

## D.G. Stavenga, Evolution of color and vision in butterflies

Recent research demonstrates that butterflies have evolved from moths, which is corroborated by optical studies on butterfly eyes. The moth corneal nipple array exists in many butterfly families, but often in reduced form, and it is even absent in Papilionidae. Moth eyes have an extensive tapetum, which is present in reduced form in butterflies, or it is absent, as in Papilionidae. The inconspicuous moths possess color vision, used for detecting flowers. Butterfly color vision is in addition used for recognizing the colourful wing patterns. A comparative survey of wing coloration of pierid butterflies, using UV photography and reflectance spectrophotometry, reveals the evolutionary changes in colors of the main subfamilies. Two quite different methods of sexual dichroism have been developed among pierid butterflies.

Butterfly compound eyes are composed of numerous ommatidia. The basic groundplan of butterfly eyes, encountered in Nymphalidae, exists of three types of randomly arranged ommatidia, with either 1 UV and 1 blue receptor, or 2 UV, or 2 blue receptors. All ommatidia contain 9 green receptors. In Pieridae, the set of short-wavelength receptors is expanded, and the green receptors have greatly diversified by spectrally selective filters. This has occurred even more elaborately in Papilionidae