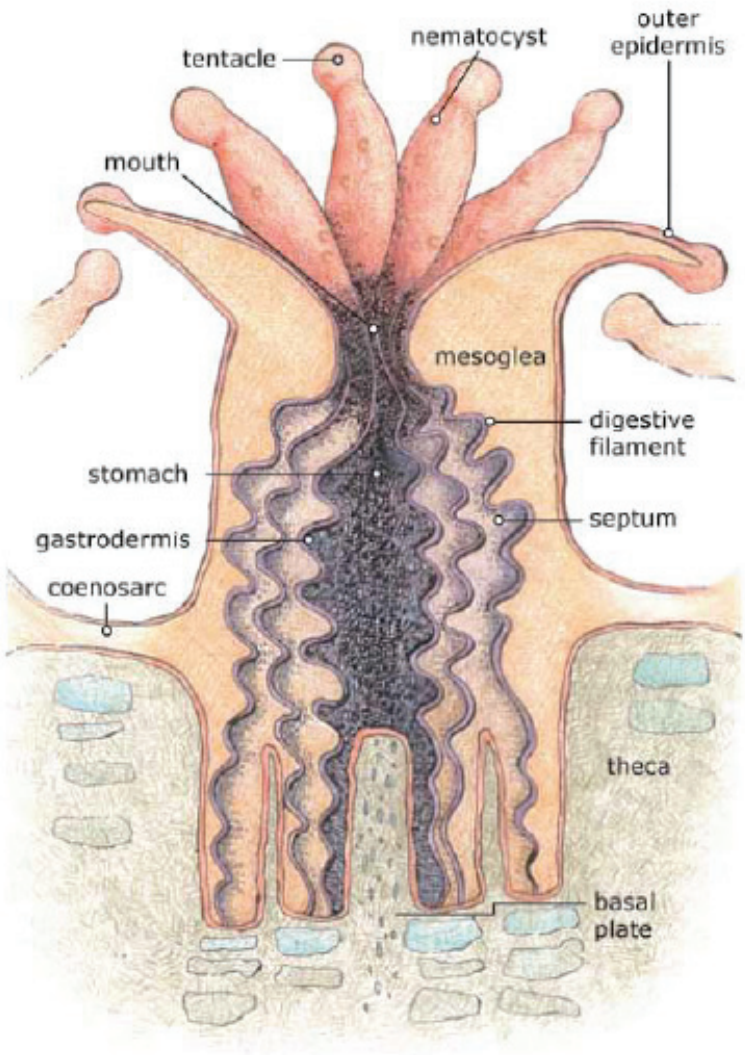
Student Vocabulary Words

calcium carbonate: a material that forms coral skeletons. Occurs in nature as limestone.
coral colony: many coral polyps that are clustered together and are connected to one another.
coral polyp: one individual coral animal with a soft, tube-shaped body, and a mouth surrounded by tentacles; grows in colonies to form large reef structures.
nematocyst: thread-like stinging cells that contain toxic substances used to capture prey.
photosynthesis: the process of using energy from the sun to make starches and sugars from carbon dioxide and water.
plankton: organisms that are suspended in the water column and transported by tides and currents.
predator: an animal that hunts and kills other animals for its food.
symbiosis: a relationship between different species where one, or both, of the organisms benefit from the presence of the other.
tentacle: a long, slender, and flexible appendage an animal uses for feeling, grasping, or moving.
zooplankton: free-floating, microscopic aquatic animals.
zooxanthellae: microscopic, single-celled algae that live inside the tissues of corals and produce food for coral through photosynthesis.

Lesson Plans

Lesson Preparation

- Review the Science Background in the Unit Overview.
- Preview the PowerPoint presentations *Features of a Coral Polyp,* make arrangements to project it.
- Review and make copies of Student Worksheets *Coral Structures and Coral Adaptations Student Reflection.*
- Have all student materials ready (popcorn, play dough, glitter/sand, transparency strips, coral samples)
- Alternative polyp model: disposable gloves, 4 x 11" paper, double stick tape and green permanent pen.
- Optional: create space in the classroom as a Word Wall (i.e. large piece of paper to write important vocabulary words as you go through the lessons)



I. *Coral Polyp Models*

A. Show an image of a coral reef. Ask the students to vote on whether coral is a rock, plant, or animal. Then, display a close-up image of coral that shows individual polyps, and explain that coral is many tiny animals, called polyps, living closely together in a colony. Point out a polyp on the image; explain that each polyp has a rock-like skeletal base (calyx) and microscopic plant-like algae called *zooxanthellae* imbedded in the outer epidermis that help to give the polyp its vibrant color.

B. Allow the students to view different types of coral skeletons with a hand-held magnifier lens, or dissecting microscope. Point out to the students the *calyx* structure and to explain its function for coral growth and survival. Calyx is the cup-like calcium carbonate skeleton of stony corals in which a coral polyp sits. The calyx keeps the polyp anchored to the reef. When a coral is stressed the polyp retracts into the calyx cup. This protects the polyp from predators and the elements.

C. Distribute Student Worksheet *Coral Structures* and view PowerPoint presentation, allowing students ample time to identify structures and describe functions.

D. To further reinforce structure and function of a coral polyp have students turn their hand and arm into a polyp.

1. Give each student one disposable glove and place it onto their hand. Explain that this represents the ***polyp with tentacles***.
2. Next, each student will receive a piece of construction paper. With the help of a neighbor they should wrap the piece of paper around their forearm so that it looks like a paper cylinder. Give each student two or three pieces of tape to secure the cylinder on their arm. This represents the ***calyx***.
3. Each student should take a green marker and draw green dots onto the palm of the glove. These green dots represent the ***zooxanthellae***.
4. At the tip of each finger every student will need small pieces of double stick tape. This represents the ***stinging nematocysts*** that are found at the end of the tentacles to catch the zooplankton at night.

E. Now that the students have turned their hand and arm into a coral polyp, review with the class each structure and its function. Have student volunteers name a structure and give the function of that structure to the coral polyp. (**Optional:** Instead of class review, may want to have students do the review as a pair share. Each student gets a chance to name each coral polyp structure and its function.)

F. Explain to the students how the zooxanthellae assist the polyp in the feeding process. Refer the class back to the polyp they made on their hand and arm as you explain this next portion. Zooxanthellae are photosynthetic, single-celled organisms. Often, zooxanthellae are concentrated in the polyps' tentacles. (green dots) Although the zooxanthellae supply a major part of a polyp's energy needs, most corals also require zooplankton prey. Most corals feed at night. When capturing food particles, corals feed in a manner similar to sea anemones. Polyps extend their tentacles to capture prey, first stinging them with toxic nematocyst cells, then drawing them toward their mouths.

For more information see: http://www.coris.noaa.gov/about/what_are

II. *Coral Colony Simulations*

A. Have students get together into small groups of four or five. Explain that they are individual polyps that are now together as part of a coral colony on a reef. In order to simulate a coral colony, the students will need to place their elbows on the desk with the polyp part sticking up vertically. It will look like an "L". Have them try and get as close together as possible. They should be touching if possible. (elbow to elbow)

B. Explain to the students that they will act out the role of coral polyps (the "animal" part of coral), and simulate coral polyps' adaptations for feeding and defending themselves. Remind students that they are polyps and are anchored to the reef in their calyx cup (the rock part of the coral) so from here on out they can only wave their fingers or tentacles in order to capture food. Practice waving tentacles around safely. (No elbowing your neighbors!)

C. Have students simulate coral feeding adaptations at night by waving their tentacles around searching for and capturing *plankton* (popcorn) tossed to them by the *current* (teacher).
[Suggestion: If possible do this portion of the lesson outside. Popcorn can get messy.]
   1) Explain to students that the popcorn represents plankton. (No eating of popcorn at this point in the lesson.)
   2) Have students count how many "plankton" they captured. When they determine that they did not capture enough food to survive, ask the students to explain another adaptation option coral polyps have to obtain food.
   3) Prompt the students with clues – (*uses sun to make its own food, gives coral its color, and others*) – until they realize that the rest of the food is supplied by the symbiotic "plant" part of coral, the *zooxanthellae*.
   4) Discuss the symbiotic relationship coral polyps have with the *zooxanthellae* living inside their tissues. (Caught "popcorn" may be consumed at this time, but be sure students share with other "polyps" that did not capture any food. Corals similarly share food with others in the colony.) Refer to "What is Coral," in the Teachers' Science Background.

D. Have students simulate coral feeding adaptations during the daytime by retracting their tentacles (arms), and open their mouths to let in sunlight. Tell them to dance around while rubbing their bellies and singing: "*Zooxanthellae* (zoo-zan-THE-lay) in my body use light to produce nutrients that help me!"
   1) Have students create and wear *zooxanthellae* badges to represent the symbiotic algae in the coral polyp's tissues.
   2) Repeat day and night feeding adaptation role-play to assess student comprehension. Classroom lights may be switched on and off to simulate day and night, or ask the students to create a signal to represent each.
   3) Explain to the students that living in a colony is an adaptation that helps all the polyps receive enough food because they are connected and can share nutrients.
   4) During the last nighttime feeding simulation, ask the "polyps" who captured more plankton than the others to share their popcorn with their neighbors. Lead a discussion on how living in a colony can help protect coral.

E. Class debrief of coral feeding simulation
   1) How difficult is it to catch the zooplankton?
   2) Why is it important for corals to have zooxanthellae?
   3) What happens to the coral polyps not able to capture any food?
   4) Prediction for which structure is more crucial in coral survival? Why?
   5) What implications might this have on the environmental conditions for coral survival?
   6) Would you expect other marine animals to also have symbiotic relationships with zooxanthellae? Explain your answer.

F. Conduct simulations of stress on the coral colony. Explain what it means to be stressed by providing examples of stresses in daily life. Brainstorm possible natural stresses to coral.
   1) Explain how coral is adapted to protect itself from natural threats, such as predators, or other coral species invading their space. For example, some corals have stinging cells, and some have a mucous covering that prevents them from getting covered in sediment.
   2) Explain how storms can wash the sediment from land into the ocean and over the reef, and how this can damage coral. Excess sediment can smother the coral, because polyps cannot get enough oxygen, and the *zooxanthellae* can starve if the sun is blocked.
   3) Demonstrate how, when a coral polyp is stressed, it retracts into its protective cup, signaling to the next polyp, and so on. Have students simulate coral reactions to stress.

III. *Coral Adaptations Reflection*

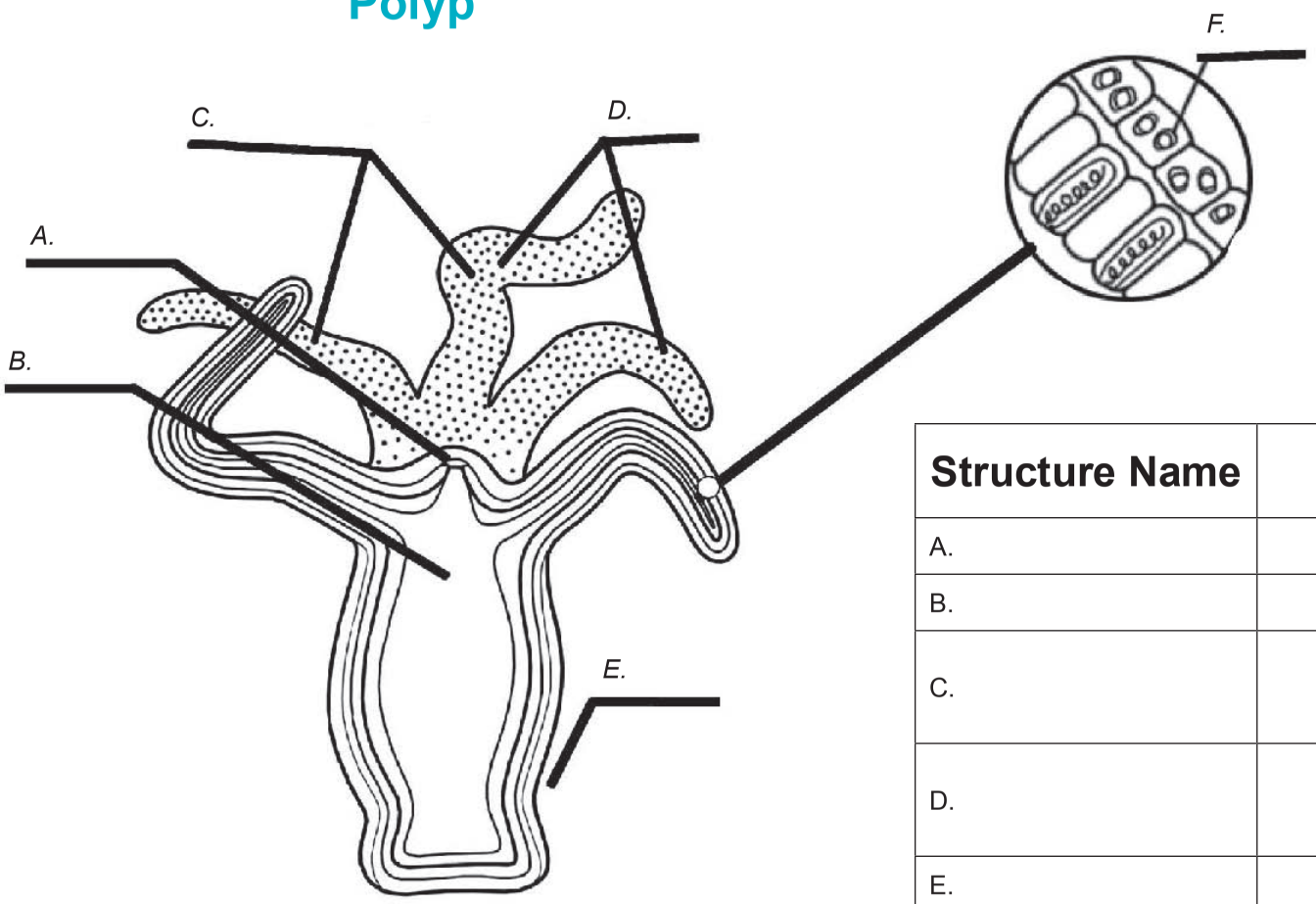
A. Distribute the Student Worksheet *Coral Adaptations Student Reflection*.

LESSON 2 Coral Structures

Name: _____ **Date:** _____

Directions: Complete the table as you view the PowerPoint presentation. Label each structure of the coral polyp and the function of that structure.

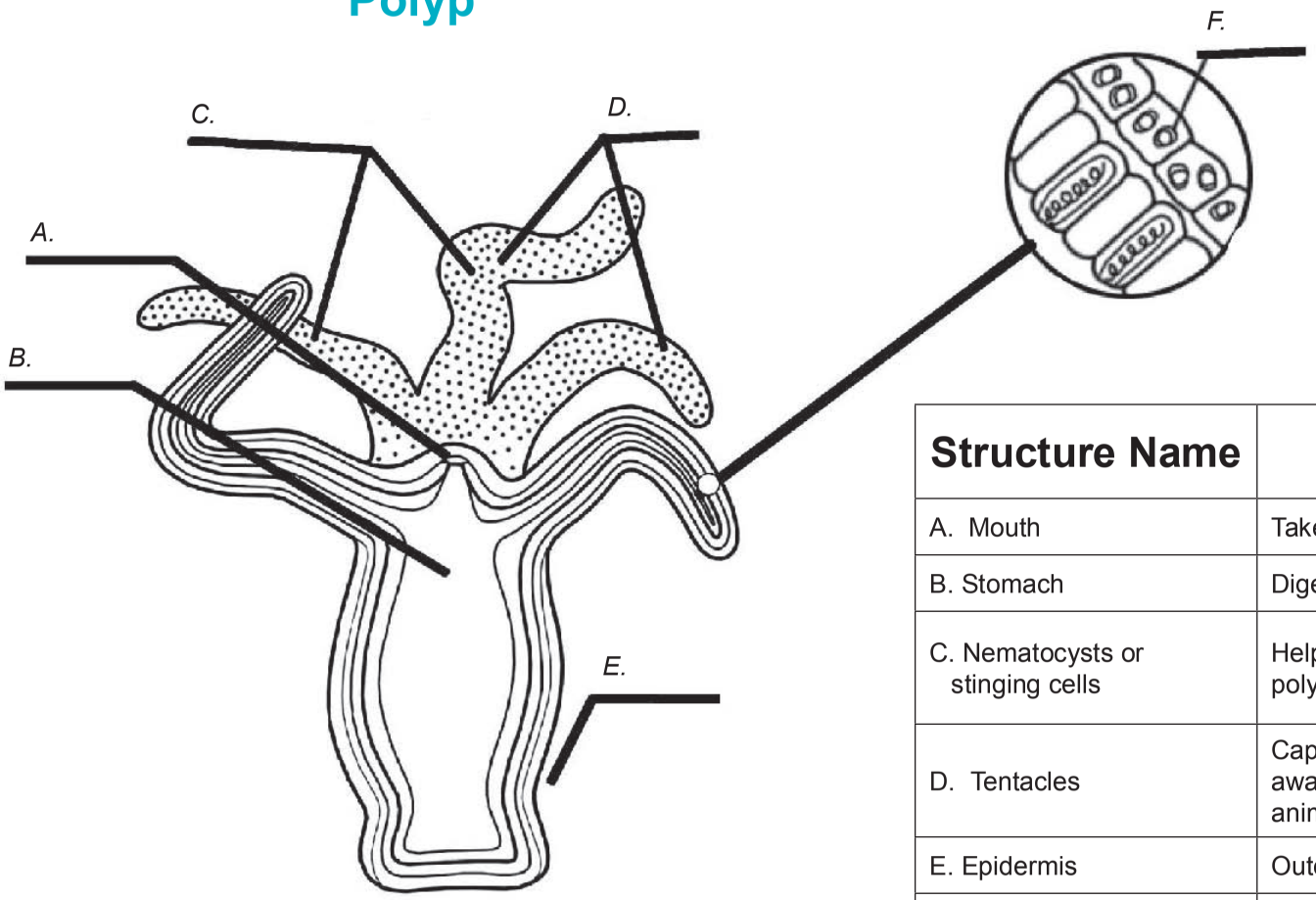
Polyp



Structure Name	Function
A.	
B.	
C.	
D.	
E.	
F.	

LESSON 2 Coral Structures -Teacher Answer Key

Polyp



Structure Name	Function
A. Mouth	Take in food and get rid of waste
B. Stomach	Digest the captured prey
C. Nematocysts or stinging cells	Help the polyp capture food and protect the polyp from predators
D. Tentacles	Capture and ingest plankton for food, clear away debris from the mouth, and act as the animal's primary means of defense
E. Epidermis	Outer tissue layer of the polyp
F. Zoozanthelle	Make food for the polyp through photosynthesis

LESSON 2 Coral Adaptations Student Reflection

Name_____ **Date** _____

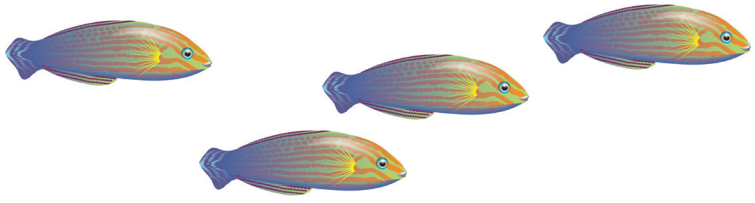
(use back of sheet if you need more space for your answers.)

What I Learned about the structure of a coral polyp:

What I Learned about coral adaptations:

- Day:

- Night



Coral Adaptations Student Reflection

Identify three stressors to coral reefs:

What I still have questions about or <u>do</u> not understand:

Rate Your Reflection:	**Poor**				**Excellent**
Identifies all structures of a coral polyp:	1	2	3	4	5
Compares day/night feeding adaptations:	1	2	3	4	5
Lists 3 stresses to coral:	1	2	3	4	5