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Zoologists challenge longstanding theory that 'eyespot' mimic the eyes of predators' enemies

Circular markings on creatures such as butterflies are effective against predators because they are conspicuous features, not because they mimic the eyes of the predators' own enemies, according to research published today in the journal, *Behavioral Ecology*¹. Zoologists based at the University of Cambridge challenge the 150-year-old theory about why these markings are effective against predators.

Many animals possess protective markings to avoid predation, including patterns to reduce the risk of detection (camouflage), to indicate that the animal is toxic or inedible ('warning colours'), or to mimic another animal or object ('mimicry' and 'masquerade'). In addition, many creatures such as butterflies, moths, and fish possess two or more pairs of circular markings, often referred to as 'eyespot'. Many eyespots are effective in startling or intimidating predators, and can help to prevent or stop an attack. For the past 150 years it has been assumed that this is because they mimic the eyes of the predator's own enemies.

However, recent work by University of Cambridge zoologists, Martin Stevens, Chloe Hardman, and Claire Stubbins, indicates that this widely-held hypothesis has no experimental support.

Stevens, Hardman, and Stubbins tested the response of wild avian predators to artificial moths, created from waterproof paper. Specific patterns, such as intimidating eyespots of different shapes, sizes and number, and with different levels of eye mimicry, were printed on to the paper using a high quality printer. These 'moths' were then pinned to trees of various species at a height of one to three metres in the mixed deciduous Madingley Woods in Cambridgeshire, UK. Attached to each of the artificial moths was an edible mealworm as a temptation for woodland birds such as the blue tits, great tits, blackbirds, and house sparrows.

The zoologists discovered that artificial moths with circular markings survived no better than those with other conspicuous features and that the features of eyespots which most encouraged predators to avoid them are large size, a high number of spots, and conspicuousness in general.

As Dr Stevens explains, 'the birds were equally likely to avoid artificial moths with markings such as bars and squares as they were to avoid those with two eye-like markings. This leads us to conclude that eyespots work because they are highly conspicuous features, not because they mimic the eyes of the predators' own enemies. This suggests that circular markings on many real animals need not necessarily, as most accounts claim, mimic the eyes of other animals.'

(ends)

¹ **Conspicuousness, not eye mimicry, makes "eyespot" effective antipredator signals (Martin Stevens, Chloe J. Hardman, and Claire L. Stubbins) *Behavioral Ecology* doi:10.1093/beheco/arm162**

Notes to editors

A PDF of the research paper can be found from 10am on Thursday 21st February at:
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Behavioral Ecology

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