

OCEAN CLASSROOM

The Study of Corals

What are corals?

STUDENT GUIDE

THE
UNIVERSITY
OF RHODE ISLAND
GRADUATE SCHOOL
OF OCEANOGRAPHY

Guiding Question

“What is coral?”

Essay

Take turns reading aloud. Highlight important facts.

The Anatomy of a Coral Polyp

Coral reefs are large underwater structures composed of the skeletons of colonial marine **invertebrates** called coral. They typically live in a compact **colony** of many identical individuals. Corals are related to sea anemones, and they all share the same simple structure, the **polyp**. Each individual coral is referred to as a polyp.

Most reef-building corals are made up of hundreds of thousands of individual polyps. Anatomically, a polyp is a very simple **organism**. Much of its body consists of a stomach filled with digestive **filaments**. The stomach lies inside a soft sac-like body with a mouth at the top.

The polyp takes in food and expels waste through its mouth, the only opening. A ring of **tentacles** surrounds the mouth and aids in capturing food, expelling waste and clearing away debris. The tentacles pierce prey and release toxins into them using special stinging cells called **nematocysts**. Then, the tentacles place the food inside the polyp. The nematocysts are located inside the polyp's outer tissue, called the **epidermis**.

Calcium carbonate is secreted by reef-building polyps and forms a skeleton under the tissue.



This limestone skeleton protects the coral from weather and waves. The polyp sits on a protective cup called a **calyx**, which is also made of calcium carbonate. The base of the calyx is called the **basal plate**. The walls surrounding the calyx are called the **theca**.

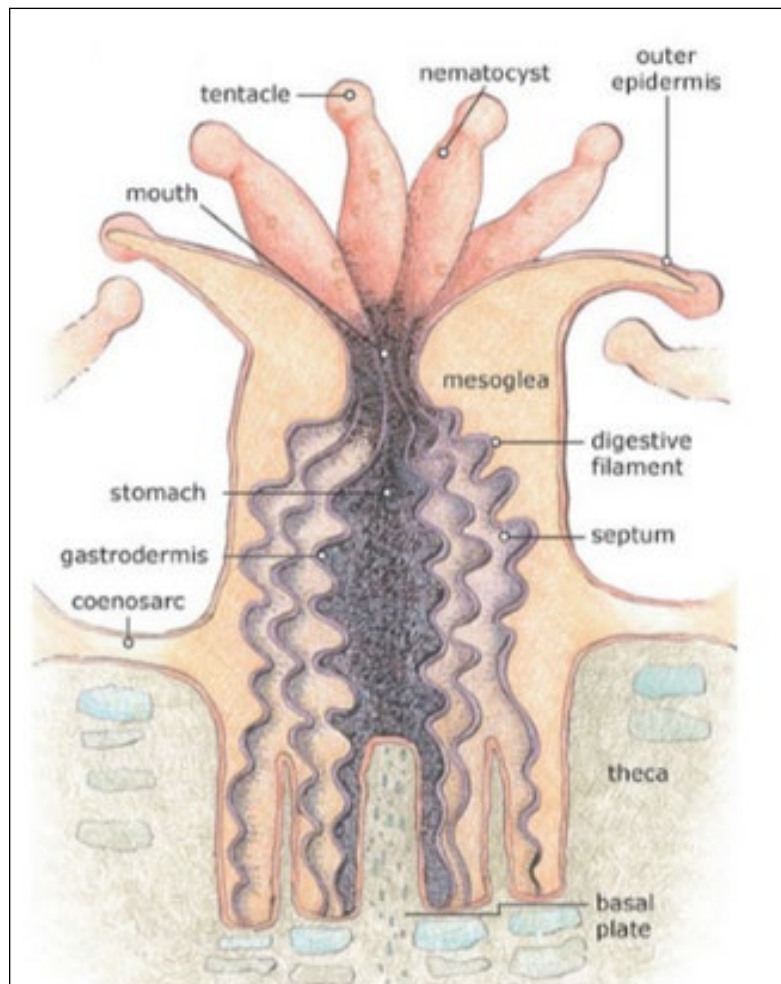
The **coenosarc** is a thin band of living tissue that connects individual polyps to one another within a colony. Thus, the connected polyps work together as one big organism. And, when colonies connect, you have a **coral reef**.

Define: Vocabulary Terms

Each member of your group will look up three or four words. Write clear and detailed definitions, then share them within your group

- | | |
|----------------------|--------------------------|
| Basal Plate | Calcium carbonate |
| Calyx | Coenosarc |
| Coral reef | Colony |
| Epidermis | Filaments |
| Invertebrates | Nematocysts |
| Organism | Polyp |
| Tentacles | Theca |

Diagram: Anatomy of a Coral Polyp



NOAA National Ocean Service

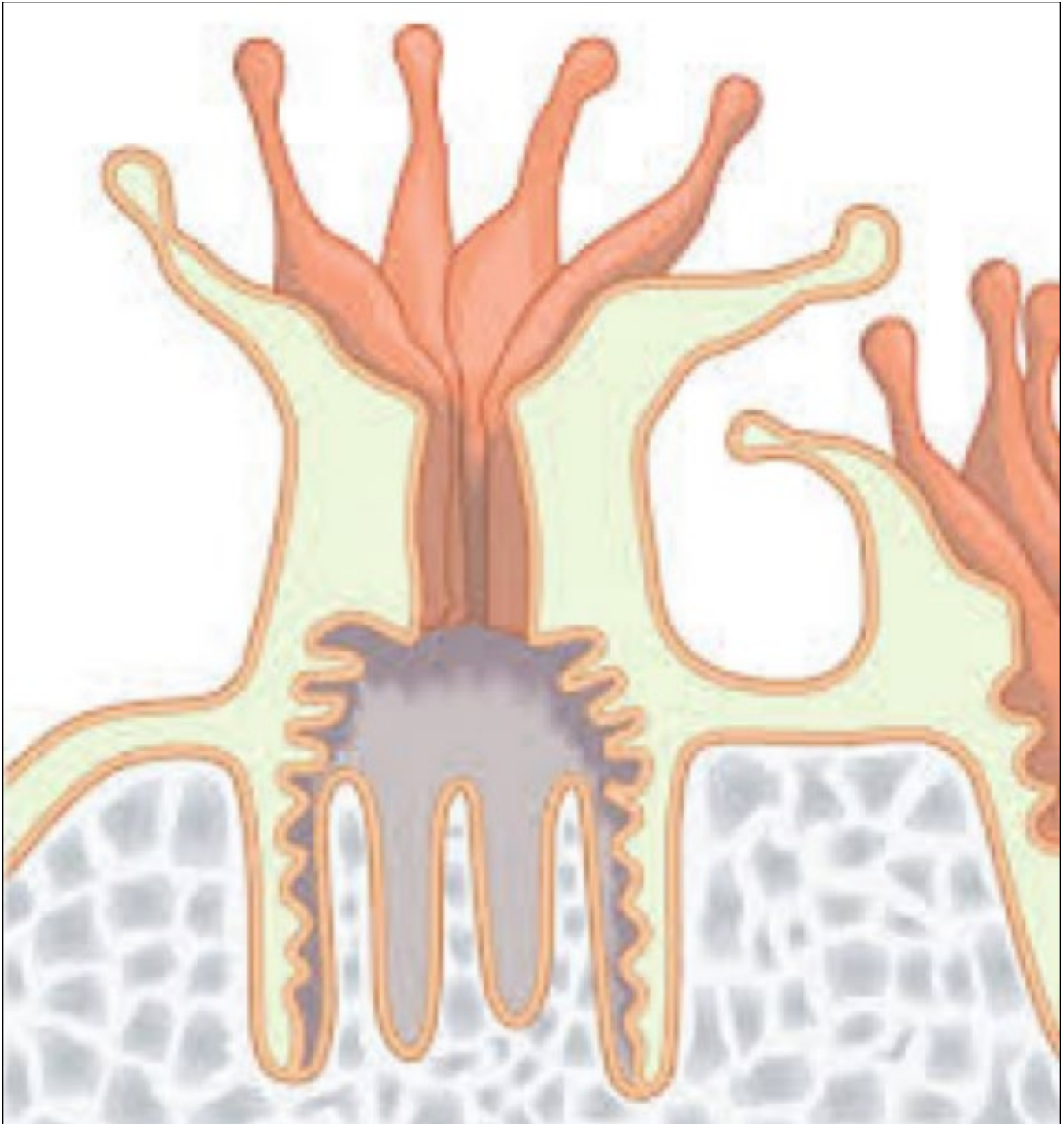
Activity: Labeling Worksheet

Working within your group, use the words below to label this diagram.

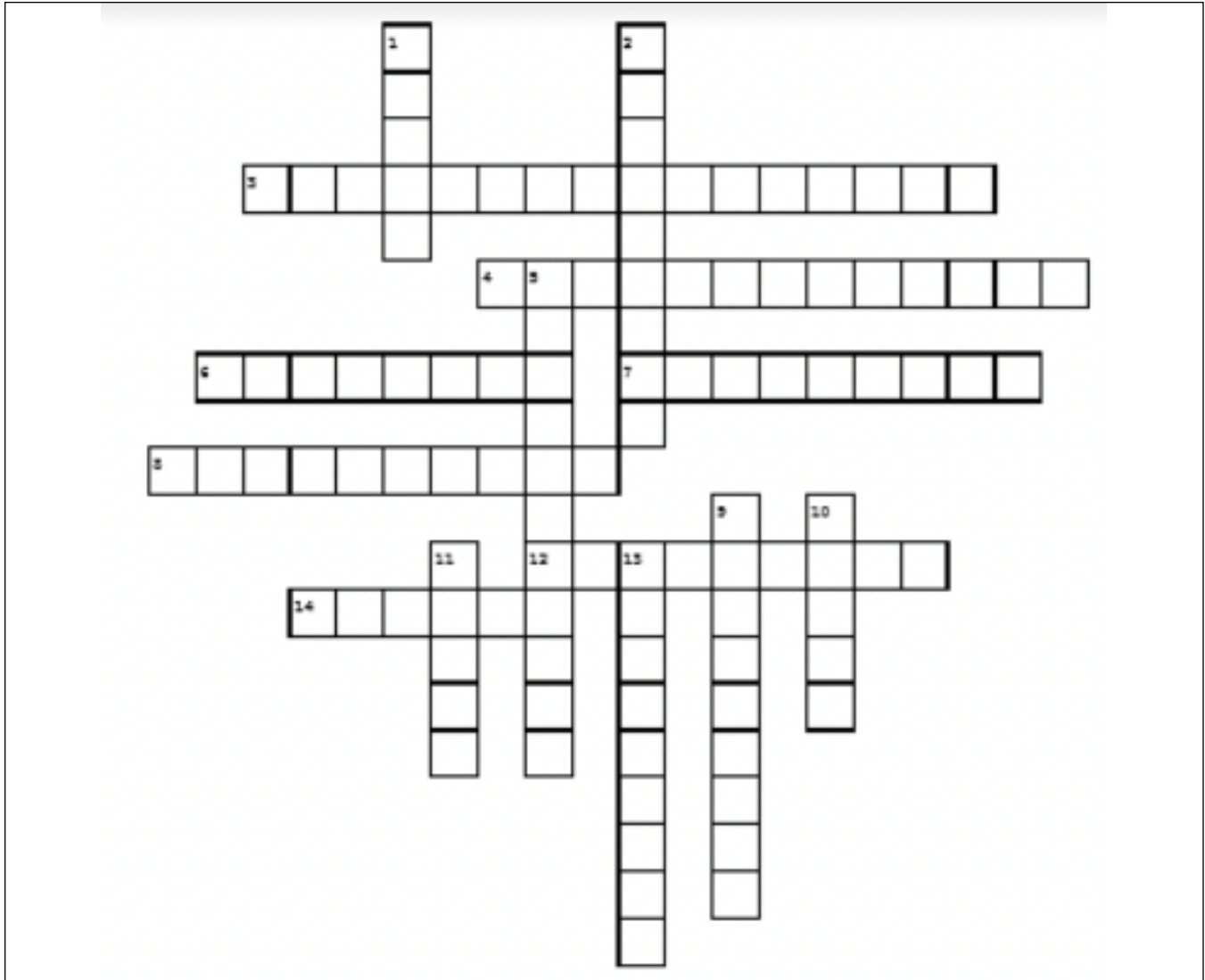
Mouth
Stomach
Tentacles

Epidermis
Nematocysts
Coenosarc

Theca
Basal Plate
Calyx (Callicle)



Activity: **Crossword Puzzle**
 Anatomy of a Coral Polyp



Down

1. hard walls that surround the protective cup of the coral
2. thin thread-like structures inside the stomach of a coral polyp
5. a specialized cell in the tentacles of a polyp containing venom or toxins
9. an underwater diverse ecosystem characterized by many colonies of reef-building corals
10. the protective cup on which the coral polyp sits. It is made of calcium carbonate.
11. coral polyps are tiny soft-bodied organisms related to sea anemones and jellyfish
13. the outer layer of cells that covers the coral polyp

Across

3. CaCO_3 is a chemical compound that makes coral skeletons
4. animals that do not have a backbone
6. any living thing composed of cells where the parts work together for growth and life
7. slender flexible limbs or appendages of an animal especially around the mouth
8. the very bottom of the polyp's protective cup or calyx
12. the living tissue that connects polyps together and allows them to share nutrients
14. a community of organisms of genetically identical polyps that live together

Activity:

Word Search

Working with your group, find and circle the vocabulary terms below.

Basal	S	B	Z	C	B	E	M	D	C	S	I	K	S	C	M
Calcium	N	N	A	F	A	U	C	A	O	E	G	E	T	O	S
Calyx	L	U	B	S	I	R	L	B	P	N	T	P	Z	E	I
Carbonate	M	D	N	C	A	Y	B	I	R	A	Q	L	H	N	N
Coenosarc	F	A	L	C	X	L	D	O	R	S	E	A	T	O	A
Colony	U	A	D	W	F	E	N	B	N	C	U	T	U	S	G
Coral	C	S	B	J	R	P	E	Y	T	A	C	E	O	A	R
Reefs	H	N	E	M	A	T	O	C	Y	S	T	S	M	R	O
Epidermis	P	C	I	L	R	L	A	R	O	C	K	E	L	C	H
Filaments	T	S	P	E	C	S	T	N	E	M	A	L	I	F	W
Invertebrates	F	S	V	K	L	A	C	O	L	O	N	Y	P	D	K
Mouth	L	N	F	Y	Y	B	T	H	E	C	A	Y	K	M	D
Nematocysts	I	J	B	E	A	M	N	N	G	V	L	D	S	P	E
Organism	Z	T	A	N	E	M	T	N	E	O	U	U	A	M	W
Plate	U	H	Z	R	V	R	F	L	P	T	Y	I	Z	N	T
Polyp															
Tentacles															
Theca															

Activity:**Corals and Calcium Carbonate Chemistry****Background**

There are two basic types of coral: hard corals and soft corals. Hard corals have an outer skeleton made of limestone, also known as calcium carbonate (CaCO_3), and soft corals have bits of calcium carbonate embedded inside their bodies. The CaCO_3 in soft corals is in the form of little spikes that help bind many individual polyps together in fan- or whip-like structures. In hard corals, each polyp sits inside a little cup called a calyx, which is built from calcium carbonate. Many cups connected together make up a coral colony, and when hundreds of hard coral colonies grow next to and on top of one another, thus coral reefs are formed.

You can see calcium carbonate skeletons in these 3-D models. Click on one!!

- <https://sketchfab.com/3d-models/acropora-sp-33ed3d6d70bb4ce69922fbbada01b4d2>
- <https://sketchfab.com/3d-models/pocillopora-meandrina-3bacf518167b46d78fef48ef9e0b7019>
- <https://sketchfab.com/3d-models/pocillopora-verrucosa-9b897db9434a48309071385d0dd52d87>
- <https://sketchfab.com/3d-models/foeliacious-montipora-sp-d26a10a601e34570a5571714a422e226>

As you know, coral polyps need three things in order to produce calcium carbonate; they need carbon dioxide, oxygen and carbon. When the coral polyp ingests ocean water, it obtains the building blocks it needs to produce hard skeletons. More specifically, the ocean water gives the coral polyp carbonate, calcium and bicarbonate ions. Unfortunately, there are hydrogen ions in ocean water and these interfere with the production of limestone because they attach to the much needed carbonate ions. Thus, the polyp must work hard to rid itself of the ingested hydrogen. Pollution, such as ocean acidification and global warming (rising ocean temperatures), causes seawater to experience an increase in carbon dioxide, an increase in hydrogen ions, and a decrease in carbonate ions, all while lowering the water's pH. As pollution increases, less calcium carbonate is produced.

Watch the following presentation about coral polyp calcification to better understand the chemistry behind it:

- <https://www.whoi.edu/interactives/calcification/index.html>

Activity:**Corals and Calcium Carbonate Chemistry** *(continued)***Building a Skeleton**

A coral polyp has microscopic algae, called zooxanthellae, living in their tissue, and through the process of photosynthesis, the polyp gets nutrition from the algae. The coral polyps use the oxygen and sugars produced by the algae for growth and energy, and the polyps release heat, waste, and carbon dioxide—a process called respiration (the same process humans use in breathing). Humans breathe in oxygen and exhale carbon dioxide.

Procedure:

Let's use your own exhaled breath to simulate the role of respiration in coral reef growth by doing the following:

Materials

- 1 clear plastic cup (8 oz.) filled with 6 oz. lime water
- empty clear plastic cup (8 oz.)
- 1 clear plastic cup (8 oz.) filled with 6 oz. tap water
- two drinking straws
- small (#2) coffee filter
- measuring cup
- 1 oz. white vinegar
- eyedropper

1. Examine the lime water and describe its appearance. Lime water is the common name for saturated calcium hydroxide solution, $\text{Ca}(\text{OH})_2$.
2. Place one of the drinking straws into the lime water and blow gently into the liquid. **DO NOT INHALE OR BLOW TOO HARD.** Continue exhaling through the straw until a white precipitate (solid) forms.
3. Place the coffee filter over the empty cup. Carefully pour the lime water into an empty cup through the filter to separate the precipitate from the liquid.
4. Put the white precipitate aside and allow it to dry and solidify.
5. Now place a drinking straw into a cup of tap water. blow gently. Observe what happens.
6. Calcium carbonate, the substance that makes up coral skeletons, reacts with weak acid (such as vinegar). To prove that the substance you filtered out of the lime water is indeed calcium carbonate, use the eyedropper to add a 5 drops of white vinegar to the precipitate. Observe what happens. (Note: put drops of vinegar on chalk and it will fizz!)
7. Answer these questions:
 - Describe how the lime water reacted when carbon dioxide was added.
 - Why do you think this happened?
 - Describe how the tap water reacted when carbon dioxide was added.
 - Describe what happened to the precipitate (white substance) when you added vinegar.
 - Why do you think this happened?

Resources: Videos, Interactive Sites and Live Feed

Let's watch short videos about coral polyps with your group.

Click on the links below :

- https://www.youtube.com/watch?v=Bn2xkJhte4&ab_channel=KhaledbinSultanLivingOceansFoundation
- <https://serc.carleton.edu/eslabs/corals/2b.html>

Now it's time to try this interactive site by yourself. Click on the link below :

- https://www.livingoceansfoundation.org/wp-content/uploads/education_interactive/unit_3_coral_anatomy/

You can also take a vocabulary test, study from flashcards or play a matching game! Click on the links below:

- <https://quizlet.com/544772807/test>
- <https://quizlet.com/544772807/flashcards>
- <https://quizlet.com/544772807/match>

You can even see a coral reef through a LIVE feed camera!

Click on the link below:

- https://www.youtube.com/watch?v=F109TZt3nRc&ab_channel=ExploreLiveNatureCams