What Color Were Dinosaurs?

by Mary Bates, art by Jeff Harter

When the first dinosaur fossils were discovered, scientists thought they looked like lizards. So they drew pictures of living dinosaurs as scaly and drab.

But a string of discoveries starting in the 1970s has changed all that. The first surprise was that many dinosaurs had feathers. Some had just simple bristles. Others were covered in complex plumes. And now, scientists may be able to tell what color those feathers were.

Stone Colors

In the 1980s, scientists began looking at fossil feathers with powerful microscopes. They saw tiny, sausage-shaped ridges inside. Most thought these were traces of bacteria that munched on the feather after the dinosaur died.

But in 2007, Jakob Vinther looked at the fossil feathers and saw something different. To him, the tiny blobs inside looked like melanosomes. Melanosomes are packets that hold melanin, the natural brownish pigment (color) found in hair, skin, and feathers.

Melanosomes are different shapes depending on what color they carry. In modern bird feathers, sausage-shaped melanosomes hold black and brown tones. Rounder melanosomes carry reddish-brown. The more melanosomes there are, the darker the color. Feathers with no melanosomes are white.

One fossil feather Vinther studied looked like it had once had stripes. Under the microscope, Vinther could see sausage shapes only in every other stripe. That's not a pattern you would expect from bacteria.

Vinther teamed up with bird expert Richard Prum. Together they looked at fossil feathers of *Anchiornis huxleyi*, a small feathered dinosaur that roamed China 155 million years ago.

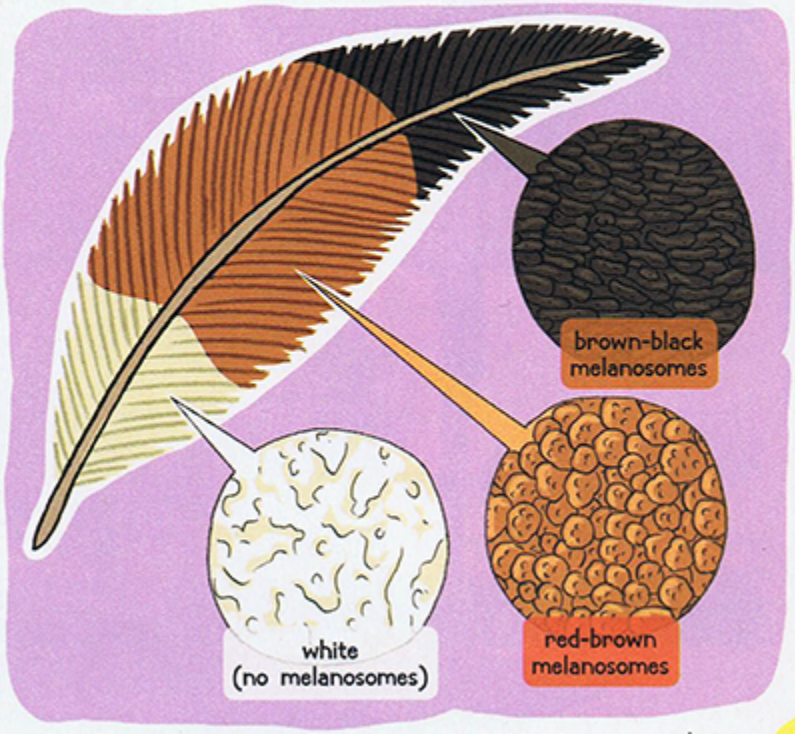
Melanosomes are tiny packets that hold melanins, the brownish pigments that color skin, hair, and feathers. Different shaped melanosomes hold different shades. White places don't have any. Melanosomes are tiny—100 times thinner than a hair.

The results were striking. Under the microscope, they could see bands of long and round melanosomes. There were more in some places, meaning darker color.

By tracing the patterns of the fossil melanosomes and comparing them to modern birds, they were able to map the colors of *Anchiornis*. It was not drab at all! Instead, it looked more like a woodpecker, with a dark gray body, banded wings, and a rusty red crest on its head.

And that wasn't all. In 2009, researchers found a fossil feather with melanosomes in neat stacks.

Anchiornis was a small feathered dinosaur with bold stripes.



Caihong juji likely had dark feathers and a shimmering rainbow ruff.

In modern birds, stacked melanosomes act like tiny prisms in the feathers. They scatter light to make rainbow colors like those on a hummingbird's throat. So some dinos also shimmered!

What Can We Learn from Colors?

Dinosaur colors aren't just interesting—they can also tell us a lot about how the animals lived.

Prum thinks that *Anchiornis* used its bold plumage to signal to other birds and attract mates—the same way modern birds use their flashy feathers. "This aspect of bird biology is also dinosaur biology," he says.

A dinosaur's colors can also be a clue to how it hunted. A crow-sized meat-eating dinosaur named *Microraptor* had wing feathers on both arms and legs. Scientists used to think that it hunted at night, because it had very large eyes. But its wings show iridescent color. And that would only have shown up in daylight. So maybe *Microraptor* wasn't a night bird after all.

And then there's *Sinosauropteryx*. This turkey-sized dinosaur lived in China about 125 million years ago. In addition to a tiger-striped tail, it sported a bandit mask, a light belly, and a dark back. This light/dark pattern is

Artists are redrawing their dinosaurs to match fossil pigments. This is *Microraptor*, black with an iridescent tail.

Microraptor's feathers may have looked like this modern blackbird.

Modern birds often display their colorful feathers while dancing to impress mates. Did *Sinosauropteryx* do the same?

often seen in birds that live in open meadows or grasslands. So maybe this dinosaur did too.

What about Pink?

Incredible as these discoveries are, some colors are still missing.

The bright pink and orange colors of birds like flamingos and orioles come from pigments in the foods they eat, not from melanin. These pigments don't leave traces in fossils. So we can't tell (yet!) if dinosaur feathers were red, pink, orange, or yellow.

But science is full of surprises. New technology may someday reveal more fossil colors. Vinther says, "it's a brave new world" when it comes to understanding how dinosaurs looked and behaved. "We know so much more today than we did just a few decades ago."

And their world turns out to be surprisingly fluffy and colorful.

Who Grew the First Feather?

Scientists don't know exactly how feathers evolved. But they think the first feathers were simple hollow quills that grew out of a dino's skin. Feathers are keratin, the same stuff that makes horns, hair, and reptile scales. These early bristles gradually evolved prongs, and finally grew into complex feathers.

The earliest feathers would not have been useful for flying. So what were they for? They were probably for decoration, and helped dinosaurs keep warm. Even simple feathers could be fluffed out to show off, warn rivals, and startle predators. Modern birds use their feathers in all these ways today.

Feathers evolved from simple bristles to complex shapes.