

Harnessing the mechanisms of fungal bioluminescence to confer autonomous luminescence in plant and animal cells

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By exploiting the hispidin synthase pathway in plants, MRC Laboratory of Medical Sciences scientists have created Chrysanthemums that glow in the dark.
Credit: LightBio

In a striking new study [published](#) in *Science Advances*, a team of synthetic biologists led by Karen Sarkisyan at the MRC Laboratory of Medical Sciences, have reported the discovery of multiple plant enzymes—hispidin synthases—that can perform the most complex reaction of the bioluminescence pathway.

This discovery is a [significant milestone](#) toward figuring out whether [plants](#) can natively produce all the molecules required for light emission. It also means that the glow of bioluminescent plants can now be more closely aligned with their internal biology.

The technology reported in the paper is a hybrid [pathway](#) that couples the newly found plant hispidin synthases to other necessary bioluminescence enzymes found in mushrooms. This hybrid pathway allows the subtle inner rhythms and dynamics within plants to be unveiled as an ever-changing display of living light.

"This technology is a plug-and-play tool to visualize virtually any molecular physiology at the organismal level, completely non-invasively," Sarkisyan states. His work also revealed that not only does a single indigenous plant gene effectively substitute for two [fungal genes](#), the plant gene is notably smaller and has simpler biological requirements for luminescence. The gene's reduced size also enhances its usability and flexibility, making it more adaptable for extended applications.

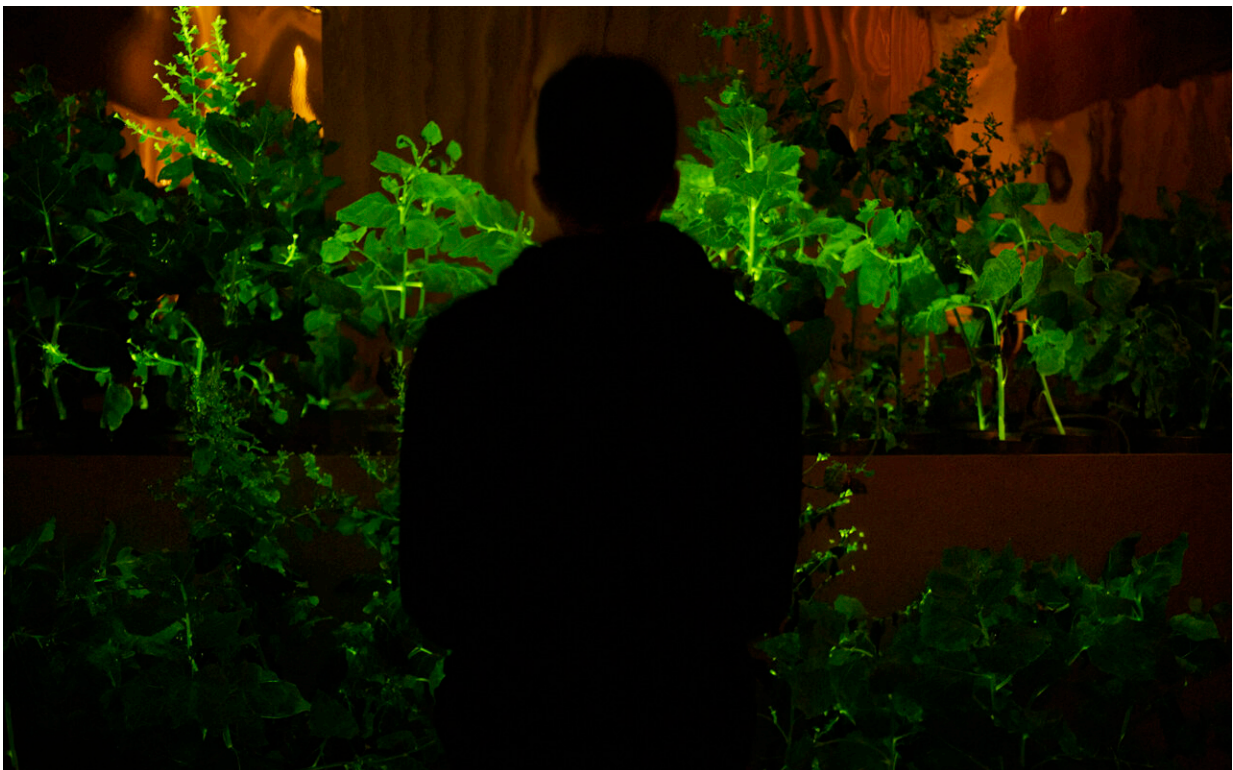
This research was sponsored by Light Bio, a plant synthetic biology company co-founded by Sarkisyan, which aims to transform the horticulture industry with beautiful biotech creations, such as glowing plants. The first product to exploit the hispidin-based pathway is Firefly Petunia, so named because its bright light-emitting flower buds resemble fireflies.

Beyond the advances in aesthetics that luminous vegetation may provide

to plant lovers, the foundational science offers profound insights into plant molecular physiology. By enabling continuous monitoring of plant responses to various stresses, such as [drought stress](#) or attacks by pests, the technology may lead to significant progress in fields such as crop development and [disease resistance](#).

Sarkysian's bioluminescence pathway has been replicated in other species including yeast and even in human cells.

"We love growing our bioluminescent petunias, they are truly magical. But beyond aesthetics, understanding how we can adapt self-sustained luminescence to monitor [disease progression](#) and assist in the screening of drug candidates will make this technology even more impactful," says Sarkysian.



MRC Laboratory of Medical Sciences synthetic biologist Karen Sarkysian observes his glowing plants which could one day be used to signal health or disease. Credit: LightBio



By exploiting an enzyme pathway found in bioluminescent fungi, MRC-LMS scientist Karen Sarkysian has created glow in the dark Firefly Petunias[®] with biotech company LightBio. Credit: LightBio

More information: Kseniia Palkina et al, A hybrid pathway for self-sustained luminescence, *Science Advances* (2024). [DOI: 10.1126/sciadv.adk1992](https://doi.org/10.1126/sciadv.adk1992). www.science.org/doi/10.1126/sciadv.adk1992

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