

Virtual Firefly Festival Lesson: Bioluminescence

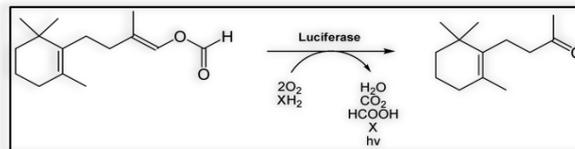
In this lesson, participants will learn about how fireflies produce light before answering true/false questions to test their understanding of this phenomenon and learn more through self-guided exploration.

Fireflies are **bioluminescent** animals, which means they have the ability to create light with their bodies! The iconic flash is created by a chemical reaction inside the last segment of their abdomen (check out the Firefly Anatomy lesson) and it is a high-efficiency “cold light” that can be different colors depending on the species; the energy produced by this reaction is all light, while in an incandescent light bulb, a large portion of the energy created is emitted as heat.



Photo courtesy of Paul Zahl via [Nat Geo](#)

Here’s how it works: fireflies mix a chemical called **luciferin** with **ATP** (a molecule in all cells that stores energy) and the enzyme **luciferase**. These mix together and create new molecules that are then mixed with **oxygen**, which makes the chemical reaction explode in a beautiful flash of light! This reaction happens inside cells that also contain uric acid crystals that reflect and intensify the light, kind of like when a sunbeam hits a crystal hanging in a window. This chemical process is the same in all other bioluminescent animals, such as deep-sea fish, jellyfish, and squids!



luciferin and luciferase reaction courtesy of [Yikrazuul](#)

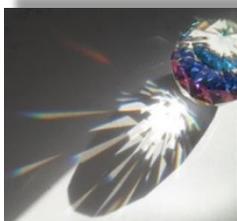


Image courtesy of [Blue Skies](#)

But why do fireflies light up? This display is how they talk to each other. Fireflies use their flashes to attract mates, display where their territories are, and warn predators that the chemicals creating the light are not only bitter but potentially toxic. These chemicals are not just essential to the firefly’s survival: humans have discovered that artificially-produced luciferase can be used to study how cells grow and react to each other by literally lighting them up and making them easier to see. This means we can use it to study not just how plants and animals grow but also to teach us how diseases affect and

move through our bodies.

To learn more, check out these links and test yourself by answering the corresponding question. You can find the answers at the bottom of the page, but no peeking!

[A more detailed look at the luciferin/luciferase reaction](#)

1. True or False? Fireflies have lungs like humans that send the oxygen to their abdomen.

[Explore more bioluminescent animals](#)

2. True or False? Most bioluminescent animals live in the ocean.

[Check out the flash colors for different firefly species!](#)

3. True or False? Though yellow-green is probably the most common flash color, one species of firefly actually flashes blue.

1. False: Fireflies and other insects do not have lungs like humans; fireflies use organs called *spiracles* to transport oxygen.
2. True: Most are marine and there are almost no freshwater bioluminescent species, but there are some fungi that glow!
3. True: *Phausis reticulata*, or the blue ghost firefly, is native to the southeastern US and very little is known about their habits.