

# Traits produced by melanin may signal the bearer's capacity to combat free radicals

October 3 2008

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Some animal species have developed conspicuous traits produced by melanin pigments (for instance, dark manes in lions, black stripes in some birds and fishes). These traits are used as signals during contests for resources and/or contribute to increase the mating opportunities.

However, the efficiency of these traits as signals depends on the fact that they transmit honest information about the quality of the bearer. This would be only assured by the fact that producing or maintaining the signal inevitably implies a cost. Thus, only those individuals able to afford the cost would also be able to conveniently express the signal.

Signals produced by melanin pigments have challenged our understanding because they are apparently cost-free and strongly controlled by the genotype. Melanin pigments are not as limited in production as carotenoids, yellow-red pigments common in vertebrates and only obtained from certain food items. In fact, melanin is constructed from amino acids present in proteins of the organism. However, recent experimental studies have become to disentangle the cost at the basis of melanin-based signals.

A recent article by Ismael Galván at the Museo Nacional de Ciencias Naturales (CSIC) in Madrid and Carlos Alonso-Alvarez at IREC-CSIC, Spain, published in the online, open-access journal *PLoS ONE* proposes a novel hypothesis suggesting that these traits could indicate the ability of the bearer in fighting free radicals and oxidative damage. On the basis of medical bibliography, the researchers realized that tissue melanization is

constrained in the presence of high enough levels of a key intracellular antioxidant named glutathione, which is considered one of the most powerful antioxidants present in virtually all animal cells.

The scientists hypothesized that low levels of this substance are also required to express melanin-based signals present in many animals. This implies that individuals able to express these signals should be also able to fight off an oxidative challenge, as a consequence of the low levels of the cited antioxidant. Only those animals with alternative antioxidant resources would be able to afford the cost of signaling. By chemically inhibiting the production of glutathione at the red blood cells, authors were able to significantly increase the size of a black stripe present in the feathers of the breast of great tits (a common garden bird). This stripe is a conspicuous trait playing a significant role during combats for territory, food or mates.

Furthermore, the reduction of glutathione levels also induced a mobilization of other antioxidant molecules to the blood plasma, supporting the cost, such as hypothesized by Alonso-Alvarez and colleagues.

Citation: Galván I, Alonso-Alvarez C (2008) An Intracellular Antioxidant Determines the Expression of a Melanin-Based Signal in a Bird. PLoS ONE 3(10): e3335. doi:10.1371/journal.pone.0003335  
[dx.plos.org/10.1371/journal.pone.0003335](https://doi.org/10.1371/journal.pone.0003335)

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Citation: Traits produced by melanin may signal the bearer's capacity to combat free radicals (2008, October 3) retrieved 20 April 2024 from <https://phys.org/news/2008-10-traits-melanin-bearer-capacity-combat.html>

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