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Fine feathers: Why red birds look so fit and sexy

By Rachel Feltman May 20

For birds like the cardinal, red coloring is extremely important. The brighter the hue on a male's feathers, the more likely a female is to take notice. Now two independent teams of scientists believe they've found the gene that allows birds to produce shades of red. And the identity of the gene might actually help explain why the color evolved in the first place.

"To produce red feathers, birds convert yellow dietary pigments known as carotenoids into red pigments and then deposit them in the feathers," Miguel Carneiro of the University of Porto in Portugal, who co-led one of the two studies published Thursday in Current Biology, said in a statement.

"It was known that some birds have the ability to synthesize red ketocarotenoids from the yellow carotenoids that they obtain in their diet, but the gene or enzyme involved, and its anatomical location, have been obscure," added Nick Mundy of Cambridge University, an author on the second study.

Carneiro's group chose to study a trio of birds that have an intriguing, intersecting history: The red siskin is, of course, red, and comes by its color honestly — without human intervention. Canaries, as you probably know, are generally yellow (though they didn't start out that way). Enter the third star of the experiment, the "red-factor canary," which is a canary-siskin hybrid bred to have bright red feathers.

Because of the intersection of these birds' ancestry, scientists can use their genetic code to track down the genes that might specifically relate to redness.

In analyzing the genomes of the red and yellow birds, the team found over 15,000 genetic variations that could be associated with red coloring. But one gene in particular, CYP2J19, really popped: It's active in the skin and liver, where the elusive enzymes responsible for producing red ketocarotenoids are thought to do their business. And it's 1,000 times more active in red birds than the yellow ones, the Atlantic reports. Lots of birds have this gene, but they only seem to use the proteins it controls in their eyes, where it produces red to act as a sort of filter and improve vision.

Mundy's team tracked that very same gene down in red-beaked finches and confirmed that mutants with yellow beaks lack the gene.

"The fact that we identified the same gene in two deeply divergent species suggests that this is likely to be very general in the bird world, and many species will use the same mechanism to produce red pigments," Carneiro told the BBC.

So when a mutation allows this gene to produce its enzymes within plumage or beaks, a yellow bird (or beak) turns red. Careful breeding can keep that trait going until it becomes the norm.

That explains how the red-factor canary came to be: Humans wanted a red canary, gosh darn it, and they made one. But why would this process occur in nature, as it has for so many other birds with red hues in their feathers and beaks?

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“In many bird species, the redder the male, the more successful it is at finding mates,” Joseph Corbo of Washington University, co-senior author of the canary study, said in a statement. But "nobody knows for sure why red color is associated with reproductive success. We thought that if we could figure out how they produced that red color, that would help us understand the advantage to being red.”

And luckily, the gene CYP2J19 offers an unusually elegant solution to this problem. It's part of a group of genes associated with detoxification. It could be that red feathers and beaks serve as bright beacons of health. If the gene is working to produce the most vibrant of red feathers, then it's also doing a ship-shape job of helping the bird metabolize toxins.

Corbo hopes that a rare mutant cardinal — one with yellow feathers — can help further confirm the gene's role.

“Every once in a while, a yellow cardinal is spotted in the wild,” he said. “We hypothesize that this is a rare mutant that is unable to produce the red carotenoid. If we find that yellow cardinals have a mutation in CYP2J19 or its regulatory elements, that would provide even more evidence that this gene is important in red coloration. We’ve got a tiny piece of tissue from a museum specimen, and we’re looking for a mutation now.”

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