

STANDARDS

- CCSS: RST.9-10.1, 2, 3, 4, 5, 6, 7, 8, 10; RST.11-12.1, 2, 3, 4, 6, 8, 9, 10; W.9-10.2, 4; W.11-12.2, 4; SL.9-10.1, 2, 3, 6; SL.11-12.1, 2, 3, 6; HSN.Q.A.1; HSA.CED.A.1
- <u>NGSS</u>: ESS 2.A, HS-LS1-5, HS-LS1-7, HS-LS2-5, HS-LS2-6, PS 1.B, PS 3.D
- <u>OLP</u>: 4.A.1, 5.A.2, 5.A.6,
 5.A.7, 5.B.5, 5.C.23, 5.C.40,
 5.C.41, 5.C.42, 5.C.43

ONLINE CONTENTS

- <u>Coral Feeding Quiz</u>
- <u>Coral: What Does it Eat?</u> <u>Video</u> Coral polyps are mostly stomach, with a mouth on top. Symbiotic algae, zooxanthellae, live in the coral and provide them with energy. Corals also snatch zooplankton and other food particles right out of the water.

CORAL FEEDING

This lesson is a part of the *Coral Feeding* unit, which explains what corals eat, how they feed, and additional ways that they obtain energy. Below is a summary of what is included in the entire unit.

UNIT CONTENTS

A. Background Information

- Predation
- Symbiosis
- Photosynthesis
- Cellular Respiration
- B. Lessons

Watch it! Coral – What Does It Eat?

A worksheet to accompany the <u>Coral – What Does It Eat?</u> video

It's Tentacular!

An activity to simulate feeding strategies of corals

Symbiosis Charades

 A game of charades adapted to learn different forms of symbiosis

Round and Round

• An art project to show the relationship between coral and zooxanthellae, photosynthesis and cellular respiration

Read it! What's on the Menu?

 A worksheet to accompany the <u>What's on the Menu:</u> <u>Sunlight, Plankton or Organic Debris?</u> field blog







LESSON 2

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LEARNING OBJECTIVES

- Define symbiosis.
- Differentiate between the different types of symbiotic relationships.
- Explain the three types of symbiosis that exist between corals and zooxanthellae.

KEYWORDS

- Commensalism
- Ectosymbiont
- Endosymbiont
- Facultative Symbiosis
- Mutualism
- Obligate Symbiosis
- Parasitism
- Symbiosis

MATERIALS

- Internet/library
- Watch It! Coral What Does It Eat? student worksheet
- Lesson 2: Symbiosis Charades
 student worksheet
- Appendix A: Symbiosis Charades Cards
- Appendix B: Symbiosis Charades Answer Cards

EXTENSION

• Have students research and write their own symbiosis charades cards so they can play more rounds.

STANDARDS

- <u>CCSS</u>: RST.9-10.4, 5; RST.11-12.9; SL.9-10.1, 2, 3, 6; SL.11-12.1, 2, 3, 6
- <u>NGSS</u>: HS-LS2-6
- **<u>OLP</u>**: 5.B.5, 5.C.42, 5.C.43

TEACHER'S NOTES

PROCEDURE

- 1. Laminate **Appendix A: Symbiosis Charades Cards** to reuse them.
- Watch Coral What Does It Eat? YouTube video (<u>https://youtu.be/tZuxZdG6TfM</u>) and answer questions on the Watch It! Coral – What Does It Eat? student worksheet.
- 3. Teach Background Information section B) Symbiosis.
- 4. Hand out Lesson 2: Symbiosis Charades student worksheet.
- 5. Assign each student a partner. This activity works best in pairs, but could be done in a group of three. Students will be acting out a symbiotic relationship and the class will guess what forms of symbiosis (parasitism, commensalism, mutualism, obligate, facultative, endosymbiont, ectosymbiont) it is.
- 6. As there are many variations on the rules of charades, discuss which ones you want to use with your class. Recommended:
 - time limit of one minute
 - allow students to say the name of the organism that they are impersonating out loud, but no other words may be spoken when presenting
 - props are allowed
 - sound effects are allowed
 - · all gestures and sounds must be respectful
- 7. Each pair of students should receive one of the Appendix A: Symbiosis Charades Cards, which briefly describes a symbiotic relationship. To make this activity harder, you may want to remove the types of relationships from the cards before handing them out.
- 8. Give students time to research their relationship. There is a section at the top of the student worksheet for them to take notes. The pair should then discuss how they will act out the relationship. Remind them to speak quietly so other groups do not overhear their discussion.
- 9. Have one pair of students at a time act out their relationship. When a pair is finished, have the class vote on what types of symbiosis they think the pair acted out. Have a few students explain their reasoning. Then, ask the pair to explain the relationship they demonstrated. NOTE: Each symbiotic relationship found on a card involves more than one type of symbiosis, so students should be able to vote for more than one. You might want to break them into sets: parasitism, commensalism, and mutualism; obligate and facultative; and endosymbiont and ectosymbiont.
- 10. Have students complete questions on their student worksheets.





INSTRUCTIONS: Research the organisms in *italics* on the **Symbiosis Charades Card** assigned to you by your teacher. Take notes on their symbiotic relationship below.

NO 1.	TES: Organisms involved in this relationship:andand
2.	What happens to the first organism in this relationship?
3.	What happens to the second organism in this relationship?
4.	Types of symbiosis represented:
5.	Additional notes to help you act this relationship out during charades:

You have just participated in Symbiosis Charades. Now, answer the following questions.

1. In your own words, define the following and give an example from Symbiosis Charades:

Term	Definition	Example
Symbiosis		
Parasitism		



Term	Definition	Example
Commensalism		
Mutualism		
Facultative		
Symbiosis		
Obligate		
Symplosis		
Endosymbiont		
Lindosymbiolit		
Ectosymbiont		
1		

2. Which types of symbiosis are found between coral and zooxanthellae? Explain your answer.

3. Provide three different examples of symbiotic relationships that were not acted out during Symbiosis Charades.

4. Which of the symbiotic relationships acted out by your classmates was your favorite? Why?

Khaled bin Sultan Living Oceans Foundation	SYMBIOSIS	CHARADES					
INSTRUCTIONS: Research the organism your teacher. Take notes on their symbiotic	INSTRUCTIONS: Research the organisms in <i>italics</i> on the Symbiosis Charades Card assigned to you by your teacher. Take notes on their symbiotic relationship below.						
NOTES: 1. Organisms involved in this relations	ship:	_ and					
2. What happens to the first organism	in this relationship?						
3. What happens to the second organi	ism in this relationship?						
4. Types of symbiosis represented:							
5. Additional notes to help you act this	relationship out during charade	es:					
See Appendix B for the answer keys.							

You have just participated in Symbiosis Charades. Now, answer the following questions.

1. In your own words, define the following and give an example from Symbiosis Charades:

Term	Definition Example	
Symbiosis	A close ecological relationship between the individuals of two (or more) different species.	This is represented by every Symbiosis Charades Card.
Parasitism	A type of symbiosis where one organism benefits and the other is harmed.	This is seen in the relationship between: the trematode and coral, louse and fish, copepod and fish, barnacle and mud crab, and male and female anglerfish.

Term	Definition	Example
Commensalism	A type of symbiosis where one organism benefits and the other is neither benefiting nor being harmed.	This is seen in the relationship between: the hermit crab and snail, pearlfish and sea cucumber, triggerfish and other fish, imperial shrimp and nudibranch, and barnacle and whale
Mutualism	A type of symbiosis where both organisms benefit.	This is seen in the relationship between: the boxer crab and anemone, wrasse and sea bass, anemonefish and anemone, decorator crab and sponge, shrimp goby and pistol shrimp, and zooxanthellae and coral.
Facultative Symbiosis	A symbiotic relationship where organisms can survive without the relationship, but it increases their chances of survival.	This is seen in the relationship between: the boxer crab and anemone, wrasse and sea bass, decorator crab and sponge, hermit crab and snail, shrimp goby and pistol shrimp, pearlfish and sea cucumber, triggerfish and other fish, imperial shrimp and nudibranch, and barnacle and whale.
Obligate Symbiosis	A type of symbiosis where organisms require the relationship to survive.	This is seen in the relationship between: the trematode and coral, anemonefish and anemone, zooxanthellae and coral, louse and fish, copepod and fish, barnacle and mud crab, and male and female anglerfish.
Endosymbiont	A symbiotic relationship where one organism lives inside another organism.	This is seen in the relationship between: the trematode and coral, zooxanthellae and coral, copepod and fish, and pearlfish and sea cucumber.
Ectosymbiont	A symbiotic relationship where one organism lives on the body of another organism.	This is seen in the relationship between: the decorator crab and sponge, louse and fish, barnacle and mud crab, male and female anglerfish, and barnacle and whale.



Unit 4: Coral Feeding - Symbiosis Charades Answer Key

2. Which types of symbiosis are found between coral and zooxanthellae? Explain your answer. There are three forms of symbiosis that exist between corals and zooxanthellae. First, corals form a mutualistic relationship with zooxanthellae; both organisms benefit. Corals get most of their oxygen and energy from zooxanthellae while the zooxanthellae gain protection from living inside of the coral's tissues, as well as receiving necessary nutrients from the coral by recycling the coral's waste. Second, zooxanthellae are also considered endosymbionts because they live inside the tissues of the coral polyps. Finally, they have an obligate symbiotic relationship; without the zooxanthellae, the corals do not receive enough energy to survive.

3. Provide three *different* examples of symbiotic relationships that were not acted out during Symbiosis Charades.

Answers may vary, but here is one example: Another example of symbiosis would be a sea turtle and tangs. The tangs receive a meal by removing algae and parasites from the turtle's back. Since they both benefit, this is an example of mutualism.

4. Which of the symbiotic relationships acted out by your classmates was your favorite? Why? Answers may vary.



Mutualism Facultative	Parasitism Obligate Ectosymbiont
The <i>boxer crab</i> has a unique type of boxing glove <i>anemones</i> !	The <i>tongue-eating louse</i> gets its name from what it does to a <i>fish</i> .
Parasitism Obligate Endosymbiont	H
Can a <i>coral</i> get pimples? When they are invaded by a <i>trematode</i> , it looks like it.	Decorator crabs get their name from what they do with sponges.
H	┼─────────────────────────┤ Parasitism Obligate Ectosymbiont │ │
A <i>wrasse</i> is like a dentist to the <i>sea bass</i> .	Loxo is a barnacle that makes male <i>mud crabs</i> think they are females.
└─ <u>─</u> ─ <u>─</u> ─ <u>─</u> ─ <u>─</u> ─ <u>─</u> Mutualism Obligate I	┼──────────────────┤ Parasitism Obligate Ectosymbiont │ │
Anemonefish are named for their home in an an anemone.	A unique symbiosis is found within one species the <i>male</i> and <i>female anglerfish</i> .
Parasitism Obligate Endosymbiont	┼─────────────────────────┤ Commensalism Facultative Endosymbiont │ │
Find out what this <i>copepod</i> has to do to a <i>fish</i> to be known as the eye maggot.	The <i>pearlfish</i> makes its home during the day in an odd part of a <i>sea cucumber</i> .
Commensalism Facultative – – – – – – – – – – – – – – – – – – –	+
<i>Hermit crabs</i> get their homes secondhand, from a sea snail.	The <i>titan triggerfish</i> helps out smaller <i>fish</i> while it goes about its daily routine.
├	┼
The <i>shrimp goby fish</i> and <i>pistol shrimp</i> are sometimes known as the odd couple of the ocean.	An <i>imperial shrimp</i> has an interesting mode of transportation a <i>nudibranch</i> .
Mutualism Obligate Endosymbiont	┼────────────────────────────────────
<i>Zooxanthellae</i> live in the endoderm of many <i>corals</i> .	Barnacles are often found on <i>whales</i> , especially around their mouths.

-			
1	. Organisms involved in this relationship: <u>boxer crab</u> and anemone	1.	Organisms involved in this relationship: louse and fish
2	2. What happens to the first organism in this relationship?	2.	What happens to the first organism in this relationship?
	The boxer crab is able to deter a predator		The louse feeds off of the fish's blood and
3	attack with the stinging anemone. What happens to the second organism in this	3.	mucus. What happens to the second organism in this
	relationship?		relationship?
	the bits of food the crab drops while eating.		lost to the louse.
4	. Types of symbiosis represented:	4.	Types of symbiosis represented:
	gets food		fish
	 Facultative – both could survive without this relationship, but it holps them 		Obligate – louse cannot live without this rolationship
	this relationship, but it helps them		 Ectosymbiont –louse lives on the body of
			fish
1	. Organisms involved in this relationship: trematode and	1.	decorator crab and
	Coral What happens to the first organism in this	2	Sponge
ľ	relationship?	2.	relationship?
3	The trematode lives off of the coral. What happens to the second organism in this		The decorator crab blends in with its surroundings
	relationship?	3.	What happens to the second organism in this
	line coral grow slower than normal due to the loss of energy.		The sponge is exposed to different food
4	. Types of symbiosis represented:		sources as it is now mobile, attached to the
	 Parasitism – trematode benefits from harming coral 	4.	Types of symbiosis represented:
	Obligate – trematode cannot live without this relationship		Mutualism – crab gets camouflage, sponge rate food
	 Endosymbiont – trematode lives inside of 		 Facultative – both could survive without
	coral		this relationship, but it helps them
			of crab
1	. Organisms involved in this relationship: wrasse and	1.	Organisms involved in this relationship: barnacle and
2		2	<u>mud crab</u> . What happens to the first organism in this
	relationship?		relationship?
3	What happens to the second organism in this	3.	What happens to the second organism in this
	relationship?		relationship?
	leftover food stuck in its teeth removed.		and expends a lot of energy taking care of the
4	 Types of symbiosis represented: Mutualism – wrasse gets food, see base 	4	barnacle. Types of symbiosis represented:
	has parasites removed	.	 Parasitism – barnacle benefits from
	 Facultative – both could survive without this relationship, but it helps them 		 harming crab Obligate – barnacle cannot live without
			this relationship
			 Ectosymbiont –barnacle lives on the body of crab

1.	Organisms involved in this relationship: anemonefish and	1.	Organisms involved in this relationship: <u>male anglerfish</u> and
2.	What happens to the first organism in this	2.	What happens to the first organism in this
	Anemonefish are protected by the anemone		The male anglerfish gets to mate and gets an
3.	they live in. What happens to the second organism in this relationship?	3.	energy source. What happens to the second organism in this relationship?
	The anemone is protected from predators, as well, and also recycle the waste of the	4.	The female loses nourishment. Types of symbiosis represented:
4.	anemonefish. Types of symbiosis represented:		 Parasitism – male benefits from harming female
	 Mutualism – both receive protection Obligate – anomonofish cannot live 		Obligate – male cannot live without this relationship
	without this relationship		 Ectosymbiont –male lives on the body of
			female
1.	Organisms involved in this relationship: <u>copepod</u> and	1.	Organisms involved in this relationship: <u>pearlfish</u> and
2	What happens to the first organism in this	2	What happens to the first organism in this
2.	relationship?	2.	relationship?
2	I ne copepod gains a food source.		I ne pearifish gets shelter in the sea
5.	relationshin?	2	What happens to the second organism in this
	The fish is blinded and loses nourishment.	3.	relationship?
4.	Types of symbiosis represented:		The sea cucumber is not affected.
	 Parasitism – copepod benefits from horming field 	4.	Types of symbiosis represented:
	narming fish		Commensalism – pearlfish gets shelter
	 Obligate – copepod cannot live without this relationship 		while not affecting sea cucumber
	Endosymbiont – cononod livos insido of		 Facultative – both could survive without this relationship, but it halps poorlight
	fich		Endocymbiont – poorlfish lives inside of
	11311		sea cucumber
1	Organisms involved in this relationship:	1	Organisms involved in this relationship:
1.	hermit crab and snail	1.	triggerfish and fish
2.	What happens to the first organism in this relationship?	2.	What happens to the first organism in this relationship?
	Hermit crabs get shelter in the shells of sea		The triggerfish is not affected.
	snails.	3.	What happens to the second organism in this
3.	What happens to the second organism in this relationship?		relationship? The smaller fish get more feeding locations.
	The snail is not affected.	4.	Types of symbiosis represented:
4.	Types of symbiosis represented:		Commensalism –smaller fish get access to
	Commensalism – hermit crab gets shelter		more food while not affecting triggerfish
	while not affecting snail		Facultative – both could survive without
	Facultative – both could survive without		this relationship, but it helps smaller fish
	this relationship, but it helps hermit crab		-

1.	Organisms involved in this relationship: <u>shrimp goby fish</u> and	1.	Organisms involved in this relationship: <u>imperial shrimp</u> and
2.	What happens to the first organism in this relationship?	2.	What happens to the first organism in this relationship?
3.	The shrimp goby fish gets protection. What happens to the second organism in this relationship?	3.	The imperial shrimp gets a free ride and protection. What happens to the second organism in this
4.	The pistol shrimp gets a burrow. Types of symbiosis represented:		relationship? The nudibranch is not affected.
	 Mutualism –goby is protected, shrimp gets a home Facultative – both could survive without this relationship, but it helps them 	4.	 Types of symbiosis represented: Commensalism – shrimp gets to move while not affecting nudibranch Facultative – both could survive without this relationship, but it halps abrimp
1.	Organisms involved in this relationship: <u>zooxanthellae</u> and coral	1.	Organisms involved in this relationship: barnacle and whale
2.	What happens to the first organism in this relationship?	2.	What happens to the first organism in this relationship?
3.	Zooxanthellae get protection and nutrients. What happens to the second organism in this relationship?	3.	The barnacle gets a home and a food source. What happens to the second organism in this relationship?
	The coral get food and their waste is recycled.		The whale is not affected.
4.	 Mutualism – both get nutrients 	4.	Commensalism – barnacle gets a
	 Obligate – coral cannot live without this relationship 		substrate and food while not affecting whale
	 Endosymbiont – zooxanthellae live inside of coral 		 Facultative – both could survive without this relationship, but it helps barnacle Ectosymbiont –barnacle lives on the body of whale

