

Bright warning colors on poison dart frogs also act as camouflage

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'The bright colours of the Dyeing Poison Dart Frog (*Dendrobates tinctorius*) act as both a salient warning and camouflage.' Credit: James B. Barnett

Poison dart frogs are well known for their deadly toxins and bright colours, which have made them a classic example of warning coloration.

The Dyeing Dart Frog, for example, is highly toxic and warns its predators with a bright yellow-and-black pattern.

However, new research led by scientists at the University of Bristol has revealed that the colour pattern does more than simply signal "danger". Counterintuitively, it also works as [camouflage](#).

Lead author, Jim Barnett completed this research, published today in the journal *Proceedings of the National Academy of Sciences*, while studying for a Ph.D. at Bristol. He is now based at McGill University in Canada.

He said: "Effective as [warning](#) signals are, it's not necessarily the best strategy to be maximally conspicuous.

"Certain predators have evolved tolerance of toxins that would be deadly for humans, and some individual predators may have not encountered the warning signal prey before (a dangerous mistake for the [predator](#), but also for the frog).

"So, colour patterns that could be distinctive close-up, but work as camouflage from a distance, would provide a clear advantage."

Combining fieldwork in the jungles of French Guiana, computational modelling, and laboratory visual search experiments, Barnett and colleagues from the University of Bristol's School of Biological Sciences and the School of Experimental Psychology investigated how the Dyeing Dart Frog uses its colours to balance the benefits of effective warning signals with the advantages of concealment.

They found that, despite being highly conspicuous at close range, the particular colours and their arrangement allow the pattern to blend together to form background-matching camouflage when viewed from a distance.

The [frog's pattern](#), therefore, allows it to get the best of both worlds: high fidelity camouflage until a predator discovers it, at which point its bright, highly salient, warning signal becomes clear.

Co-author Professor Innes Cuthill from the University of Bristol added: "How many other animals use 'distance-dependent coloration' to balance competing evolutionary pressures is yet to be explored.

"Being able to signal when close to a would-be mate, whilst remaining inconspicuous to more distant predators would seem beneficial. So too for human applications such as [military camouflage](#), where recognition by allies is as important as concealment from foes. Also, signage that only need be clear at the distance where the information is needed, but might be distracting if detected earlier."

More information: James B. Barnett et al., "Distance-dependent defensive coloration in the poison frog *Dendrobates tinctorius*, Dendrobatidae," *PNAS* (2018).

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