Coral Up Close

Photo: FGBNMS/Schmahl

Acknowledgement

This activity has been adapted from Shedd Aquarium's Coral Reefs Activity Guide for Grades 3-5 *that is no longer in publication.*

Grade Level

3-12

Timeframe

45 Minutes

Materials

- Coral Polyp Diagram (see Related Links section)
- Non-latex surgical gloves (1 per student)
- Paper lunch bags (1 per student)
- Washable green markers (can be shared by students)
- 2 wooden dowel rods
- Cord or string
- 2 plastic clips
- Gummy worms

Photo: FGBNMS/Drinnen

Activity Summary

This activity will introduce students to the multi-faceted biology of reef-building corals--animals that are also part plant and part mineral. Students will turn their own hands into coral polyp models and learn about the special symbiotic relationship that enables corals to survive.

Learning Objectives

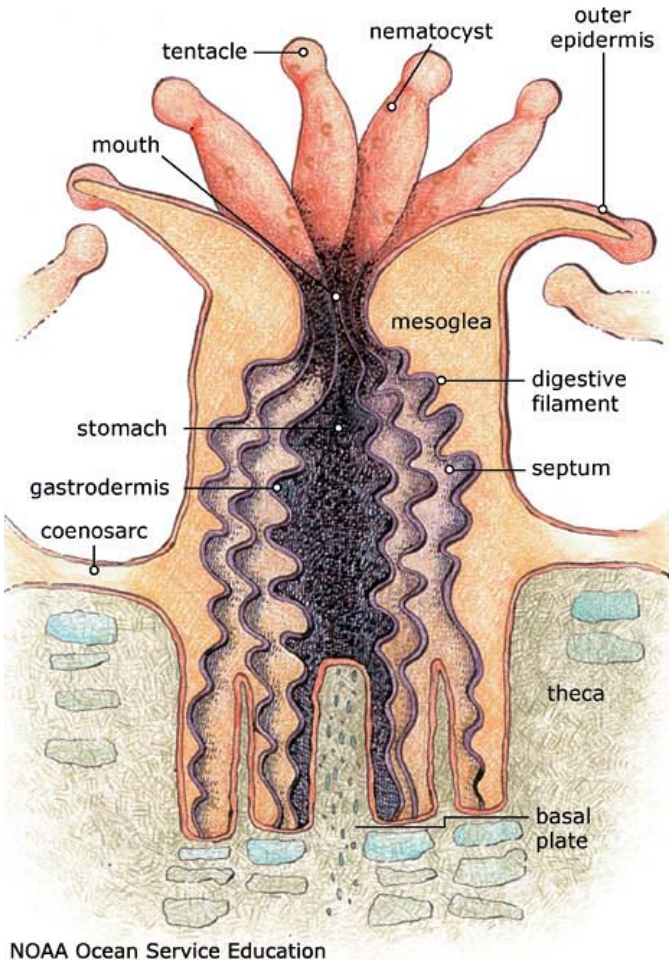
Students will:

- role play a coral polyp to understand its function on the reef,
- be introduced to the biology of coral polyps, and
- explore the role that photosynthesis plays in a coral polyp's relationship with zooxanthellae.

Background Information

As larvae, coral polyps are free swimming. However, once they settle to the bottom, the rest of their lives will be spent attached in one place.

Polyps build a hard (stony) external skeleton by extracting calcium, carbon and oxygen from seawater and depositing it as a hard, calcium carbonate cup under their bodies. Over time, polyps continue to add layers of calcium carbonate to the cups beneath them (basal plates),



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resulting in upward growth of the skeleton.

Hundreds to thousands of coral polyps together make up a reef-building coral colony. Each polyp is connected to the next by a thin layer of tissue (coenesarc), creating a living mat over a shared skeleton.

By themselves, coral polyps cannot create reefs. The key to their growth is tiny algae called zooxanthellae, which live inside the tissues of the polyps.

By day, most reef-building coral polyps curl up inside their skeletal cups, letting the zooxanthellae do their job. At night, polyps become predators. They stretch out their tentacles and use their harpoon-like nematocysts to catch the tiny zooplankton drifting by. This is known as raptorial feeding.

More information about coral biology is available at http://flowergarden.noaa.gov/education/coralbasics.html

Preparation

- Cut two sections of cord/string about 28" long. Tie one end of each cord/string to the end of each dowel. At the other end of each cord/string, tie some type of clip to which a gummy worm may be attached, yet still be pulled free. Attach one gummy worm to each string just before the activity begins.
- Before distributing the bags to the students, cut the bottom rectangle off each paper lunch bag to create a cylinder.

Procedure

1) Display the Polyp Anatomy diagram in front of the class. Point out that a coral polyp consists mostly of a mouth and stomach. It lacks most body parts of other animals leaving it unable to move from place to place, see, or hear. Discuss how coral polyps use two methods to feed.
2) Explain to students that they are going to role-play the life of a coral polyp using their hands as models. Distribute the gloves, paper bags, and green markers.
3) Instruct students to open the paper bag cylinder and fold over one end as if they were cuffing their pants. Have them repeat this to create a double "cuff," then place this over their non-writing hand, like a bracelet, with

Vocabulary

Calcium carbonate – The main component of coral skeletons, as well as the shells of snails, clams and crabs. It is formed from calcium, carbon and oxygen ($CaCO_3$).

Nematocysts – Thread-like stinging cells in the tentacles of coral polyps, anemones and jellies.

Photosynthesis – The process by which plants use sunlight and chlorophyll to convert carbon dioxide and water into simple carbohydrates and oxygen.

Symbiosis – A living arrangement between organisms in which at least one organism benefits.

Zooplankton – Free-floating, often microscopic, aquatic animals

Zooxanthellae – Single-celled photosynthetic algae that live symbiotically within coral polyp tissues.

the cuffed end at the top. This represents the skeletal cup that the coral polyp sits in.

4) Instruct students to place the surgical glove on the same hand as the bag. The gloved hand represents the coral polyp.
5) Instruct students to use the green markers to place dots all over the gloved hand. Since this is washable marker, it will rub off on desks and other surfaces, so advise them to avoid touching anything. (If they do touch things, it can be cleaned up using a wet-wipe.) These dots represent the zooxanthellae living in the polyp's tissues.
6) Since coral polyps rarely live alone, cluster groups of students together to make colonies. Instruct students to place their elbows close together on a table with all of their "polyps" reaching upward.
7) Leave the classroom lights on to simulate day time and ask the students how the corals are likely to be feeding. Since photosynthesis is the primary method during the day, instruct students to retract their tentacles (close their hands into fists) even with the tops of their skeletal cups (bags). The green zooxanthellae (green dots) can now get to work.
8) Turn off the classroom lights to simulate night time and ask the student how the corals are likely to be feeding now. Since no light is available, polyps should stretch out their tentacles (fingers) for raptorial feeding.
9) Remind students that coral polyps are attached to the substrate and cannot move, so their elbows must remain on the table. And, coral polyps cannot see, so they must keep their eyes closed. Using the dowels like fishing poles, dangle the gummy worms over the cluster of polyps (colony) and move them around. Invite the students to try to capture the "plankton" with their tentacles.

Photo: FGBNMS/Drinnen

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10) Once the gummy worms have both been caught, invite the students to open their eyes and see who got them. Use this as an opportunity to discuss how the colony works as a community and when even some of the polyps feed, they all benefit.
11) To close out the activity, ask students to remove their gloves by grasping them from the bottom and pulling them off inside out (to contain the green marker ink). Throw away or recycle the gloves, if that is an option. Next, ask students to unroll the cuffs on their paper bags and flatten them back out to be used again.

Discussion

This activity is an example of modeling nature in an effort to improve understanding. However, no model is 100% accurate.

How was this model helpful to the students?

What are some limitations of this model?

a) Hard coral polyps have tentacles in multiples of 6, but our hands only have 5 fingers.
b) Polyps don't catch food directly with their tentacles, but with their nematocysts.

Extension

Coral polyps not only get food from their symbiotic algae, but they also get their colors from them.

Coral bleaching is a term used to describe a situation in which corals appear to turn white. In actuality, what has happened is that the algae have left the corals.

This situation is usually the result of some kind of stress event, often high water temperatures. Without the algae, the coral polyps are mostly clear, allowing you to see through to their white skeletons below--hence, the bleached appearance.

Coral bleaching is not necessarily a death sentence. If stress conditions are alleviated in time, the corals may take on new algae and return to a healthy state. Even so, recovery may take weeks to months and recently stressed corals may be more susceptible to coral diseases.

You can simulate this process by doing the activity using green sticker dots instead of green marker to represent the zooxanthellae. Stickers may be slowly removed as stress levels rise in a simulated bleaching event.

More information about coral bleaching is available at http://flowergarden.noaa.gov/education/bleaching.html

Education Standards

National Education Standards - Science	3-LS2.D, 5-LS2.A Ecosystems: Interactions, Energy, Dynamics 4-LS1.A, 4-LS1.D From Molecules to Organisms: Structure & Processes MS-LS2.A, HS-LS2.A Interdependent Relationships in Ecosystems
Texas Essential Knowledge & Skills (TEKS) - Science	3.3C Represent the natural world using models. Identify their limitations. 3.9B Identify and describe the flow of energy in a food chain and predict how changes in a food chain affect the ecosystem. 3.10A Explore how structure and functions of plants and animals allow them to survive in a particular environment. 4.3C Represent the natural world using models. 4.9A Investigate that most producers need sunlight, water, and carbon dioxide to make their own food, while consumers are dependent on other organisms for food. 4.9B Describe the flow of energy through food webs and predict how changes in the ecosystem affect the food web. 4.10A Explore how adaptations enable organisms to survive in their environment. 5.3C Develop a model that represents how something works or looks that cannot be seen. 5.9B Describe how the flow of energy derived from the Sun is transferred through a food chain. 5.9C Predict the effects of changes in ecosystems caused by living organisms. 5.10A Compare the structures and functions of different species that help them survive. 6.3B Use models to represent aspects of the natural world. 6.3C Identify advantages and limitations of models. 7.3B Use models to represent aspects of the natural world. 7.3C Identify advantages and limitations of models. 7.5A Recognize that radiant energy from the sun is transformed into chemical energy through the process of photosynthesis. 7.8A Predict and describe how different types of catastrophic events impact ecosystems. 7.13A Investigate how organisms respond to external stimuli found in the environment. 8.3B Use models to represent aspects of the natural world. 8.3C Identify advantages and limitations of models. 8.11A Describe producer/consumer relationships as they occur in food webs. Aquatic Science.5D Identify the interdependence of organisms in an aquatic environment. Aquatic Science.10B Compare and describe how adaptations allow an organism to exist within an aquatic environment. Aquatic Science.12A Predict effects of thermal changes from humans on the living and nonliving components of an aquatic ecosystem. Biology.12A Interpret relationships among organisms. Biology.12B Compare variations and adaptations of organisms in different ecosystems. Biology.12F Describe how environmental change can impact ecosystem stability.
Ocean Literacy Principles	2. The ocean and life in the ocean shape the features of Earth. (d) 5. The ocean supports a great diversity of life and ecosystems. (a, d) 6. The ocean and humans are inextricably interconnected. (e)
Climate Literacy Principles	3. Life on Earth depends on, is shaped by, and affects climate. (a, c) 7. Climate change will have consequences for the earth system and human lives. (c, d)

Related Links

Flower Garden Banks National Marine Sanctuary (FGBNMS)
http://flowergarden.noaa.gov

FGBNMS Education Lessons & Activities, including this lesson and the Coral Polyp Diagram
http://flowergarden.noaa.gov/document_library/eddocuments.html

Coral Basics
http://flowergarden.noaa.gov/education/coralbasics.html

Coral Bleaching
http://flowergarden.noaa.gov/education/bleaching.html

National Marine Sanctuaries
http://sanctuaries.noaa.gov

For More Information

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Acknowledgement

This lesson was originally developed by Shedd Aquarium and appeared in their *Coral Reefs Activity Guide for Grades 3-5* published in 2000. This is a modified version of the activity as it has been adapted by Flower Garden Banks National Marine Sanctuary, with approval from Shedd Aquarium.