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Exploring the Bioluminescence of Glow Pikmin

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Abstract

Pikmin 4 introduced players to the new Glow Pikmin, nocturnal creatures that have a range of strengths in gameplay to rival existing Pikmin. One of their defining features is their bioluminescence, which allows them to form a Glow Mob – a ball of bioluminescent light – to attack enemies. This paper explores real-world examples of bioluminescence to suggest additional survival advantages related to the evolution of the Glow Pikmin's bioluminescence.

Keywords: Video game; Biology; Evolution; Pikmin; Bioluminescence

Introduction

Glow Pikmin (*Pikminidae supravelum*), shown in Figure 1, are a type of Pikmin found in the game Pikmin 4 [1]. They have near-indestructible properties, combining the strengths of nearly all predecessor Pikmin into one [2]. They can resist fire, electricity, water, poison, and ice damage, making them incredibly powerful in gameplay [2]. They are nocturnal, so are only present during night expeditions, or whilst exploring caves [2].



Figure 1 – Glow Pikmin carrying a glow pellet [3].

The green bioluminescence of the Glow Pikmin is their defining characteristic, and whilst the evolution of bioluminescence is still speculated within the real world, it is known it can present survival advantages to organisms exhibiting it. This paper will investigate survival advantages the Glow Pikmin may experience due to this bioluminescence and draw comparisons to bioluminescence in real-world organisms.

What is Bioluminescence?

Bioluminescence occurs within organisms due to a chemical reaction occurring that produces light as a

by-product [4]. Most bioluminescent reactions are caused by the oxidation of luciferin to form oxyluciferin, a process that uses ATP. This reaction (shown in Figure 2) is catalysed by the luciferase enzyme [4]. Bioluminescent organisms can absorb luciferin and luciferase through their food, symbiotic relationships, or produce it within their bodies [4].



Figure 2 – Reaction pathway of the oxidation of luciferin to produce the light seen in bioluminescent reactions [5].

Bioluminescence in the Natural World

Fireflies are similar to Glow Pikmin in that they have light-producing organs, and exhibit bioluminescence [6]. Fireflies produce luciferase within their bodies and are able to control their bioluminescence through controlling how much oxygen enters the light-producing organs [7]. Limiting the amount of oxygen entering these organs prevents the luciferin substrate being catalysed to oxyluciferin, therefore preventing light being produced as a by-product. The firefly uses this ability to flash their light organ to locate a mate during mating season [7].

Additionally, female fireflies also use this flashing ability to mimic competing species females to attract

a male of a different species [7]. Once they have attracted a mate of the opposing species, they will eat them [7]!



Figure 3 – Male firefly with a glowing light organ [8].

Another use of bioluminescence in the natural world is as a defence mechanism. *Swima bombiviridis*, also known as the Green Bomber, is a worm that lives in the midnight zone of the ocean. This worm has the ability to produce bioluminescent "bombs" to ward away predators [9]. They produce bioluminescent fluid in their bodies and store it in sacs around the head [9]. When the worms encounter a predator, they can burst the fluid-filled sacks and startle the predator allowing them time to escape [9].

Bioluminescence of Pikmin

Within the night expeditions in Pikmin 4, the player must protect Lumiknolls (seen in Figure 4) from attacks against enemy creatures [10]. Glow Pikmin are the only type of Pikmin that can survive the harsh conditions of the night expeditions. Therefore, their bioluminescence likely evolved to support them in the protection of the Lumiknoll.



Figure 4 – Glow Pikmin surrounding a Lumiknoll during a night expedition [11].

During night expeditions, glow pellets (seen in Figure 1) can be found around the map. Pikmin can transport glow pellets to Lumiknolls, to act as fuel to produce more Glow Pikmin – potentially acting as a source for the Glow Pikmin's luciferin and luciferase. As Glow Pikmin do not undergo sexual reproduction, it is unlikely they have evolved bioluminescence as a method to locate a mate. Also, Glow Pikmin do not have a diet, so their bioluminescence is unlikely to assist in the location and hunt for food, as can be the case with other real-world organisms [12].

Glow Pikmin can form a Glow Mob – a bright ball of light resembling a nucleus and surrounding electron density – to attack enemies [2]. This attack is similar in principle to the bioluminescent "bombs" produced by *Swima bombiviridis*, with the goal to startle the predator. However, in the Glow Pikmin's case, the Glow Mob is used to gain an advantage in attacking enemies, rather than to escape. This suggests Glow Pikmin's bioluminescence has evolved as a defence mechanism against enemies attempting to attack the Lumiknoll.

Finally, the Glow Pikmin may have evolved bioluminescence to mimic the Lumiknoll glow. This mimicry is similar to female fireflies mimicking competitor species as a way to attract competing males and then eat them. In the Pikmin's case, drawing attention away from the Lumiknoll through mimicking the same glow can delay the enemies pursuit, giving the Pikmin more time to defend.

Are Glow Pikmin Actually Bioluminescent?

An important observation made within Pikmin 4 by Captain Olimar is upon the death of a Glow Pikmin, they turn into "a form of light – perhaps a photon" [1]. This suggests Glow Pikmin are not bioluminescent at all and are instead made of photons. This argument is supported by their ability to form the Glow Mob [1]. These observations present an opportunity for further research into the Glow Pikmin, to determine whether they should be classed as Pikmin at all.

Conclusion

Whilst little is known about the origins and biology of Glow Pikmin, an investigation into bioluminescence in the real-world has revealed potential explanations evolution of the Glow to the Pikmin's bioluminescence. It is likely the Glow Pikmin evolved this characteristic as a method to mimic the Lumiknoll glow, distracting enemies in their pursuit of the real Lumiknoll. Additionally, examples with similar motivations to the Glow Mob have been discovered within the real-world, such as the Swima bombiviridis' bioluminescent "bombs". However, further investigation into the nature of Glow Pikmin is required due to observations made suggesting they may not be biological matter at all.

References

- [1] Nintendo (2023) *Pikmin 4*, [Computer game], Nintendo Switch, Nintendo.
- [2] Pikipedia (2025) *Glow Pikmin*. Available at: <u>https://www.pikminwiki.com/Glow_Pikmin</u> [Accessed: 4 February 2025].
- [3] Pikipedia (2024) Glow pellet. Available at: <u>https://www.pikminwiki.com/Glow_pellet</u> [Accessed: 4 February 2025].
- [4] Evers, J. (2023) *Bioluminescence*. Available at: <u>https://education.nationalgeographic.org/resource/bioluminescence/</u> [Accessed: 5 February 2025].
- [5] National Oceanic and Atmospheric Administration (no date) *Bioluminescence fact sheet*. Available at: <u>https://oceanexplorer.noaa.gov/edu/materials/bioluminescence-fact-sheet.pdf</u> [Accessed: 11 February 2025].
- [6] The Editors of Encyclopedia Brittanica (2025) *firefly-insect*. Available at: <u>https://www.britannica.com/animal/firefly-insect</u> [Accessed: 10 February 2025].
- [7] Chapman, K. (2023) *Bioluminescent beasties*. Available at: <u>https://edu.rsc.org/everyday-chemistry/how-do-fireflies-produce-light/4017472.article</u> [Accessed: 10 February 2025].
- [8] Fu, X. (2024) Image of Aquaticia leii, a species of firefly that lives in Chinese rice paddies. Available at: <u>https://www.nationalgeographic.com/animals/article/fireflies-bioluminescence-glowing-genes-discovery</u> [Accessed: 11 February 2025].
- [9] Aguilera, M. (2009) Scientists Discover Bioluminescent 'Green Bombers' From the Deep Sea. Available at: <u>https://scripps.ucsd.edu/news/scientists-discover-bioluminescent-green-bombers-deep-sea</u> [Accessed: 10 February 2025].
- [10] Pikipedia (2024) Night expedition. Available at: <u>https://www.pikminwiki.com/Night_expedition</u> [Accessed: 10 February 2025].
- [11] Pikmin 4 (2023) Glow Pikmin next to a Lumiknoll. Available at: <u>https://www.pikminwiki.com/Night_expedition#/media/File:P4_Glow_Pikmin_and_Luminol.jpg</u> [Accessed: 10 February 2025].
- [12] National Oceanic and Atmospheric Administration (no date) *What is bioluminescence?* Available at: https://oceanexplorer.noaa.gov/facts/bioluminescence.html [Accessed: 10 February 2025].