MICROSCOPIC MONSTERS

Accompanies Episode 4 of the 13-part video series

A Monster in the Shallows

Written by Eric R Russell & Bruce J Russell

In this episode...

While navigating the dense aquatic weed forest of the pond shallows, the *Cyclops* is pulled off course by a tentacled animal called *Hydra*. With quick action by the crew they barely escape. They begin observation of *Hydra*, how it reproduces, and how the predator feeds and digests captured prey. The ship's naturalist volunteers to take the diving bell on a mission inside the hydra's gut to observe digestion from inside the animal's stomach.

EXPLORATION GUIDE & JOURNAL

Pond Ecology: Weedy Shallows

The Log of Captain Jonathan Adler

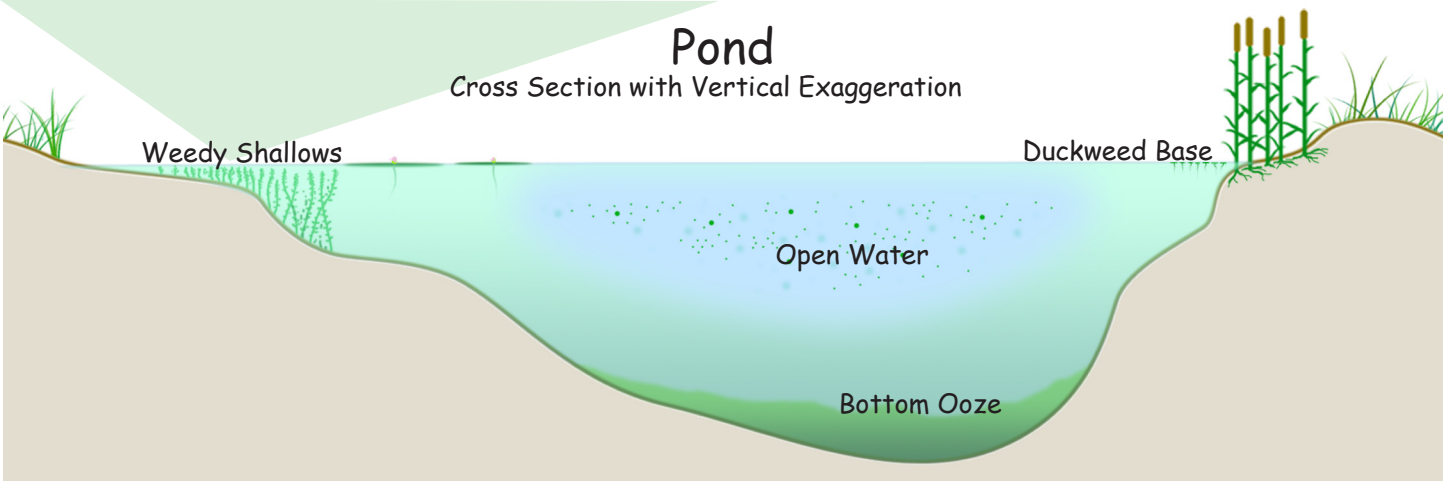
Day 10: 09:00 hours... Trying to make our way clear of the dense weedy shallows the ship is suddenly grabbed by a tentacled monster and held tight in its arms. Even under full power we are unable to escape!

A glance outside reveals that we are being drawn toward the creature's mouth. It obviously intends to swallow the Cyclops whole!

As we stare helplessly down the gullet of the monster, Lyra suggests a plan that might force the animal to release the Cyclops: electrifying the outer hull. Engine master Barron connects the ship's batteries to the hull plating and throws the switch.

With the crackle of electricity and the smell of ozone the ship lurches free. The monster releases the Cyclops. We steam away to safety and watch the beast from a safe distance.

In her biological research key, Lyra discovers that this animal is called Hydra, named after the many-headed serpent of ancient Greek mythology.



MS Cyclops

Vehicle Dimensions

LENGTH	1 mm
BEAM	.65 mm

Vehicle Mission

Maximum speed	10 centimeters per minute
Maximum depth	2.5 meters
Mission duration	60 days

The microsubmersible *Cyclops* is designed for extended exploration of freshwater ponds, streams, and wetlands. The vehicle carries a standard crew of four.

- Captain
- Ship's Naturalist
- Helmsman/Navigator
- Engine Master

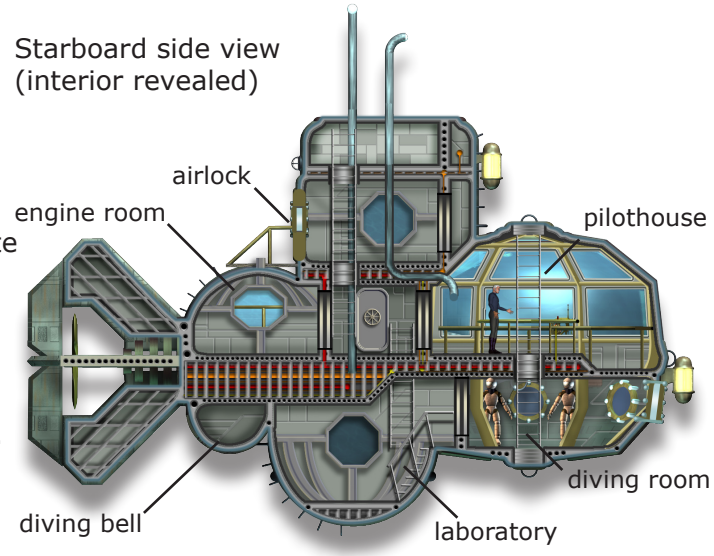
There are two onboard auxilary craft for specialized exploration: a *diving bell*, and a terrestrial *crawler/rover* (disassembled).

The glass enclosed pilothouse is a unique feature that allows for optimal observation of the surrounding aquatic environment.

Manipulator grabbers (claws) facilitate rapid making-fast and retrieving samples for study.

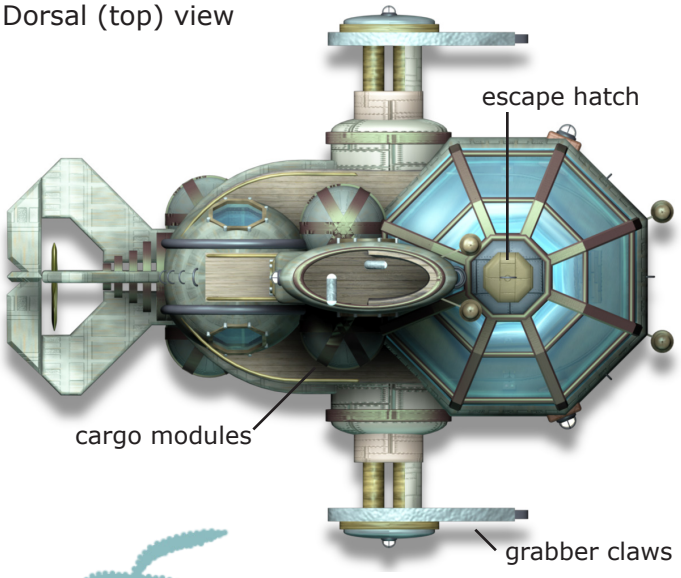
What if you were a scientist onboard the *Cyclops*? Imagine what the pond environment looks like to these micro sized explorers, only 50 microns (*µm)* tall. What unique problems might they encounter because of their size? How would they acquire repair materials, such as glass? Where would they find food, fuel, or oxygen?

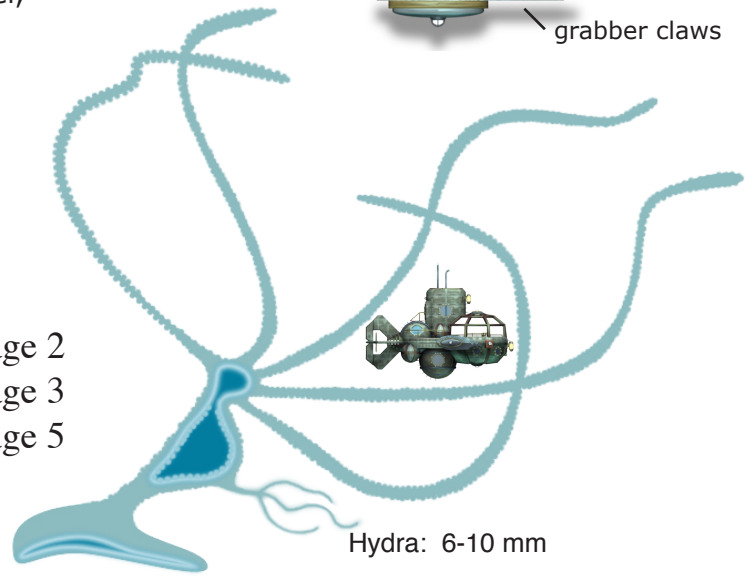
Starboard side view
(interior revealed)



Micro Submersible Cyclops: 1000 *µm*

Dorsal (top) view





Hydra: 6-10 mm

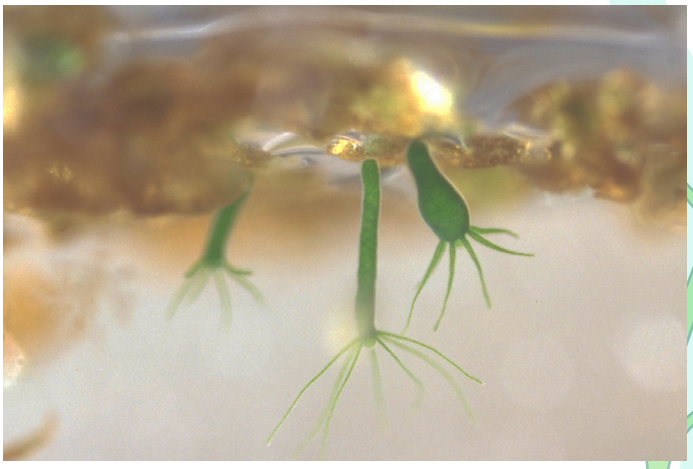
Contents of this guide...

About the Organism

Hydra
A Monster of the Microcosm

Hydra is a predator of weedy shallows. Because they live attached to plants and other underwater surfaces, hydras are easy to collect and study with a hand lens or microscope.

Green hydras show up best against white, light colored ones against dark backgrounds. If duckweed is present (tiny, bright green floating leaves with rootlets hanging below), check the hanging rootlets — a favorite attachment site for Hydra.



When examining try different lighting methods to see Hydra's anatomy.

- Do any have **buds**? What are they?
- Have any of your hydras eaten recently?
- Can you see the little bumps on the tentacles where stinging cells are housed?
- Do any hydras protozoans running about on their bodies and tentacles?

EXPLORATION GUIDE & JOURNAL

The Log of Captain Jonathan Adler

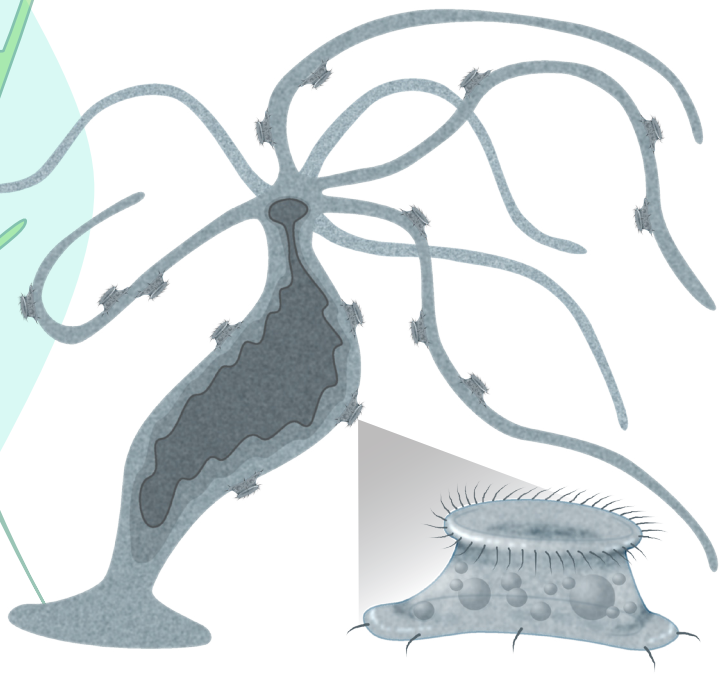
Day 10: 11:30 hours... Hiding beneath a giant aquatic plant leaf we observe the hydra, now safely beyond the reach of its tentacles. There is so much we do not know about this monster. We may not have another opportunity like this one for detailed observation.

Closer magnification through my telescope reveals some unusual movement on the creature's skin. Then we see it – single-celled organisms cover the hydra!

These disc-shaped single-celled organisms are ciliates, adapted for living on the surface of the hydra. They use their cilia to make feeding currents for pulling in bits of food, and for walking and hanging onto the hydra.

We have a theory that these single-celled partners scavenge bits of food captured by the hydra. This helps to keep the monster free of pesky bacteria. In exchange, the hydra provides its tiny guests a home safe from other predators.

How, we wonder, does a baby hydra become home to these partners? Which begs the question: where do baby hydras come from?



A Quiet Feeding Frenzy

A cloths-hanger/stocking net swept through the pond weeds will often capture great numbers of *Daphnia* and other small crustaceans — dinners for hydra! Add a few *Daphnia* and observe with these questions in mind:

- How does hydra capture its prey?
- Does it paralyze its victim before swallowing?
- How long does digestion take?
- What happens to the undigested portion of the meal?

Cloning New Hydras by Budding

Hydras reproduce by **budding**. In the days following a large meal, you might discover how hydra reproduces by budding from a new individual, and how long the process takes.

EXPLORATION GUIDE & JOURNAL

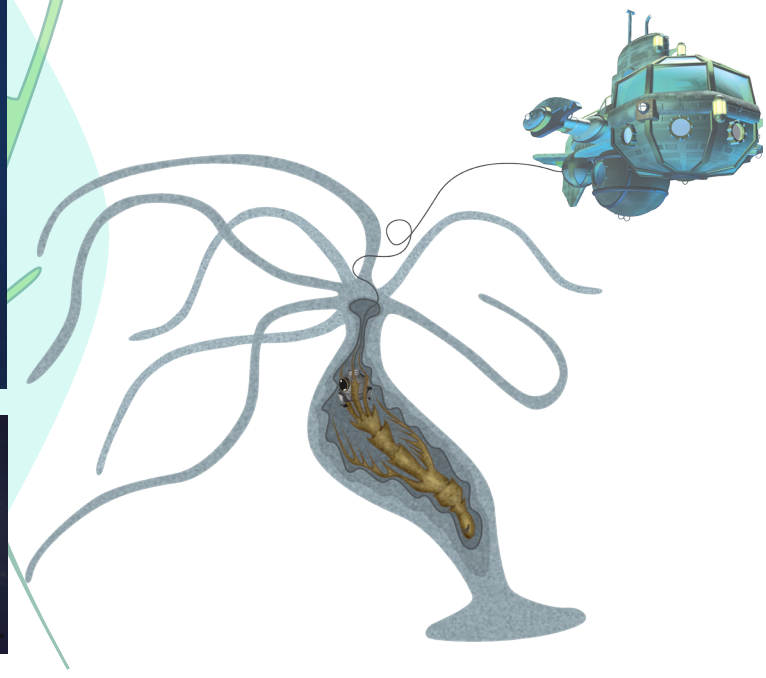
The Log of Captain Jonathan Adler

12:15 hours... What luck! We have just seen a nearby hydra capture a copepod. The unfortunate copepod struggles for a moment, then becomes still. Lyra believes that the hydra's tentacles have a stunning effect on the copepod – stinging cells! We believe that these stinging cells inject the captured animal with a paralyzing agent. When it is immobile, the hydra devours the prey alive.

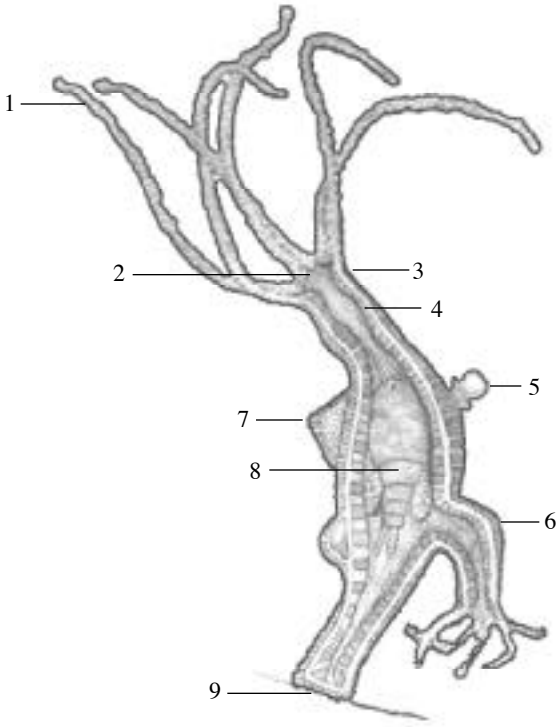
Lyra suggests a bold mission! She wants to use our diving bell to observe how the hydra digests its copepod dinner. The diving bell is a sturdy vessel, so I grant permission for this bold venture.

13:00 hours... The diving bell is now inside the hydra's gut! Lyra observes that acid is building up quickly around the captured copepod. She believes that the hydra's stomach lining excretes the acid, which digests the meal. But the copepod's protective shell is indigestable. How does hydra manage the indigestable parts?

The chemical alarm rings in the diving bell! The hydra's stomach acid is beginning to dissolve the bell's hatch seals – and if it does, it will digest Lyra as well! We try, but are unable to pull the diving bell out of the hydra. Then finally, the hydra spits out the shell of the copepod and my ship's naturalist with it.



Key to Organism



Hydra

1. tentacles with stinging cells
2. mouth
3. epidermis
4. gastrodermis
5. female reproductive parts
6. bud
7. male reproductive parts
8. copepod undergoing digestion
9. basal disc

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Photosynthetic Fauna
Plagued by a Predator
A Monster in the Shallows
The Bacterium that Came to Dinner
Voyage to the Bottom of the Food Chain
Quick Current Critters
Down the Waterfall
Forest Floor Explore
The Great Termite Kingdom
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