

No Longer Dragging Their Tails

Dinosaurs Rediscovered

By Michael J. Benton
 Thames & Hudson,
 320 pages, \$34.95

BY JOHN STEELE GORDON

THE MESOZOIC ERA, which began more than 250 million years ago, is probably as close as we will get to an alien living world—a world profoundly different from the biosphere in which humans evolved and now live. Dominating that world were, of course, the dinosaurs. These marvelous animals filled thousands of niches in nature and ranged in size from creatures smaller than a chicken to 70-ton monsters more than 120 feet from nose to tail tip, the largest beings to have ever walked the earth.

Until recent decades, we were able to perceive such a world only dimly, partly because we lacked the tools with which to explore it. Beyond what fossils had obviously verified, most of what we thought we knew about dinosaurs was really speculation, and, it turns out, much of it was wrong. In “Dinosaurs Rediscovered,” Michael J. Benton, a professor at the University of Bristol, takes us through what he calls a “scientific revolution” in his field of paleontology. It is a fascinating story, and Mr. Benton tells it both expertly and entertainingly.

It was the Victorians who first understood that the ancient earth was very different from the modern one—the word “dinosaur” was coined only in 1842. But they perceived the Mesozoic’s creatures as great lumbering beasts that went through life dragging their tails behind them

and finally died out from sheer stupidity, out-competed by mammals—an image that persisted, with some alteration, for more than a century.

Since about 1970, however, our understanding of dinosaurs has changed dramatically. New, rich fossils beds have been found in China, Argentina and North Africa, inaugurating a golden age of discovery and revealing animals of extraordinary range and diversity. There is the *Yi qi*, for instance, a small flying dinosaur whose fossil remains were found in China: It had both feathers and membranous wings, like a bat. In Morocco, fossils were found for the *Spinosaurus*, a creature about as big as a *T. rex*; but it was a semi-aquatic fish eater rather than a land animal. Such recent fossil discoveries, as well as older ones, have been subjected to new techniques of study—digital imaging, electron microscopes, CT scans—bringing dinosaurs to vivid life, at least in the human imagination.

Mr. Benton begins with the work of his own research group in 2010. Thanks to a refined understanding of biomechanics, it had become possible to estimate the shape of various dinosaurs. But what color were they? Dinosaurs had been traditionally depicted as gray or brown. But many living reptiles are brightly colored, so why shouldn’t dinosaurs be? And some dinosaurs had feathers like their avian descendants, again

suggesting a colorful presentation. Eventually a scanning electron microscope detected so-called melanosomes in the fossilized feathers of a recently discovered dinosaur named *Sinosauropteryx*. (It was only 3 feet long and would have made an excellent pet for the Flintstone family.) Melanosomes are specialized parts of the cells for hair and feathers; differently shaped melanosomes produce different colors. Mr. Benton and his co-researchers determined that the *Sinosauropteryx* was orange, with an orange-and-white striped tail.

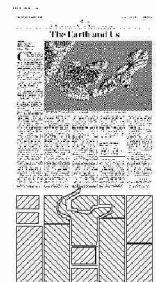
Well before advances in the understanding of dinosaur color,

other researchers—led by Robert Bakker, both a paleontologist and a gifted artist—had revised the image of dinosaurs as tail-dragging hulks. Basing his drawings on the latest scientific evidence, Mr. Bakker portrayed theropods as dynamic and active creatures, their long tails balancing their bodies on the pivot of their hips. The menacing, steely-eyed *Velociraptors* in “Jurassic Park” convey this basic body architecture (though the movie’s *Velociraptors* were in fact modeled on a different, larger dinosaur, the *Deinonychus*).

How hard could a *Tyrannosaurus rex* bite? When a piece of *Triceratops* bone was found with a deep gash in it, Mr. Benton tells us, scientists made a cast of the puncture and found that it matched the tip of a *T. rex* tooth. Then they made a model of the tooth (about the size and shape of a banana) and tested it on a rig, driving it into pieces of cow bone. They calculated that a force of 1.4 tons—a little less than the bite force of a great white shark—was needed to penetrate a *Triceratops* bone so deeply. Later studies indicated that a *T. rex* could bite with a force as high as 5.8 tons. “This is the strongest bite force ever demonstrated in any animal living or extinct,” Mr. Benton writes, adding that studies now allow us “to answer the classic dino-geek question: could *T. rex* have bitten a car in half? The answer is a resounding ‘yes.’”

What about the *T. rex* brain? We already knew from the sockets that a *T. rex* had large, forward-facing eyes and thus excellent depth-perception. From today’s scanning we can see the size and shape of its brain as well, without destroying the skull, and know that, because of a well-developed olfactory lobe, the *T. rex* had an excellent sense of smell. The beast might not have solved differential equations, but it was neurologically well-equipped for the world in which it lived.

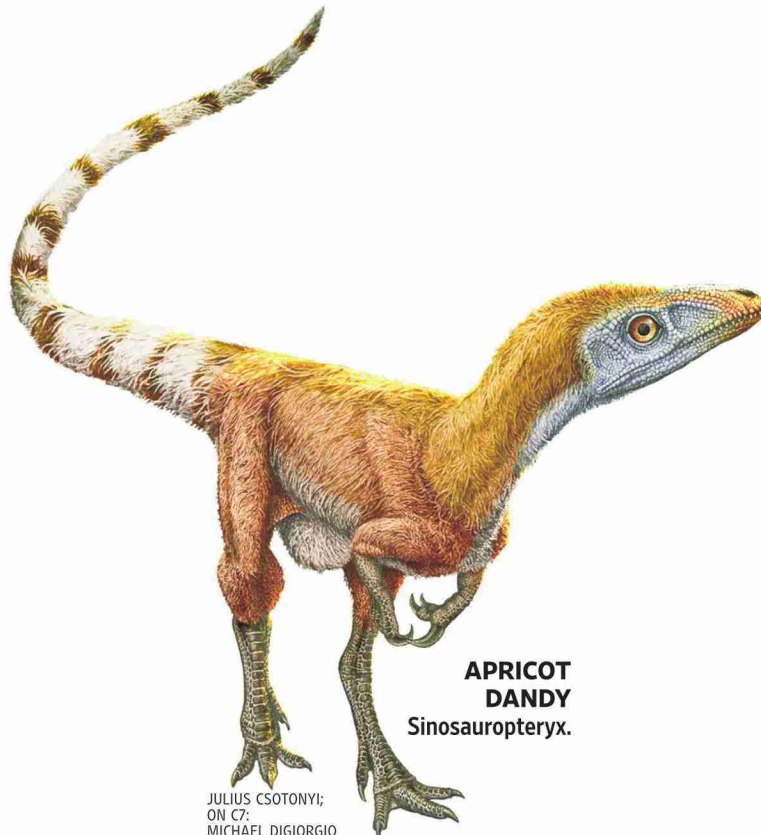
Mr. Benton reminds us that, in 1980, the Nobel-winning physicist Luis Alvarez, along with his son Walter, a geologist, argued that the world of the dinosaurs didn’t just peter out as the Victorians had thought but ended in an instant—



when an asteroid or comet slammed into the earth. (The place was later determined to be near what is now the Yucatán Peninsula in Mexico.) The global catastrophe that followed wiped out 75% of all the earth's species: The dinosaurs that had ruled the world for 150 million years were gone, and the lowly mammals, none larger than a rabbit in the Mesozoic, could take over. There is probably no grand life lesson to be learned from the fate of the dinosaurs, but Mr. Benton's deeply engaging book instructively shows us, yet again, how advances in technology have converted mere speculation into testable science.

Mr. Gordon is the author of "An Empire of Wealth: The Epic History of American Economic Power."

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