



ScienceWatch - If You've Got It, Flaunt It!

The most casual naturalist can readily see that in the bird world the colorful displays and melodious songs performed by males are their way of boasting to females, "I am the greatest." But when a female searches for a healthy male with good genes to pass on to her offspring, exactly what is she looking for? More importantly, are the sexual advertisements displayed by males a true reflection of their underlying robustness or can unhealthy males produce the same signals as healthy ones? Intuitively we would guess that the male sexual display honestly reflects his health status, and two studies in the April 4, 2003 issue of *Science* say we are right.

In one study a team headed by Jonathon Blount, an evolutionary biologist at the University of Glasgow, U.K., manipulated the levels of carotenoid pigments in the diets of zebra finches (*Taeniopygia guttata*) native to Australian grasslands. Carotenoids are red and yellow pigments made by plants, the best example being carrots. They also form the basis for coloration of body parts used in male sexual displays.

In zebra finch males the carotenoids yield a bright red bill and orange cheek patches. In contrast, females lack cheek patches and have orange bills. Over the last decade scientists have also found that carotenoids function as antioxidants and stimulators (by an unknown mechanism) of the immune system. These findings have prompted researchers to theorize that extraordinary sexual displays indicate how well a male copes with diseases and parasites. A diseased male, the theory says, will have a stressed and weakened immune system that uses up the carotenoids, making the display colors dim. Conversely, males in better health should require fewer pigments for immune function, making the carotenoids available for more vivid ornamental displays.



To test the theory, Blount *et al.*, controlled the level of carotenoids in the diets of ten pairs of zebra finch brothers. One of each pair was fed carotenoid-supplemented water. By the fourth week birds with supplemented water had significantly redder bills than the unsupplemented control birds and were more preferred by females, who spent more time perched next to the supplemented males than the controls. Next the team showed that the carotenoid supplements boosted the immune system. They did this by injecting both groups of males with a plant protein known to stimulate the immune system. The supplemented males exhibited greater swelling at the injection site, indicating a stronger response by the immune system. They also showed more carotenoids circulating in their blood. Consequently, when female zebra finches select males with redder bills they are getting a mate that has a strong immune system to ward off disease, enabling him to be a good provider.

The second report by a team led by evolutionary biologist Bruno Faivre at the University of Burgundy in Dijon, France, looked at the relationship between bill color and immune response in male European blackbirds (*Turdus merula*) - yes the ones in the Beatles song.



Male blackbirds exhibit a black plumage with a yellow to orange bill, while females are brown with a brown bill. In an earlier report Faivre *et al.*, showed that males with orange bills are more successful at gaining healthy females and generating more offspring. In this report they measured the level of carotenoids in the bills of 47 males and then immunized 32 of them by injection with sheep red blood cells. The foreign cells act like an infection, stimulating the immune system to mount a response. Seven days later the immunized birds showed a significant drop in bill carotenoids and in the intensity of bill color.

Thus, when a male blackbird gets an infection, the carotenoids needed by the immune system to fight it off are released from the bill, changing the bill to yellow in the process. Consequently, when blackbird females choose males with orange bills and not yellow, they are getting an infection-free mate.

In addition to the two studies just described, earlier work by other authors demonstrated a preference by female barn swallows (*Hirundo rustica*) for males with long tails. These long-tailed males also exhibited a strong immune response when challenged by sheep red blood cells and were more likely to survive to the next breeding season.

Apparently, when males flaunt certain physical characteristics during sexual display, they are honestly advertising their state of health and females are wise to pay attention to these signals. Gold's gym here I come!



Saul Scheinbach

Footnote - An 8-year old girl learning about birds discovered that the bills of male starlings turn bright yellow during the mating season. During one of her walks observing starlings she spotted one poor fellow whose peak was still a dingy gray. “That one’s beak isn’t very yellow,” she said. After a pause, she added, “He must already be married.”

[From the NYTimes; May 12, 2003.]