

Biologists find what colors a butterfly's world

August 10 2023



The UCI team made its finding this while investigating the Heliconius butterfly.
Credit: Alejandro Santilana

As butterflies flit among flowers, they don't all view blossoms the same way. In a phenomenon called sexually dimorphic vision, females of some butterfly species perceive ultraviolet color while the males see light and dark. University of California, Irvine biologists have discovered that in

at least one species, the variation results from a vision gene's jump onto a sex chromosome. It's the first known finding that this kind of genetic change causes sexually dimorphic vision.

The study appears in *Proceedings of the National Academy of Sciences*.

The UCI team determined this while investigating the *Heliconius* butterfly genus. Some of its [species](#) see ultraviolet color, an array wider than the visible light spectrum that humans perceive. A substance produced by the opsin gene accounts for these butterflies' visual capacity. In *Heliconius* species with sexually dimorphic vision, ultraviolet color perception is only present in females.

In searching for the [genetic mechanism](#) behind this difference, the UCI biologists selected as their subject *Heliconius charithonia*, in which visual capacity is sexually dimorphic. When they finished assembling the first complete genome for this species, they learned that its W—or female—chromosome contained the opsin gene.

"This is the first known instance where dimorphic color vision in animals comes from a [single gene](#) moving to a [sex chromosome](#)," said first author Mahul Chakraborty, an assistant project scientist in ecology and evolutionary biology. "Besides the discovery's scientific significance, it highlights the complexities of automated [genetic sequencing](#) and the crucial role of validation."

He did much of his work on the project while a postdoctoral researcher in the laboratories of co-corresponding authors Adriana Briscoe and J.J. Emerson, both [faculty members](#) in the Department of Ecology and Evolutionary Biology.

Previously assembled genomes for *Heliconius charithonia* were fragmentary. None included the W chromosome, whose highly repetitive

code can pose stumbling blocks for automatic sequencing. UCI researchers began their study by automatically sequencing the species genome, but this failed to reveal all expected copies of the opsin gene. Undeterred, they next examined the coding manually.

"I went through every bit of the sequencing," said Angelica Lara, who was an ecology and evolutionary biology undergraduate when she started working with the investigative team. Lara continued to participate in the project as a postbaccalaureate researcher after earning her degree. "I still couldn't find the opsin after all that review. Then I realized a part of the code for the W chromosome had not been well formatted, and I believed the opsin had to be located there," she said.

Lara's efforts cued Chakraborty to examine that segment more closely. It turned out that the automatic sequencing had dropped that section of the chromosome's coding, likely stymied by its repetitiveness. Restoring it revealed the opsin gene, and the team confirmed the finding with additional tests.

"Without this manual annotation and investigation, we would have made assumptions that were incorrect and misleading," said Briscoe, professor of ecology and [evolutionary biology](#). "Now that we've made this discovery, we can dig much deeper into the mechanics behind the dimorphism and understanding its purpose."

Scientists believe the vision difference may be the reason that females and males within some [butterfly species](#) feed on different types of flowers. So far, the only other creatures known to have sexually dimorphic [vision](#) are certain kinds of primates.

More information: Mahul Chakraborty et al, Sex-linked gene traffic underlies the acquisition of sexually dimorphic UV color vision in Heliconius butterflies, *Proceedings of the National Academy of Sciences*

(2023). [DOI: 10.1073/pnas.2301411120](https://doi.org/10.1073/pnas.2301411120)

Provided by University of California, Irvine

Citation: Biologists find what colors a butterfly's world (2023, August 10) retrieved 28 April 2024 from <https://phys.org/news/2023-08-biologists-butterfly-world.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.