

Photuris, a complete and horrid deception

Daylight is fading. Soon, the exact spot where you are standing will become a place of unthinkable violence. A life will be lost, but it may well be the saviour of the one who took it.

As you continue walking through the marsh at dusk, you see a remarkable bright flash appear not far away. He is a *Photinus* firefly trying to crack the photonic code for finding a mate. His light flashes vary in intensity but appear in repeatable intervals¹. He is waiting for a female *Photinus* beetle to notice his flashes. To be able to mate, he needs to find her somewhere perched on the bushes nearby.

You see a new flash appear a bit further down towards the treeline. As you come closer with your boots slushing through the mud, you see another firefly. She is sitting steadily, waiting for the *Photinus* male to touch down close to her. Once he has made a soft landing, he continues flashing towards the female in the hopes of being chosen by her. He doesn't notice that she is a lot bigger than he is, nor that she has stopped glowing.

In the blink of your eye, the larger female has jumped on top of the male. She grabs him by the neck with her big mandibles and starts chomping away until his head nearly falls off. She then takes her sweet time to devour his soft insides.



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She is a *Photuris* female. A completely different species altogether than the male who thought he found a suitable partner. While she uses light signals to find males of her own species, she also preys on and deceives *Photinus* males^{2,3}. By feeding on *Photinus*, she gets a nutritious meal containing lucibufagins, defensive compounds that make the beetles distasteful to other predators, such as birds⁴.

Protection through distasteful lucibufagins is so valuable that *Photuris* females go to great lengths to get it. Scientists have observed *Photuris* females stealing silk-wrapped *Photinus* captured by orb-weaving spiders⁵. Such theft can obviously come at a great risk as the spiders could also successfully capture and eat thieving *Photuris* females.

Bioluminescence evolved around 183 million years ago during the Jurassic period in the common ancestor of fireflies and other beetles⁶. It is not yet clear why bioluminescence evolved, but scientists suspect that producing the bioluminescent compound luciferin helped to withstand oxidative stress as a result of increasing oxygen levels at the time. Bioluminescence only later evolved as a mating signal, leading to the remarkable light shows witnessed earlier¹.

Lucibufagins evolved much later, about 66 million years ago, and only in some groups of fireflies. The protective nature of lucibufagins led *Photuris* to tune into the signals of *Photinus*. In turn, *Photinus* males refine their perception of light signals to avoid approaching females of the wrong species⁷. Over many generations, fine tuning of signals between deceiver and victim/escapee has occurred through a process called coevolution.

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- 1 [Lewis SM & Cratsley CK. 2008. Flash signal evolution, mate choice, and predation in fireflies. Annu Rev Entomol 53: 293-321.](#)
- 2 [Barber HS. 1951. North American fireflies of the genus *Photuris*. Smithson Misc Collect 117: 1-58.](#)
- 3 [Lloyd JE. 2018. A naturalist's long walk among shadows: of North American *Photuris* – patterns, outlines, silhouettes... echoes. Self-published, Gainesville, FL, USA. 477 pp.](#)
- 4 [Eisner T *et al.* 1978. Lucibufagins: Defensive steroids from the fireflies *Photinus ignitus* and *P. marginellus* \(Coleoptera: Lampyridae\). Proc Natl Acad Sci USA 75: 905-908.](#)
- 5 [Faust L *et al.* 2012. Thieves in the Night: Kleptoparasitism by Fireflies in the Genus *Photuris* Dejean \(Coleoptera: Lampyridae\). Coleopt Bull 66: 1-6.](#)
- 6 [Zhu C *et al.* 2024. Firefly toxin lucibufagins evolved after the origin of bioluminescence. PNAS Nexus 3: 215.](#)
- 7 [Maquitico Y *et al.* 2024. Deceptive seduction by femme fatale fireflies and its avoidance by males of a synchronous firefly species \(Coleoptera: Lampyridae\). Insects 15: 78.](#)

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