Hyperspectral microscopy reveals the nanostructures that give butterflies their colors

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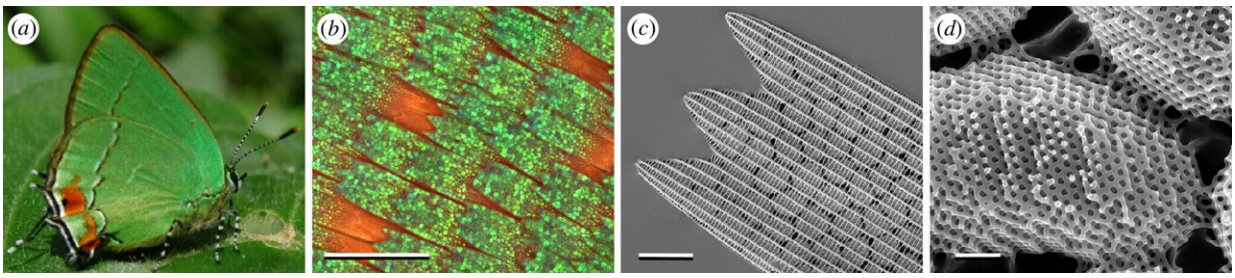

The green wings of Erora opisena originate from wing scales containing photonic gyroid nanostructures. Credit: *Journal of The Royal Society Interface* (2024). DOI: 10.1098/rsif.2024.0185

Scientists have found a new way to see how butterflies develop their colors.

Butterflies use color for a number of important functions, including as signals for mate-choice or to ward off predators.

Dr. Annie Jessop, a post-doctoral fellow from Murdoch University's School of Mathematics, Statistics, Chemistry and Physics led the revealing new research.

She said that butterflies and many other insects use tiny structures to create colors rather than pigments, but there were mysteries surrounding them.

The article "Elucidating nanostructural organisation and photonic properties of butterfly wing scales using hyperspectral microscopy" is published in the *Journal of the Royal Society Interface*.

"Butterflies, and many other insects use nanostructures to generate color, a phenomenon known as structural color," Dr. Jessop said.

"While we have lots of knowledge about how color is produced from these structures, we have much less knowledge about how these structures develop in biological systems.

"Our study set out to develop a method that would allow scientists to measure the color that these structures produce throughout development.

"This would then allow us to infer certain structural details at different time points, like the size of the structures.

"Our research successfully demonstrated that the method proposed, hyperspectral microscopy, has the appropriate spatial, temporal, and spectral resolution to do this and could reveal the development of optical nanostructures in living biological systems."

Hyperspectral microscopy is a microscopy technique that provides spectral data for each image pixel and that can record in many hundreds of color channels, depending on setup.

This differs from conventional light microscopy that only records in three color channels (red, blue, and green) and from multispectral imaging that records in three to fifteen color channels.

"The microscope can measure the colors the structures produce over time, helping us to understand for the first time, how these tiny structures develop in living butterflies," Dr. Jessop said.

More information: Anna-Lee Jessop et al, Elucidating nanostructural organization and photonic properties of butterfly wing scales using hyperspectral microscopy, *Journal of The Royal Society Interface* (2024). DOI: 10.1098/rsif.2024.0185

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