Project Anchor Down

PAD Scientific Report

R2.V1
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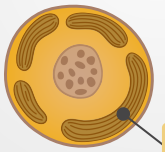
A Symbiont's Journey

From free-living in the ocean to taking residence *inside* the cell of a coral

Algae Symbionts

Family: *Symbiodinaceae*

Outer view [8]



Cross section

Symbionts are dominated by a **photosynthetic pigment** called **peridinin**, which is why they look tan or golden-brown. [11]

This gives coral their color!

1 Reef Waters START

Symbionts live in a free-living state floating around in the ocean [9]

Reef Waters
Microscopic view

Scale: Droplet of ocean water roughly the size of a very fine grain of sand

Not to scale

2 Coral colony

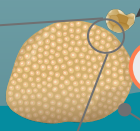
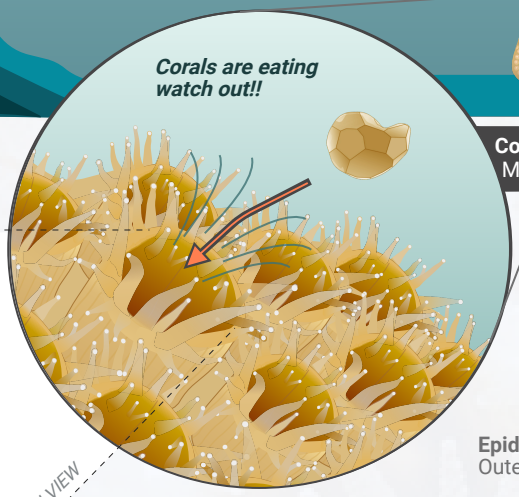


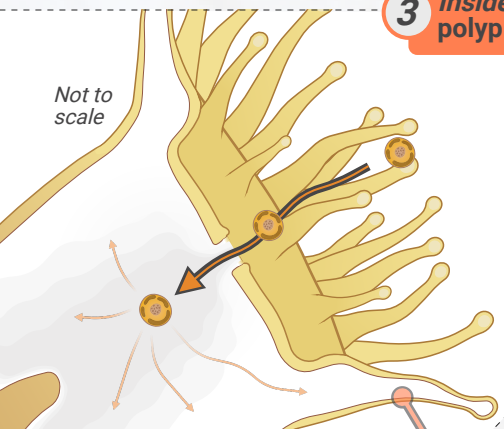
Illustration of the Atlantic coral species *Montastraea cavernosa*



Coral Colony
Multi-polyp view

3 *Inside* a polyp

Not to scale



CROSS-SECTION VIEW

Algae cells can drift inside polyp

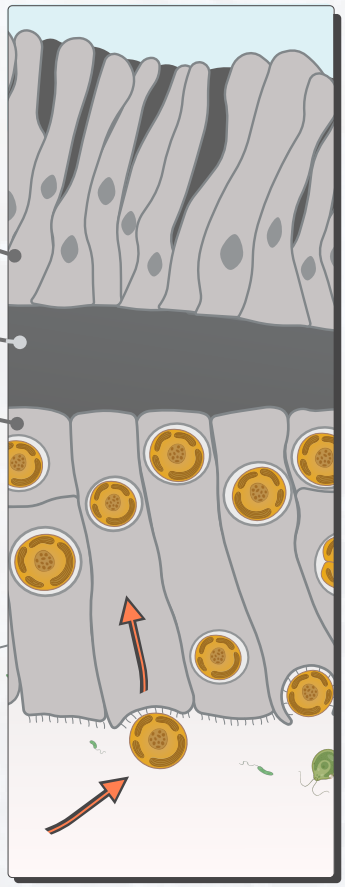
Internal body cavity (aka gastrovascular cavity or coelenteron)

Calcium carbonate skeleton

4 Gastrodermis (inner cell lining)

Coral tentacles are mainly ***hollow cavities*** filled with seawater

The inner cell lining of the body cavity in coral polyps is called the **gastrodermis**. This is where symbiosis occurs!



Epidermal cells
Outer tissue layer

Mesoglea
Connective tissue

Gastrodermal cells
Inner tissue layer
Symbiotic cells

5 Inside the coral cell FINISH

Symbiosis Establishment: Algae makes contact with a gastrodermal cell, which then pulls the algae *inside* itself in a process called **phagocytosis** [13]

Adapted from Fig. 1 in [2]

Dysbiosis (i.e., bleaching): When corals are highly stressed, symbiosis breaks down most commonly as host cells die and/or host cells expel their symbionts. [12]

Symbiont Facts

What are these symbionts that form a mutualism with coral?

These symbionts are:

- Single-celled algae
  - Algae is a catchall term for photosynthetic protists (Protists are eukaryotes that are not classified as plants, animals, or fungi)[4]
- Dinoflagellates (Algae with two flagella)[3]
- within the dinoflagellate family ***Symbiodiniaceae***

You may have heard them called Zooxanthellae, which is an older term that scientists don't use much anymore[3]

Can corals only host one symbiont species at a time?

No. Corals can host multiple symbiont species simultaneously. However, typically the population of one species will dominate. [14]

Can corals switch which symbionts they host?

Yes - this is a process known as **symbiont shuffling**. Corals can host multiple symbiont species simultaneously. However, typically the population of one species will dominate. [10]

How many symbiont species are there?

Over 30 species have been formally described within the family Symbiodiniaceae, most of which are symbiotic![5]

Which symbionts do corals prefer?

Corals vary significantly as to which symbiont species they can, or prefer, to host.[7]

Specialists: Can only host one or few species.
Generalists: Can host many species.

Do corals pass on their symbionts to their larvae when you reproduce?

Yes and no - it depends on the species. Some coral species are capable of **vertical transmission** of symbionts where they pass on their symbionts directly to their larvae; whereas, other species rely fully on **horizontal transmission** whereby their offspring must reacquire new symbionts from the environment as depicted in this report. [6][7]

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