

Relationships for Survival: The Role of Bioluminescence

OVERVIEW

In these activities, students will focus on ecological relationships and investigate the many ways that species might interact using bioluminescence.

- **Before Your Visit:** Students will explore the variety of relationships between creatures that glow.
- **During Your Visit:** Students will observe and collect information about ecological relationships between species.
- **Back in the Classroom:** Students will explore how these different relationships affect survival.

NYS Living Environment

Standard 7.1c: In all environments organisms interact with one another in many ways. Relationships amongst organisms may be competitive, harmful or beneficial.

BACKGROUND FOR EDUCATOR

Bioluminescent species interact with other creatures in many ways, such as through competition, predation, attraction, or an ongoing symbiotic relationship such as mutualism, commensalism, or parasitism. All ongoing ecological relationships, even parasitic or predatory ones, have evolved over long periods of time and are integral to an ecosystem's balance and stability.

BEFORE YOUR VISIT

Activity: How do bioluminescent organisms interact with others?

Part 1: Warm-up Discussion

Ask students:

- In what environment would bioluminescence, or the ability to glow, be particularly useful to animals? (Answers may include: nighttime, darkness, underground, the deep sea)
- What activities do you think an organism would use bioluminescence for? (Answers may include: communication — signaling mates; feeding — attracting prey with glowing body parts, allows predators to see their prey; self-defense — counter-illumination (camouflage), illuminating invading predators to attract the attention of other predators, startling attackers, distracting predators, warning signal)

Plan how your students will use the *Creatures of Light* student worksheets. Since the exhibition will be dark, we recommend that students take mental notes in the exhibition and record their observations afterwards.

Before your visit, tell students that they will be collecting information on the relationships between different species and filling in their worksheets *after* the exhibition.

Part 2: Ecological Relationships of Bioluminescent Creatures

Review students' knowledge of ecological relationships by asking them to the ways that different species in the same habitat interact. Write their answers on the board (e.g. Species A might eat Species B, Species A might use Species B's discarded shell for shelter).

Ask the students to name some of these interactions (e.g. predation, parasitism). If those terms are not on the list, ask if anyone can define predation, parasitism, and symbiosis.

Note: If you haven't covered these terms yet, this would be an ideal opportunity to teach them to students, along with mutualism and commensalism.

Write “symbiosis” on the board. (Symbiosis is a long-term interaction between different species that interact in close proximity.) Underneath, write these symbols in three rows: +,+; +,0; and +,-. (They represent the three main types of symbiosis.) Ask the students to name the term for a symbiotic relationship that benefits both species. (mutualism, +,+) What about one that benefits one species while the other species is not affected? (commensalism, +,0) Finally, what about a symbiotic relationship that benefits one species and harms the other? (parasitism, +,-)

As a class, see if you can classify all of the interactions brainstormed in Step 1 as mutualistic, commensal, parasitic, or none of the above. Then point out the additional ecological relationships NOT generally considered to be symbiotic: predation (not a long-term relationship as one species is eaten), competition (not considered to be a direct interaction between species as the focus is a fight over an external resource) and reproduction (not an interaction between species, but between individuals of a species; not always a long-term relationship).

DURING YOUR VISIT

Creatures of Light: Nature's Bioluminescence

3rd floor (45-60 minutes)

This exhibition is too dark to read or write easily, so we recommend that students make mental notes of the organisms and the relationships they observe. Distribute the student worksheet afterwards, in the Hall of Ocean Life.

Tell students that they'll be exploring and observing ecological relationships between species (on land and in the ocean). They will be collecting information about the relationships between species from different media in the exhibition (e.g. text panels, models, iPad stations, movie). Explain that they'll be writing down their observations after they leave the exhibition. Have students watch the “In the Deep Sea” video at the end of the exhibition.

Milstein Hall of Ocean Life

1st floor (30 minutes)

Find a quiet place in this hall, preferably in front of the Deep Sea Ecosystem because it has many of the organisms found in the *Creatures of Light* exhibition. Distribute the “Ecological Relationships” worksheet. Have them list the pairs of species they observed interacting in *Creatures of Light*, and record the type of interaction on the worksheet. Encourage them to try to remember as many relationships between organisms as possible.

Note: This part can be done as a group discussion, with students writing the examples as they're offered up.

Then have students explore the Milstein Hall of Ocean Life, observe other species that glow in the dark, and add these species and their relationships to the worksheet. They may also add species that don't glow if they can describe how they interact with bioluminescent organisms.

BACK IN THE CLASSROOM

Activity: Exhibition Wrap-Up

Divide students into groups and have them reflect on what they learned on their trip to the *Creatures of Light* exhibition and the Milstein Hall of Ocean Life. Ask them to answer the following questions in their notebooks, supporting each answer with examples:

- What environments do organisms that glow live in?
- What functions does bioluminescence serve for the various species that use it?
- How does bioluminescence help creatures survive in specific environments?

Afterwards, have students share some of their answers with the whole class.

Ecological Relationships Worksheet

1. List some species that you observed in the *Creatures of Light* exhibition in the first column. Then record your observations in the column that describes the kind of relationship it has: How do different species use bioluminescence? For what purposes? What kinds of relationships do they form with other species that glow?
2. List some additional species that glow that you observed in the Milstein Hall of Ocean Life. You may also add species that don't glow if you can describe how they interact with bioluminescent species.

Species	Purposes of Bioluminescence					
	Predation	Commensalism	Attraction	Defense	Mutualism	Parasitism

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Ecological Relationships Worksheet

ANSWER KEY

- List some species that you observed in the *Creatures of Light* exhibition in the first column. Then record your observations in the column that describes the kind of relationship it has: How do different species use bioluminescence? For what purposes? What kinds of relationships do they form with other species that glow?
- List some additional species that glow that you observed in the Milstein Hall of Ocean Life. You may also add species that don't glow if you can describe how they interact with bioluminescent species.

Species	Purposes of Bioluminescence					
	Predation	Commensalism	Attraction	Defense	Mutualism	Parasitism
<i>Pony Fish</i>		<i>Fish gets a way to attract mate. Bacteria get a place to live, but they can survive just as well outside the fish...</i>	<i>Male flashes to attract females</i>			
<i>Deep-sea Shrimp</i>				<i>Spits out bioluminescent saliva when threatened</i>		
<i>Fireflies</i>	<i>Female firefly sees male of different species flashing, and attacks</i>		<i>Female is attracted to male firefly flashing for reproduction</i>			
<i>Fungus gnat</i>	<i>Attracts prey (insects) into sticky lines and eats</i>					
<i>Hatchet-fish</i>				<i>Camouflage – blend in with above</i>		

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Species	Purposes of Bioluminescence					
	Predation	Commensalism	Attraction	Defense	Mutualism	Parasitism
<i>Stoplight Loosejaw Dragonfish</i>	<i>Attracts prey with lure</i>	<i>Fish gets a way to attract mate. Bacteria get a place to live, but they can survive just as well outside the fish...</i>				
<i>Honey Mushroom</i>						<i>Honey mushroom living on and eventually killing trees</i>
<i>Dinoflagellates</i>				<i>Flash to startle predators, or expose invading predators</i>		