

Lesson #5: Symbiosis and Coral Anatomy

Introduction/Rationale

This lesson's aim is to build students' background knowledge before teaching coral bleaching in a later lesson. Students will learn the basic structure of corals and build upon the understanding that corals are animals and zooxanthellae are plants. They will be introduced to the concept of symbiosis through other examples in nature. Finally, students will learn the mutualistic symbiosis of corals and zooxanthellae.

Lesson Concepts and Skills

Polyp - Coral is comprised of these tiny animals living in colonies. Polyps resemble inverted jellyfish.

Zooxanthellae - Tiny plants (algae) living inside coral polyps

Symbiosis - a relationship between two species of organisms in which both members benefit from the association (mutualism), or where only one member benefits but the other is not harmed (commensalism), or where one member benefits at the expense of the well-being of the other (parasitism)

Materials

Boom box

Copy of "Happy Together" by The Turtles

One copy of "Symbiosis" from

http://www.pz.harvard.edu/ucp/curriculum/ecosystems/s5_res_symbiosis.pdf

One copy of "Symbiotic Images"

Access to a microwave or hot plate for melting chocolate

Gather the following for each student:

- Small paper plate
- 1 large marshmallow (or section of a banana or a strawberry)
- Toothpick (for boring holes in marshmallow)
- Six 2-inch strips of red licorice (either whip or regular cut into thin strips)
- $\frac{1}{2}$ square ($\frac{1}{2}$ oz.) white baking chocolate or hard candy coating
- 1 tsp. blue, green, or red sprinkles

Computer with projector

Hard copy of "Corals" PowerPoint presentation, for each student (optional)

Teacher Preparation

- Go to the site http://www.pz.harvard.edu/ucp/curriculum/ecosystems/s5_res_symbiosis.pdf and print the symbiosis documents. Cut apart each paragraph.
- Laminate the "Symbiotic Images" and "Symbiosis" paragraphs so that they may be used again in future lessons. (You could even mount them together on large construction paper.)
- Contact a few parent volunteers to assist in melting chocolate for the Extension's "Edible Coral Polyp."

Teaching Strategies Employed

Multi-sensory (aural, tactile)

Direct instruction

Time Frame

One class period

Target Audience

Grade five

Behavioral Objectives

Students will demonstrate their understanding of symbiosis by creating an original pair of organisms living symbiotically.

Students will create an edible model of a coral polyp by reading to perform a task.

Engagement

Play the song "Happy Together" by The Turtles. Ask students what they think this song has to do with plants and animals, specifically ocean life. (Some animals live together happily.) Tell students that they are about to learn about some living things with unique relationships.

Exploration

Divide students into seven groups and randomly distribute a symbiosis paragraph from

http://www.pz.harvard.edu/ucp/curriculum/ecosystems/s5_res_symbiosis.pdf to each. Instruct students to read the information and work together to

prepare to tell the rest of the class about the relationship between the two different organisms. Stress to students that they should not read directly from the paragraph, rather they should put it into their own words. Give students a reasonable amount of time to work. Circulate to "translate" as necessary.

Explanation

Ask students if the animals' and plants' relationships (from the Exploration) were equal. (No, sometimes only one organism benefited.) Tell students that when two living things have a relationship like the ones described in the Exploration, it is called symbiosis.

Show the PowerPoint presentation "Corals" to teach students about coral polyps, zooxanthellae, and symbiosis. Depending on the abilities of your students, consider printing out copies of it for them to study. Following the completion of the presentation, display slide 5 again, with the diagram of a polyp. Keep it displayed to aid students with the next activity.

Extension

Distribute "Edible Coral Polyp" directions to students. Have students silently read the directions and then ask any clarification questions. Tell them that you will be guiding them through the process step by step. Distribute the materials and have an adult volunteer melt the chocolate by this point. Call on a student to read the procedure, one step at a time, as you follow the directions and hold up the work in progress.

As you demonstrate, ask students what each ingredient of the edible polyp represents.

- Plate = limestone base
- Marshmallow = polyp body
- Licorice = tentacles
- White chocolate = limestone skeleton
- Sprinkles = zooxanthellae (algae)

Evaluation

Tell students that they must use what they have learned about symbiotic mutualism and parasitism to *create* a pair of organisms living symbiotically. They must:

1. Name both organisms and draw a diagram of each
2. Identify the type of symbiosis (mutual or parasitic) and describe it in relation to the organisms
3. Briefly describe the organisms' habitat and diet

Assessment

Use the rubric below to score students' original symbiotic organisms and assembly of the edible coral polyp.

Bibliography

Byatt, A., Fothergill, A., & Holmes, M. (2001). *The blue planet: A natural history of the oceans*. New York: DK Publishing, Inc. pp. 108.

Center for Marine Conservation. (n.d.). *Coral reefs: a fact sheet*. Retrieved <http://www.aquarium.usm.edu/old/coralreef/01.pdf>, July 22, 2004.

Coral Forest. (1996). *The edible coral polyp*. Retrieved <http://www.aquarium.usm.edu/old/coralreef/04.pdf>, July 21, 2004.

President and Fellows of Harvard College. (n.d.). *Symbiosis*. Retrieved http://www.pz.harvard.edu/ucp/curriculum/ecosystems/s5_res_symbiosis.pdf, July 21, 2004.

Name _____

Date _____

Symbiosis Rubric

	Points Possible	Points Earned
Description includes two organisms; each is given a name	4	
Drawings of organisms include labels of body parts	6	
Habitat description	4	
Diet	4	
Description of symbiotic relationship clearly illustrates parasitism or mutualism	4	
Work is neat, clear, and includes few, if any, mistakes	3	
TOTAL	25	

Name _____

Date _____

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TOTAL	25	

Symbiotic Images

Egyptian Plover



Crocodile



http://www.mtaudubon.org/html/birdwatching_field_trips_and_programs_Gambia.htm

<http://photos-nature.dyndns.org/reptiles/crocodiliens/crocodile%20du%20nil%202.jpg>

Bumblebees and Flowers



<http://www.english-nature.org.uk/news/story.asp?ID=466>
http://www.bigeastern.com/eotp/ep_opunt.jpg

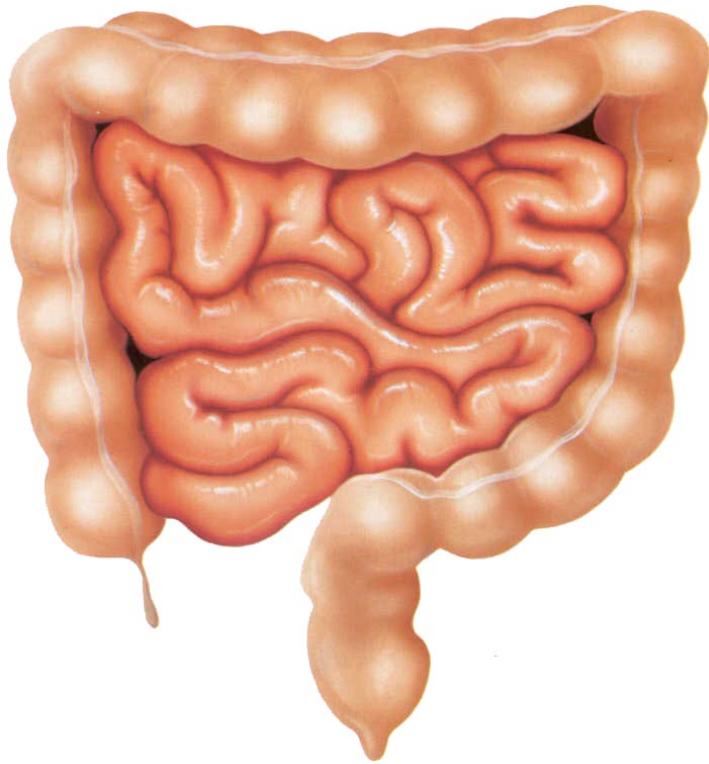
Lichen (Fungi and algae)



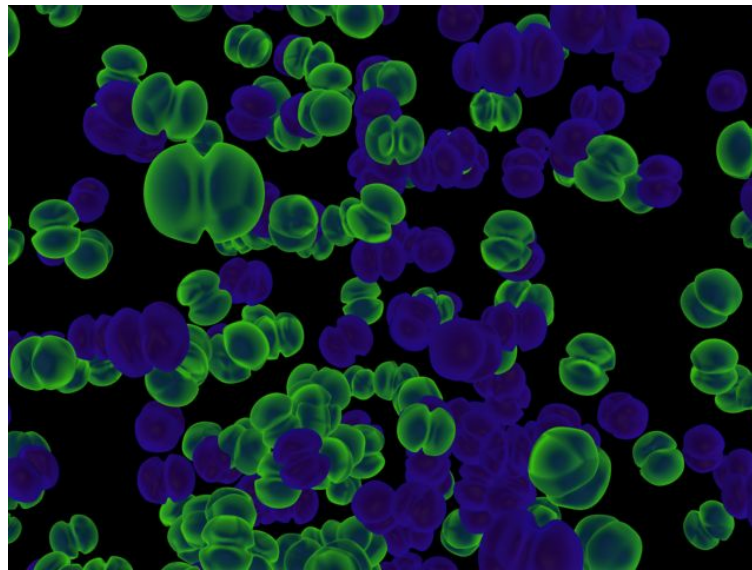
http://www.javajane.co.uk/texture2/lichen_on_branch.jpg

<http://www.javajane.co.uk/texture2/lichen3.jpg>

Intestine



Bacteria



http://www.cindys-friends.com/images/pic_intestine.jpg

<http://www.irtc.org/ftp/pub/stills/2001-10-31/bacteria.jpg>

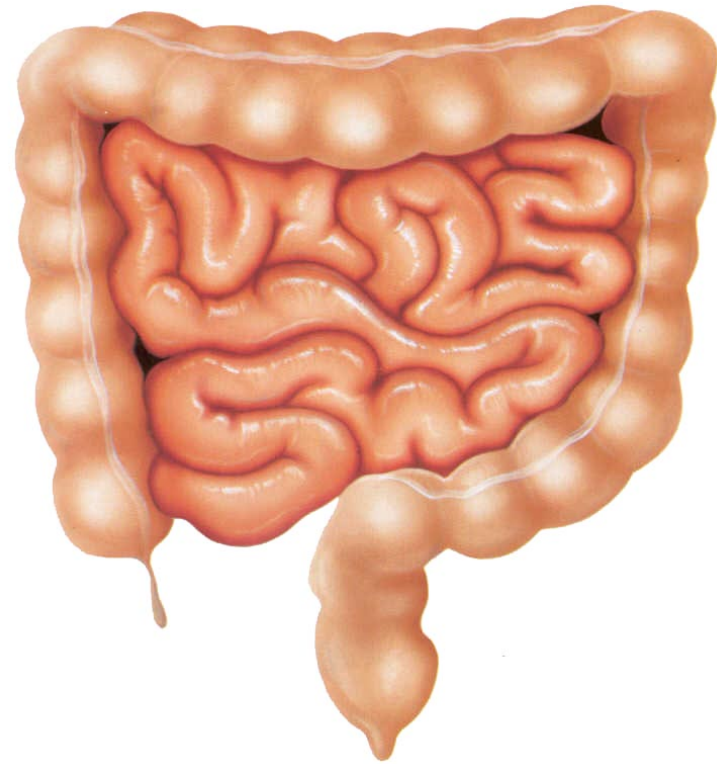
Tapeworm



www.ndpteachers.org/perit/Tapeworm%5B2%5D.JPG

http://www.cindys-friends.com/images/pic_intestine.jpg

Intestine



Ticks



Cow



http://www.cdc.gov/ncidod/dvbid/lyme/4ticks_cm.htm

<http://ohldecattle.com/assets/img/Matsn213.jpg>

Mistletoe



www.rms.nau.edu/mistletoe/

www.botgard.ucla.edu/.../a0009tx.html

Corals 101 presentation



What should you know about corals?



- They are animals
- Plants live inside of them
- Two kinds
 - Soft corals
 - Hard corals (These build reefs!)
- They are made of tiny polyps (which look like upside-down jellyfish)

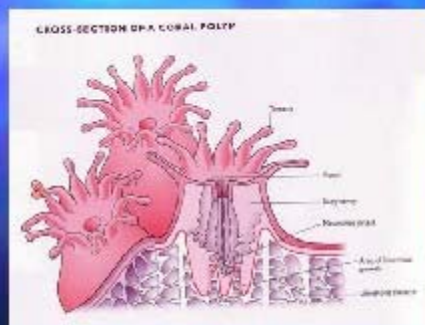
Hard Corals

The Reef Builders

- Polyps build hard limestone cups around their bases
- The cups cement together to make a coral colony
- Reefs are made of hundreds of hard coral colonies next to and on top of each other

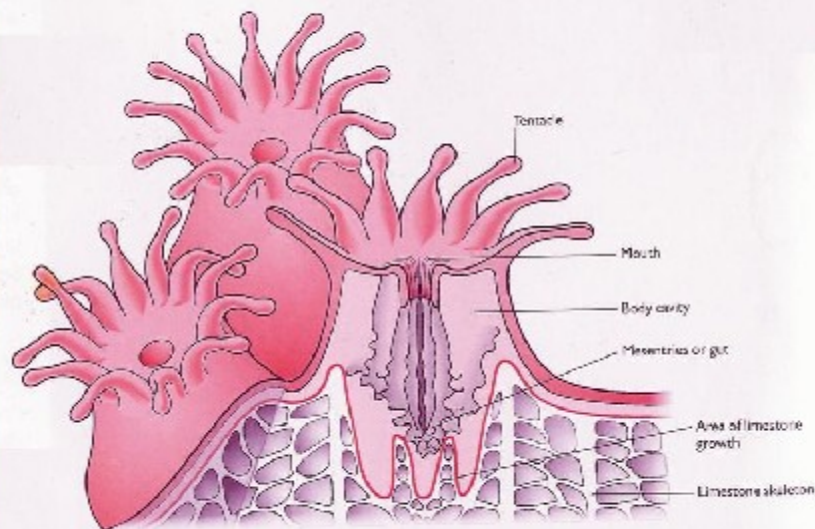


What's a Polyp?



- Tentacles release stinging cells when something brushes by them
- Polyps make their own limestone cup to hide in during the day
- At night, polyps come out to catch plankton floating by.

CROSS-SECTION OF A CORAL POLYP



Zoo-what!?! Algae, Coral Polyps' Tenants

- Inside polyps live zooxanthellae, which are algae.
- Zooxanthellae give corals their color.
- Since algae are plants, they use sunlight and CO_2 to make food (the process known as photosynthesis).

Symbiosis: *So Happy Together*



- Two organisms living together and helping each other is called ***symbiosis***.
 - Zooxanthellae make oxygen, remove the polyp's wastes, and make food for the polyp from photosynthesis.
 - Coral polyps protect the zooxanthellae, release CO₂, and provide it with necessary nutrients from their own waste.

Mutually Beneficial Symbiosis A Win-Win Situation

- Egyptian Plover bird and crocodile
- Bumblebee and flowers
- Lichens (fungi and algae)
- Your intestine and bacteria

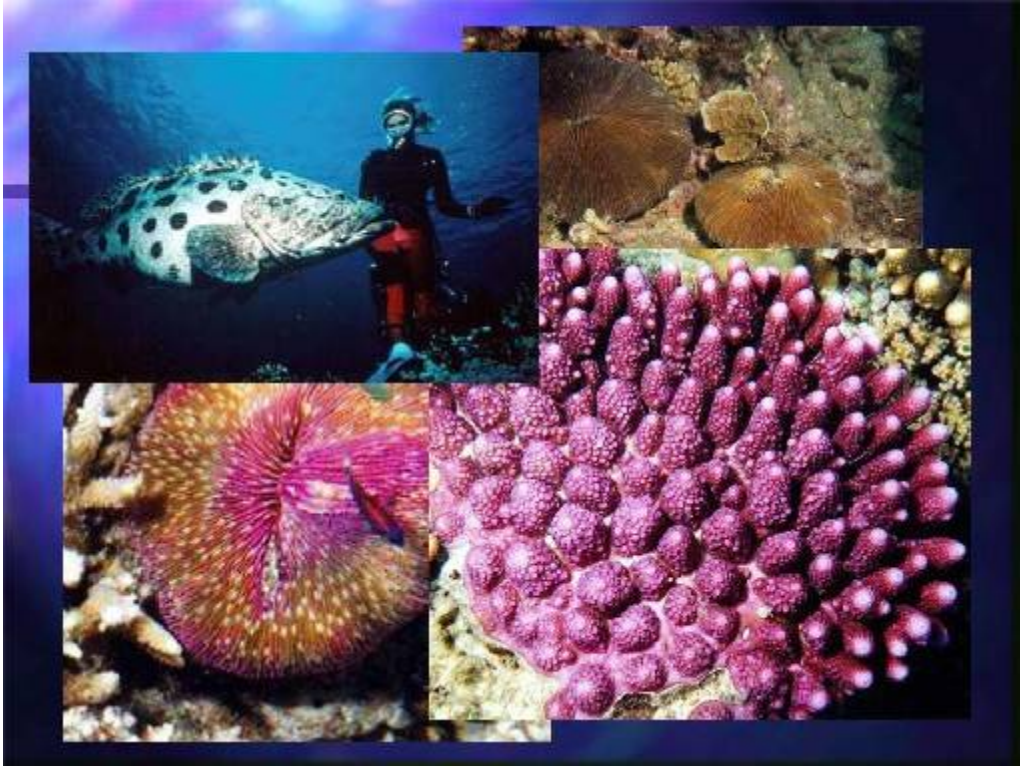
Parasitic Symbiosis A Win-Lose Situation

- Tapeworms and intestines
- Ticks and dogs
- Mistletoe and trees

How are these mutually symbiotic?

- Drivers and passengers in a carpool
- Tenants and landlords





Edible Coral Polyp activity

Materials

Small paper plate

1 large marshmallow (or section of a banana or a strawberry)

Toothpick (for boring holes in marshmallow)

Six 2-inch strips of red licorice (either whip or regular cut into thin strips)

½ square (½ oz.) white baking chocolate or hard candy coating

1 tsp. Blue, green, or red sprinkles

Microwave or hot plate

Procedure

1. Have an adult help you melt the white chocolate.
2. Roll the marshmallow in the melted white chocolate so that only the sides are coated and then stand it on the paper plate.
3. Use the toothpick to carefully poke six holes evenly around the top of the marshmallow. Be sure to remove the toothpick.
4. Insert the licorice pieces into each hole in the marshmallow.
5. Choose one color of sprinkles to sprinkle the marshmallow and licorice with. (It might be necessary to slightly dampen the marshmallow.)

Congratulations, you've made a coral polyp!