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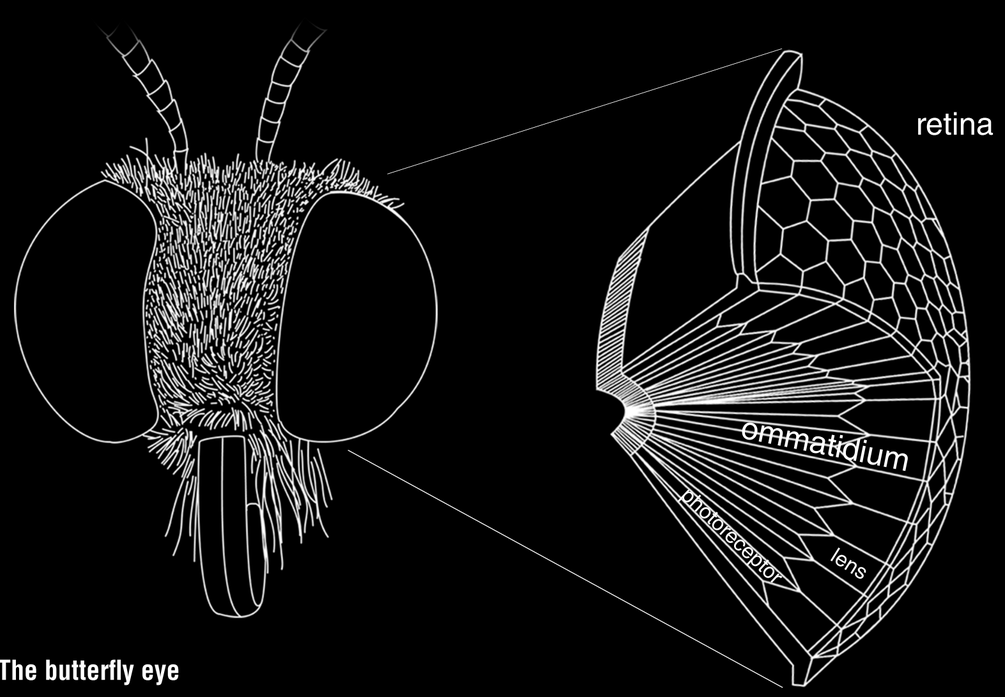
Inside butterfly eyes

Eyes are responsible for capturing information about the intensity and distribution of light. Like most insects, butterflies have compound eyes, which are composed by thousands of small hexagonal eyes. Evolution provided them with striking skills, such as larger fields of vision and better perception of fast-moving objects. Their eyes are also capable of perceiving ultraviolet and polarized light. These visual adaptations enables them to reliably detect and recognize food sources, host plants and mating partners. *Heliconius* butterflies are one example where the behavioural importance of visual information is well understood.

Asterope markii, ecuadorian Amazon

Heliconius Vision

Heliconius butterflies rely on visual cues when searching for potential mates. Multiple mimetic colour patterns pose an additional challenge since they must differentiate individuals of the same species from co-mimics to successfully reproduce.



The butterfly eye

In the insect retina there are multiple photoreceptor cells, which are sensitive to a different portion of the light spectrum and facilitate the discrimination of colour.

In the eyes of *Heliconius erato* four receptor sensitivities have been identified with spectral peaks at approximately 360 nm (UV1), 390 nm (UV2), 470 nm (Blue), 560- 600 nm (LW). The presence of red lateral filtering pigments shifts red photoreceptor cell sensitivity from 560 to 600 nm. This allows *H. erato* to precisely distinguish colours in the red-green spectrum even though they have a single LW sensitive opsin.

Why UV? Unlike their closest relatives (and humans), *Heliconius* butterflies can see UV light. A UV reflectant yellow wing pigment evolved at the same time as this ability, at the origin of the genus *Heliconius*. This colour pattern is used in mate recognition. This suggests that the visual system might facilitate the recognition of conspecifics through wing coloration.

Sex and Vision. *Heliconius* have sexually dimorphic eyes. *H. erato* males express only UV2 while females express both UV opsins in the photoreceptors. These differences might play a role in sexual selection and in mate recognition.

Shapes. *Heliconius* also use shape to search for both flowers and leaves during feeding and oviposition. Females use leaf shape cues to find *Passiflora* plants and oviposit.

UV camera

Human vision