Age of the Cybersaur

THE DRY PLAINS OF SOUTH-eastern Alberta, Canada, can be tough on local ranchers and their cattle, but the highly eroded "badlands" are paradise to paleontologists like Philip Currie. The curator of dinosaurs at the Royal Tyrell Museum in nearby Drumheller, Currie spends his summers digging for fossils in the 15,000-acre Dinosaur Provincial Park, and this has been a particularly good season. "It's the year of the ankylosaur," he says with a grin. His team has already found five spiked skulls of the armored plant eaters this summer, more than he's turned up in the last 23 years combined.

Paleontology is still an outdoor science, but not all the big discoveries are made under the summer sun anymore. Currie made headlines last year when he teamed up with Microsoft chief of technology (and known dinosaur nut) Nathan Myhrvold to create a fully functional computer simulation of a hadrosaur tail. The long, tapering tails of these gargantuan duck-billed dinos, stiffened at the base by a mass of bony supports, have confused scientists for a generation. Currie and Myhrvold's simulations suggested that hadrosaurs could use their unusual tails like bullwhips, snapping them fast enough to create sonic booms. That astonishing finding has led to new theories about how the tails might have been used; one notion is that male hadrosaurs used their snapping tails to attract mates and ward off aggressors. It also signaled the arrival of a new field of study—cyberpaleontology.

Scientists in New Mexico have used computer technology to deduce what the call of *Parasaurolophus*, a "crested duckbill," might have sounded like some 75 million years ago. Several groups are working on T. rex simulations, trying to re-create its movement and even its eyesight. And a team in Japan is using "genetic algorithms"—computer-simulated evolution—to deduce how bizarre marine creatures from the Burgess Shale formation might have moved through the Cambrian seas some 530 million years ago. Meanwhile, Timothy Rowe at the University of Texas in Austin is creating exquisitely detailed three-dimensional images of rare fossils with powerful CT scanner. The images can be studied, manipulated and even convert-

What is the sound of one duckbill quacking?

ed into exact physical replicas using industrial rapid-prototyping systems. "One of the biggest problems in paleontology is access to specimens," says Rowe. "Once a rare fossil is scanned, it can be copied and distributed around the world."

Others are not content to limit reanimation to the computer screen. A group of scientists, engineers and an artist in Europe is bringing back *Iguanodon*, a horse-sized herbivore that could walk upright or on all fours (think Dino, from "The Flintstones"), as Robosaurus, a fully autonomous dinosaur robot. Designed to roam freely among museum crowds, the scaled-down Robosaurus is "about like a big dog with a long tail on," says University of Leeds biomechanics expert R. McNeill Alexander. "Kids really like it. So do grown-ups."

The Web-based journal Palaeontologia Electronica (www-odp.tamu.edu/paleo) is a natural home for cyberpaleontology. PE encourages authors to make use of the Web's digital capabilities, including computer simulations, interactive graphics and bright, three-dimensional images. PE is a professional research journal, but the clearly worded and illustrated articles are a far cry from the stilted prose and dull illustrations of most academic journals.

"We're hoping to expand paleo's horizons beyond the printed page," says Caltech paleontologist Whitey Hagadorn, one of the "long-haired, computer-savvy heretics" who started PE. "Our grad students in 20 years are going to wonder how we ever managed to look at fossils in 2-D and black and white." The journal, like the technology, is still evolving, but PE has already exceeded the circulation of all other paleontology journals. "Issue No. 2 blows issue No. 1 out of the water," Hagadorn enthuses. "Who knows what comes next?"

In years past, says Hagadorn, paleontologists have sometimes had to follow a "find it, describe it, put it in a drawer and let it get dusty" approach to their science. "We've been looking for answers for a lot of things," agrees the Tyrell's Currie. "With computers, answering some of those questions is becoming possible." That's not to say that paleontologists will be discarding their pickup trucks and rock hammers any time soon. Despite the promise of cyberpaleontology, says Hagadorn, "the truth is still in the rocks."

THOMAS HAYDEN

The Y2K Watch

A recent survey shows that the government still lags far behind other economic sectors in Y2K readiness. Each industry received points on a scale from 1 to 100.

RANK AND SECTOR	POINTS
1 Software	88
2 Financial services	87
3 Computers	85
4 Manufacturing; telecom	84
5 Aerospace	83
6 Oil and gas	82.5
7 Pharmaceutical	82
8 Distribution	81
9 Transportation; utilities	80.5
10 Health	80
11 Government	67

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