Which came first: Primates' ability to see colorful food or see colorful sex?

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The adaptive significance of the unique ability in many primates to distinguish red hues from green ones (i.e., trichromatic color vision) has always enticed debate among evolutionary biologists. The conventional theory is that primates evolved trichromatic color vision to assist them in foraging, specifically by allowing them to detect red/orange food items from green leaf backgrounds.

However, the results from several empirical studies have called into question the extent to which trichromacy functions in foraging and if it provides a performance advantage over dichromatic primates (who lack red-green color vision). Other studies have suggested that trichromacy evolved in primates so that they could use physical traits like red skin in socio-sexual communication, such as a male providing information to a female about his mate quality.

Now, researchers at Ohio University (André Fernandez, a PhD student and his mentor, Dr. Molly R. Morris) have found that trichromatic color vision was present before it functioned in communication, suggesting that the ability to discriminate red from green was a pre-existing sensory bias that then drove the evolution of red-orange pelage and skin, possibly through sexual selection.

The study used comparative methods which incorporated the evolutionary relationships among 203 primate species to determine the sequential evolution of color vision, skin color, fur color, and mating systems. In addition the authors examined possible correlated evolution

among these four traits.

“The first thing our analysis revealed was that skin and pelage color was not responsible for the initial evolution of trichromacy in primates as some studies have suggested, because red-orange traits appeared after trichromatic color vision had already evolved,” states André Fernandez, lead author on the study.

However, once trichromatic color vision in primates did evolve, species that possessed it were more likely than not to evolve red-orange pelage and skin (which are more easily detected with trichromacy) as well as gregarious mating systems that would help in the visual comparison of potential mates.

Furthermore, the correlated evolution of red-orange pelage and skin with visual capacity was even more pronounced in species that possessed both gregariousness mating systems and trichromacy, establishing the importance of social living in the evolution of red-orange physical characteristics. Taken as a whole, this study provides the first statistical support for the hypothesis that a pre-existing bias promoted the evolution of red traits in primates through sexual selection and explains why current foraging performance does not always correlate with the ability to discriminate red.

Trichromacy in primates evolved in a context other than socio-sexual communication, and this context may have been foraging performance. However, once trichromacy evolved, it was recruited for other purposes: modern primates that possess this adaptation are more likely to be highly social and have red-orange traits used in communication and mate choice decisions

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