



Interactive Exploration of Coral Bleaching

INTRODUCTION

Coral reefs are some of the most diverse and significant ecosystems on the planet. They provide resources for many species, including humans. In this interactive exploration, you'll zoom in on a coral reef to explore the tiny animals that build reefs, the microorganisms that live inside their cells, and threats like climate change that could destroy many reefs worldwide. The concepts you'll explore apply not only to corals but also to many other organisms and ecosystems.

Before and After the Exploration

Before you start the interactive exploration, watch the [Coral Bleaching](#) video, then answer the following questions.

- Summarize the main idea or purpose of this video.
- List at least **two** things you learned from the video.
- List at least **two** questions that you still have.

Now complete the rest of the worksheet (Parts 1–5 below), or whichever parts are indicated by your instructor.

After you have completed those parts, answer the following questions.

- Were the questions you listed above answered or not? If so, describe the answers.
- If you have any more questions, list them in the space below.
- Did your understanding of corals or any other concepts change as you worked through the interactive exploration? If so, how?

PART 1: Coral Reefs

Launch the [interactive exploration for Coral Bleaching](#), which uses the same video. The video will now have five pause points, which are indicated by blue markers on the video's timeline.

- At each pause point, the video will stop playing, and a popup labeled "More Info" will appear.
- You can select the popup to open more information below the video. Hover over bold underlined terms to view their definitions.
- You can resume playing the video by selecting "Resume Animation" at the bottom of the page.

Play the video until you reach the first pause point, "Coral Reefs." Select the popup to open more information (below the video) on coral reef ecosystems and their benefits. Use this information to answer the following questions.

1. Define each of these terms in your own words.
 - a. Ecosystem

 - b. Biodiversity

 - c. Ecosystem services

2. All ecosystems, including coral reefs, have both living and nonliving components that interact.
 - a. Describe **three** specific *living* components of a coral reef. (*Hint*: These could be examples of organisms found in coral reefs.)

 - b. Describe **three** specific *nonliving* components of a coral reef. (*Hint*: These could be characteristics of the environments where coral reefs are typically found.)

 - c. Pick one living component and one nonliving component. Give an example of how they could interact.

3. Imagine that you are writing for an environmental group's social media account. Write 3–4 sentences to persuade the general public that coral reefs are valuable. Include at least **two** specific ecosystem services.

4. Think of an ecosystem that is *not* a coral reef. This ecosystem could be one that you've learned about, or one that you are personally interested in or familiar with. You could pick an ecosystem that covers a smaller area, such as a pond or a garden, or one that covers a larger area, such as an entire city or region.
 - a. Describe **three** specific *living* components of this ecosystem.

 - b. Describe **three** specific *nonliving* components of this ecosystem.

 - c. Describe **two** specific ecosystem services that this ecosystem could provide.

PART 2: The Corals

Resume playing the video until you reach the second pause point, "The Corals." Select the popup to open more information (below the video) on the tiny organisms that make up coral reefs. Use this information to answer the following questions.

5. One characteristic of living things is that they can reproduce.
 - a. Explain the difference between sexual reproduction and asexual reproduction.

 - b. Does sexual reproduction or asexual reproduction lead to greater genetic diversity? Why?

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6. Another characteristic of living things is that they are made of cells. The table below describes some common cell parts and whether they are found in coral cells. Use the diagram in the interactive exploration to complete this table.

Part	Function	In coral cells? (Yes/No)
Nucleus	Contains the cell's DNA and controls cell growth.	Yes
Cell wall		
Mitochondria		
Chloroplast		

7. Autotrophs and heterotrophs are two main groups of living things.
- Explain the difference between an autotroph and a heterotroph.
 - Are corals autotrophs or heterotrophs? Provide evidence for your decision.

8. The table below describes the parts of a coral polyp. Use the diagram in the interactive exploration to complete this table.

Part	Function
Epidermis	
Exoskeleton	
	Produces egg and sperm for sexual reproduction.
Gastrodermis	
	Digests food.
	Takes in food and releases waste.

9. Imagine that a classmate tells you corals are either a type of rock or a plant. How could you explain to them, with at least **two** pieces of supporting evidence, why that claim is incorrect?

PART 3: The Symbiont

Resume playing the video until you reach the third pause point, "The Symbiont." Select the popup to open more information (below the video) on the microorganisms that live inside coral cells. Use this information to answer the following questions.

10. Assign each symbiosis in the table below to a specific type (mutualism, parasitism, or commensalism) based on its description.

Description of the symbiosis	Type of symbiosis
Bacteria in a human's intestines feed on large sugar molecules. The bacteria break these sugars down into smaller molecules that human cells can use.	
A tapeworm in a pig's intestines feeds on partially digested food, taking nutrients away from the pig.	
An ant colony lives inside a tree. The ants kill other plants nearby that could compete with the tree for resources.	
A bird builds a nest on a tree, without affecting the tree's growth or survival.	

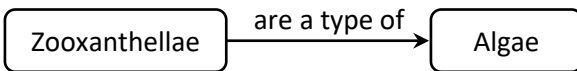
11. Think of another relationship that could be a symbiosis, which is *not* from the table above or the interactive exploration. The example can be from something else you learned or your own interests/experiences.

- a. Briefly describe the relationship you chose.
- b. Explain why you think this relationship is a symbiosis.
- c. What type of symbiosis do you think this relationship is, and why?

12. Create a diagram, such as a concept map, that shows how the following terms are connected.

- Algae
- Coral polyps
- Coral reefs
- Gastrodermis
- Mutualism
- Photosynthesis
- Symbiosis
- Zooxanthellae

For example, you can put each phrase in a box and use arrows to show connections between the phrases. Label your arrows with verbs or linking words, as shown in the example below.



13. Think about the cellular process that brings zooxanthellae from the water into coral cells.

- a. What is this process called?
- b. In one or two sentences, summarize how this process works.

PART 4: The Chloroplast

Resume playing the video until you reach the fourth pause point, “The Chloroplasts.” Select the popup to open more information (below the video) on how corals get food. Use this information to answer the questions below.

14. Determine whether corals and zooxanthellae have each characteristic in the table below. Complete the table by writing either “Yes” or “No” in the corresponding columns. (For some of this information, you may want to review the “Corals Are Animals” section at the second pause point, “The Corals.”)

Characteristic	Corals	Zooxanthellae
Has chloroplasts.		
Can perform photosynthesis.		
Uses food (sugars) that was produced by photosynthesis.		
Has mitochondria.		
Can perform cellular respiration.		

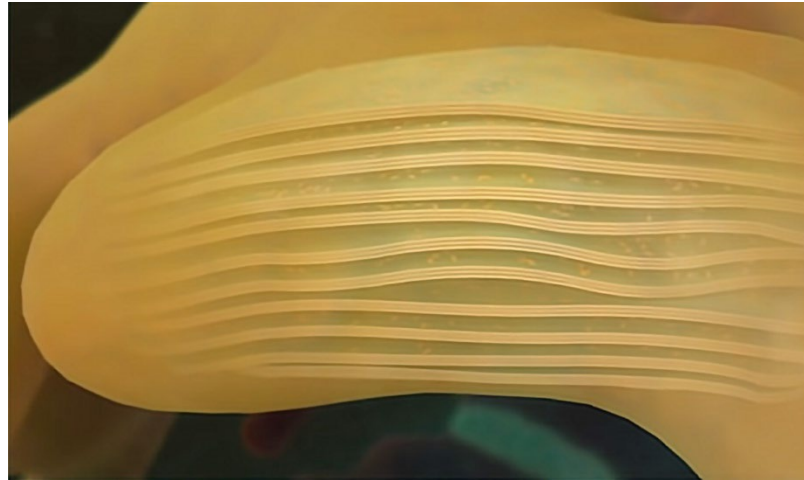
15. Create a diagram, such as a concept map, that shows how the following terms are connected. The style of this diagram can be similar to the one in Question 12.

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- Carbohydrates
- Carbon dioxide
- Chemical energy
- Light energy
- Oxygen
- Photosynthesis
- Water

16. The image below shows part of a 3D model that appears in the video.

- a. Label and/or describe how **chloroplasts**, **thylakoids**, **pigments**, and **photosystems** are represented in this model.



- b. What might be an advantage of using a model in the video rather than showing real images of the organism?

PART 5: Coral Bleaching

Resume playing the video until you reach the fifth and final pause point, “Coral Bleaching.” Select the popup to open more information (below the video) on coral bleaching, a process that can destroy reefs worldwide. Use this information to answer the questions below.

17. Coral bleaching is a major threat to coral reefs worldwide.

- a. Why is coral bleaching dangerous for corals?
- b. Why does coral bleaching cause corals to lose their color?

18. Write a paragraph or create a diagram that explains how climate change can cause coral bleaching. Include the following terms:

- climate change
- coral bleaching
- coral polyps
- heat stress
- photosystems
- reactive oxygen molecules
- zooxanthellae

19. Compare the processes of exocytosis and endocytosis (discussed at the third pause point, "The Symbiont"). How are these processes similar, and how are they different?

20. Coral bleaching negatively impacts not only corals but also many other organisms.
 - a. Propose **two** specific negative impacts that coral bleaching may have on humans.

 - b. Propose **two** specific ways that humans could help reduce coral bleaching.