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Convergent evolution of ultra-black butterfly scales

Understanding animal coloration is important for investigating sexual selection, speciation, and animal signaling. Despite a growing number of papers investigating structural colors, the role of nanostructures in creating black color patches has largely been ignored. Recently, it has been shown that certain animals have evolved micro- or nano-structures responsible for creating matte-black surfaces with reflectances approaching the darkest synthetic materials. It has been shown that certain papilionid butterflies reflect as little as 0.2% of incident light, and this phenomenon is mediated by a honeycomb scale structure with melanin bound to the cuticle. It is unknown, however, if other ultra-black butterflies use this mechanism and whether we can derive general principles about the design of ultra-black materials from butterfly scales. We examined butterflies from four subfamilies and demonstrate that ultra-black color can be achieved through various scale geometries from honeycombs to rectangular holes. Using scanning electron microscopy, we found considerable interspecific variation in the geometry of the holes that does not mirror differences in reflectance. Furthermore, we verified with finite-difference time-domain modeling that the two structural features found consistently in ultra-black scales – steep ridges and expanded trabeculae – each reduce reflectance by up to 16-fold compared to scales lacking these features. Our results demonstrate that butterflies have convergently evolved ultra-black scales by creating a material with high internal surface area that minimizes surface reflection and increases the opportunity for absorption. We hypothesize that butterflies use these ultra-black wing patches to increase the perceived brightness of color signals for use in intra- and interspecific signals

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Does lifetime methylmercury exposure impact telomere length in various organs within the zebra finch?

Methylmercury (MeHg) is a highly toxic global pollutant that affects human, wildlife, and ecosystem health. This heavy metal compound can successfully cross the blood brain barrier and is capable of inducing oxidative stress in the formation of free radicals. Organs such as the liver and kidney, which play large roles in the excretory system, may be overwhelmed by the cellular damage caused by exposure to MeHg due to their functional role. Further understanding of how MeHg exposure alters organ performance at a cellular level is critical to understanding physiological effects this toxin can have on both humans and wildlife impacted by environmental contamination. Telomere length is a recently popularized biomarker of biological aging and cellular damage, influenced by both genetics and environment. To assess the impact of MeHg on eukaryotic organisms, we studied how lifetime exposure to dietary MeHg impacts telomere length in various tissues of the zebra finch (*Taeniopygia guttata*) at four time points after hatching from eggs. Using qPCR, we measured relative telomere lengths of brain, liver, kidney, heart, and red blood cells. We predicted that telomere length would decrease with the age of birds, and individuals exposed to an environmentally relevant level of dietary MeHg would have reduced telomere lengths compared to controls. Although blood telomere length clearly declined with age as predicted, we found that mercury-exposed birds had consistently longer telomere lengths in virtually all tissues and time points relative to controls. This latter result suggests the potential selection for longer telomeres within embryos (before egg hatching) and/or disruption of the telomerase pathway by MeHg.

127-4 DAVIS-BERG, EC*; WILSON, BA; ARNOLD, C; ALMARIO-KOPP, D; Columbia College Chicago, Chicago, IL, Liberty Public Schools, Liberty, KS, Prairie State College, Chicago Heights, IL; *edavisberg@colum.edu*

Molluscs of Anderson County Prairies, a native tallgrass prairie in Eastern Kansas

Tallgrass prairies are plant and animal communities which once covered much of the United States. Anderson County Prairies (1450 acres) are located near Welda, KS; have very deep soils and higher rainfall than other prairies found further west in the state. The goal for this preserve is to maintain and enhance native biodiversity within an imperiled tallgrass prairie ecosystem. It has populations of the threatened plant, Mead's Milkweed and is owned by the Nature Conservancy. Here we present results of our periodic surveys since 2004 at Anderson County Prairies. These preserves consist of native tallgrass prairie with some plots which have been and are currently used for cattle pasture. We have found differences in gastropod diversity by land use with higher counts and different species at the non-pastured versus the pastured land. We combined soil analyses with the gastropod data to determine the source of these patterns.

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The role of understanding the eel's morphology in stopping its decline

The European eel (*Anguilla anguilla*) is a critically endangered species, whose recruitment stocks have declined to nearly 1% compared to the late 70's. An amalgam of factors are responsible for this, amongst them climate change, migration barriers and habitat loss, pollution, non-native parasites and overfishing. While most studies related to eel conservation focus on these aspects, little attention is given to the eel's morphology in function of management measures. Worryingly, however, less than 50% of the currently installed management plans reach their goals, strongly indicating that more information is needed about the eel's morphology, ecology and behavior. In a series of studies, we evaluated how the eel's morphology is related to several ecological and behavioral factors, which provides new insights to install proper management plans. First, we showed that the eel's head shape is related to diet, with broader-headed eels being on a higher trophic level than narrow-headed eels. This difference in trophic position subsequently results in pollutant uptake variability: The higher an eel's position in the food chain, the more pollutants it will accumulate. This link between morphology, ecology and pollution highlights that pollution can affect eels differently. In another study, we evaluated whether broad- and narrow-headed eels differ in migration behavior. Finally, we evaluated burrowing behavior of the European eel and substrate preference. This latter study showed that eels may also suffer from hypoxia and sediment pollution and provides novel insights in how anthropogenic actions such as dredging and extraction of sand and gravel can impact the eel's behavior. The link between an eel's morphology, behavior and ecology therefore plays a pivotal role in maintaining the European eel population.