ScienceWatch – "This is Actual Science, Not 'Avatar.' " – R. Prum

"Essentially, wherever you look, you find it." – M. Benton

Scientists have long assumed that the drab dinosaur fossils they dig up were once colorful creatures. This has been especially true for certain theropods, those fast-running, feathered reptiles thought to be the ancestors of modern birds. In fact, one theory to explain the origin of feathers is that they originally arose not for flight, but to provide a colorful display for sexual selection during mating or to startle predators or prey. But until this year, apart from what existed in an artist's imagination, paleontologists could offer no evidence of colored dinosaurs. Now two research papers provide evidence that the feathers were boldly bedecked with color.

The first report by a Chinese and British team of scientists, published in the January 27, 2010 online issue of *Nature*, finds that a 125 million-year-old, turkey-sized theropod fossil, *Sinosauroptyrex*, had a tan and white-striped tail.

Fig. 1 Sinosauroptyrex with melanosomes (inset) 5,000x

Sinosauroptyrex was first discovered in China in 1996 with a downy fringe of hairlike filaments, "dino fuzz", along its neck and backbone. At that time proponents of the dinosaur-bird theory said the filaments were feather precursors and hailed them as supporting evidence that dinosaurs evolved into birds. Opponents countered they were merely part of a reptilian fringe of internal collagen fibers that looked feathery because it had frayed-see *ScienceWatch: Birds(?) of a Feather??* (January/February 1999) or at www.hras.org]. The Chinese/British team, headed by Fucheng Zhang, Institute of Paleontology and Paleoanthropology, Beijing, China, and Michael Benton, University of Bristol, Bristol, UK, has now laid this criticism to rest by showing that the filaments have the coloration typical of modern feathers.

They used scanning electron microscopy (SEM) to find melanosomes, pigment-bearing organelles 1,000 times smaller than a

human hair, crammed into the filaments. SEM can examine surface topography at very high magnifications of up to 500,000X. The team found two types of melanosomes, rod-shaped eumelanosomes, which produce black and shades of gray, and phaeomelanosomes, which are round and generate reddish-brown to yellow hues in the feathers of modern birds. Dark bands along the tail were "absolutely packed with phaeomelanosomes", according to Benton and it led the team to conclude that *Sinosauroptyrex* had a chestnut to reddish-brown striped tail and a rufous back (see Figure 1 and title cartoon).

The second report, published in the online version of *Science* on February 5, 2010, took the melanosome analysis one step further. This Chinese/American team, headed by Qunguo Li, Beijing Museum of Natural History, Beijing, China and Richard Prum, Yale University, New Haven, CT, examined a well-preserved, 150 million-year-old fossil of a chicken-sized theropod (*Anchiornis huxleyi*) with its crown and limbs covered in feathers.

The scientists sampled portions of feathers throughout the fossil. They then measured the dimensions of the melanosomes using SEM and noted the distribution and density of each morphological type. Next they used the skills of team member Matthew Sharkey, a University of Akron, OH biologist, who has studied melanosomes in living birds, and can make predictions of feather color from the types of melanosomes found in the feather. The plumage coloration pattern they generated for *Anchiornis* is a red-and-black crown with black-and-white limbs, reminiscent of a modern pileated woodpecker (see Figure 2). The startling color pattern exhibited by *Anchiornis* led Li *et al*. to conclude that a signaling function for early feathers may have been the reason why they first evolved.

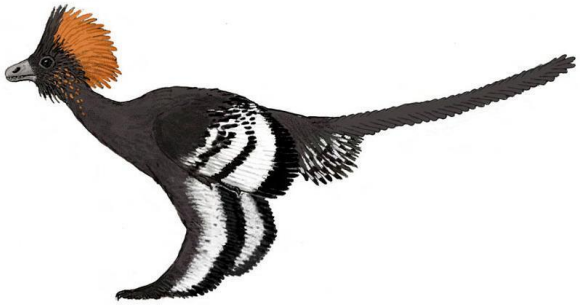

Fig. 2 Proposed color pattern for A. huxleyi

According to Prum, "a more likely function for both the crown and limb feathers of *Anchiornis* is communication or signaling. This could have been in lots of contexts, including sexual display, territoriality, etc. It could have been like modern redstarts, which use their bright wing and tail patches to scare up insects, which [the birds] then seize in flight."

In the world of early birds what may have mattered most is not who you are but how you look.

Saul Scheinbach