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← Back to Original Article

How butterfly wings build their color

Researchers zero in on gyroids, crystals that transmit light to produce a brilliant color — an effect manufacturers would lov simulate.

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Butterfly wings are so synonymous with bold color that few people may wonder what makes them that way. But Yale University researchers stu green color on the wings of five butterfly species say they have found the source of that striking color — three-dimensional crystals known as gy

Such crystals create vibrant hues through their interactions with light — a type of color that is structural, as opposed to pigment-based. Other an peacocks and frogs, have structural colors as well, but these particular butterfly colors were based on the especially complex gyroid.

"The structural colors are notable because they're so brilliant, so saturated, so pure," said biologist Richard Prum, senior author of the study pu week in Proceedings of the National Academy of Sciences.

And at last, researchers have been able to see — in three dimensions — the gyroids that create some of these colors. In doing so, they've gained a understanding of how butterflies produce them.

This study was the first to use a three-dimensional imaging method, called small-angle X-ray scattering, to directly observe the unique structure is the most challenging thing to describe in this research," said Prum. "I'm still mystified myself. It really is mind-bending."

Vinodkumar Saranathan, coauthor of the study, took a stab: "Imagine a maze of these pinwheels, hundreds of thousands of pinwheels connected directions."

The team surmised that the wing cells weave in and out among themselves, so that the external surfaces become internal, creating channels in w called chitin can be deposited. Chitin is the hard material that forms insect exoskeletons; when the cells die and decay, the chitin is left behind as making the wings a vivid green. Not all butterflies employ such complex structures to make their colors; others use simpler structures or pigme

Structural colors of all types are appealing to textile and cosmetic manufacturers because they're fade-resistant. They're also responsible for iri are used in products such as holographic wrapping paper and CDs.

Gyroids, however, are too complex for current fabrication processes, so manufacturers are keen to mimic the butterflies' method for producing only could they be used to create vibrantly hued textiles, gyroids respond to light much like wires transmit electricity, so the potential technolo applications could be enormous.

Because butterflies create such structures naturally, the findings suggest that technological developments wouldn't have to come at an enormou environmental cost.

"These guys can make all the stuff at room temperature without toxic chemicals," said University of Albany biologist Helen Ghiradella, whose p structural color had an impact on this study. "The biological systems are showing us it can be done."

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