

How Do Fireflies Help Scientists Fight Cancer?

Take a look at the firefly in **Figure 1** below. See how it's glowing? That's thanks to chemistry. A firefly is an example of a bioluminescent animal. **Bioluminescent** substances produce and give off light as the result of chemical reactions that occur within an organism. A firefly's green glow results from a reaction with the molecule called D-luciferin, and it recently inspired researchers at Stanford University who may have gotten us one step closer to understanding and curing cancer.



Figure 1. Firefly Glow. The bioluminescent green glow of a common firefly results from the molecule D-luciferin. *Source:* [Wikimedia Commons](#).

Scientists have taken advantage of bioluminescence to help them study cancer. Bioluminescent D-luciferin molecules are added to cancer cells making them easily visible under a microscope—or at least, that was the idea. Unfortunately, the light given off (**emitted**) by D-luciferin is absorbed by the cells around it, making the cancer cells difficult to observe.

It turns out, however, that it's possible to make D-luciferin much more useful by making a few tweaks to its molecular structure. By swapping out a couple of atoms, scientists at Stanford University made two new bioluminescent molecules: amino-D-luciferin (which has an orange glow) and aminoseleno-D-luciferin (which has a red glow). The changes made to the molecular structures changed the color of the light that is emitted by the molecules. This, in turn, changed how the light is absorbed by surrounding cells in the cancer studies. The researchers found that the light emitted by aminoseleno-D-luciferin was absorbed *least* by cells around it, making it the best choice for cancer research.

The researchers propose that the improved bioluminescent properties of aminoseleno-D-luciferin are due to the differences in electronegativity between the atoms they took out and those they swapped in, but more research is needed to gather evidence in support of the hypothesis. Nevertheless, even if they don't yet fully understand it, aminoseleno-D-luciferin is as exciting to cancer researchers as the invention of the telescope was to astronomers!

Reference

Conley, Nicholas. R., Anca Dragulescu-Andrasi, Jianghong Rao, and W. E. Moerner. 2012. "A Selenium Analogue of Firefly D-Luciferin with Red-Shifted Bioluminescence Emission." *Angewandte Chemie International Edition* 51: 3350–3353. doi:10.1002/anie.201105653

BiteScientist Profile



As a chemist studying at the Massachusetts Institute of Technology, **Shannon Morey's** thesis work focused on creating novel and complex molecules, called synthetic polypeptides. Shannon has been teaching high school physics and chemistry since 2014 and is currently working at Abbott Lawrence Academy in Lawrence, Massachusetts. She is a co-founder of BiteScis.