

Cornell Lab of Ornithology

From Fossils, Evidence of the Color of Early Feathers

One Monday in February, Richard Prum was waiting for an eggplant pizza and eagerly describing a dinosaur called *Anchiornis huxleyi*. Prum and a team of colleagues had just deciphered the colors of the animal's feathers, and the finding held insights about why feathers might ever have evolved in the first place.

"It was a terrible-looking fossil, but it was the best we could get—basically Jurassic roadkill," he said. Its four limbs were splayed awkwardly across the rock, head shattered, tail missing. But the 150-million-year-old Chinese limestone surrounding it was fine as parchment, and the dinosaur's feathers were etched as clearly as a tombstone rubbing.

Prum, a Yale evolutionary biologist and birder, was visiting the Cornell Lab as part of our Monday-Night Seminar series. His team's description of *Anchiornis's* color scheme, right down to the rusty spangles on its cheeks, had come out on *Science* magazine's website the week before.


Looking at the elegant painting Prum commissioned for the article is like flipping backward through an ancient field guide. Way back, before dodos, mammoths, even *T. rex*, sits this striking little roadrunner-shaped dinosaur. The sooty-black creature had dazzling black-and-white fringes on its legs, as if it wore chaps, and a bright chestnut crest worthy of a Red-breasted Merganser. It looked remarkably like a bird, but it wasn't. It had a snout instead of a bill, a sharp crescent for a thumb claw, and decidedly non-aerodynamic feathers.

Prevailing ideas hold that feathers probably evolved in service of one of


their two main present-day duties, flight and insulation. But this flightless dinosaur's bright markings highlight another key role, Prum said. The bold colors of early feathers might have helped with communication and in visual displays, he suggested.

The discovery began with a cloud of


ink trapped around a fossilized squid. Yale graduate student Jakob Vinther realized that under an electron microscope, impressions of pigment from the squid ink were still visible in the fossil. At 30,000x magnification, they looked like fields of ellipses, some fat as jelly beans, others slender as a fountain



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pen. Paleontologists had noticed these before, but until Vinther saw them in ink (which is inky because it is full of pigment), the prevailing explanation was that they were bacteria that had fed on the rotting carcass.

Present-day birds use these same pigment packets, called melanosomes, in their earth-toned feathers. So Vinther, Prum, and colleagues guessed they could learn something of Anchiornis's color by comparing its melanosomes with those of living birds. They fired up the electron microscope and analyzed feathers of 30 birds, from Acorn Woodpeckers to Zebra Finches.

They learned that the different melanosome shapes corresponded to different colors. Jelly-bean-like melanosomes yield brown to red-brown; fountain-pen shapes indicate gray to black. The team

developed an analysis that predicted Anchiornis's melanosome colors with 90 percent confidence. They had a sampler palette for dinosaur feathers.

"So right now we know of five dinosaur colors," Prum said, counting them off on his fingers. "Black, gray, brown, red-brown, and white." For a lifelong birder, it's a thrill Prum said he never expected. "I got to write the first page in the field guide of the dinosaurs," he said. "And for a kid who grew up as a birder with the Chan Robbins Golden Guide, that's about as transformative an experience as you can have."

~Hugh Powell



Spix's Macaw chicks at Al Wabra Wildlife Preservation. The 36-year-old father of two of the chicks is one of only a few remaining wild founders.

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macaw breeding results for 2010. In total we successfully bred six Spix's Macaws (*Cyanopsitta spixii*) (one male, five females) and two Lear's Macaws (*Anodorhynchus leari*) (two females).

Two of the Spix's Macaw offspring are the first in the international breeding program to be bred from a second generation parent (mother).

The breeding of these two offspring is important for another reason to; their 36-year-old father is one of only a few remaining wild founders and not only is he genetically important and the oldest Spix's Macaw to ever reproduce, he is also the oldest Spix's Macaw ever recorded!

With the addition of Al Wabra Wildlife Preservation's six offspring and one female bred by the Loro Parque Foundation earlier this

year, the studbook managed population now stands at 73 (29 males, 44 females), 56 (22 males, 34 females) of which are held at AWWP.



Lear's Macaw (*Anodorhynchus leari*) chicks at Al Wabra Wildlife Preservation.

Proposed Legislation in New Mexico

New Mexico Proposed



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Regulations of Non-Domestic Animals, Birds, and Fish Under Title 19 Natural Resources and Wildlife, Chapter 35 Captive Wildlife Uses, Part 7 Importation of Live Non-Domestic Animals, Birds and Fish.

UPDATE: The rules under the New Mexico captive wildlife law have been finalized. AFA took part in the development of the lists of avian species. As it stands there are four lists—List 1 is the species that do not require a “state import permit” to be brought into New Mexico, and List 4 does require a permit.

Through much coordination between AFA members and the AFA CITES Committee Chair, Rick Jordan, and input from the New Mexico

State Coordinator, Sandee Brennan, as well as several commercial AFA members and pet stores, most psittacines are listed on List 1 and do not require a permit.

However, any parrot species also listed under the U.S. Endangered Species Act is still listed on List 4 and will require state approval to be brought into the state. Be advised there are several common species on this list, including Scarlet-chested Parakeets, Turquoise Parakeets, Hooded Parakeets, Golden Conures, Cuban and Vinaceous Amazons and a few others.

Below is an excerpt of the official AFA position paper on the New Mexico import law.

“The American Federation of Aviculture (AFA) submits that there is insufficient scientific and/or commercial data to support the proposals that psittacine species, as well as the many species of birds that are commonly kept in captivity in New Mexico and throughout the United States (either as pets or as breeders), should be treated as non-domestic, or as dangerous, or as invasive, or as likely to cause harm to the economy, environment, protected wildlife, human health or safety in New Mexico...”

To read the complete document, please go to www.afabirds.org/legislation.shtml. The position paper is available for download as an Acrobat PDF.




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