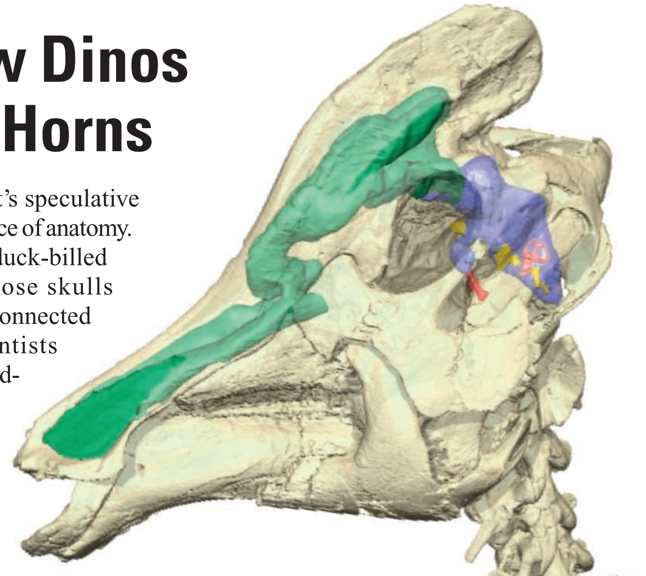
Skulls Show Dinos Blew Their Horns

Nothing gets a paleontologist's speculative juices flowing like a strange piece of anatomy. Case in point: lambeosaurs, duck-billed dinosaurs (hadrosaurs) whose skulls sported hollow, bony crests connected to the animals' noses. Scientists have argued that the weird headgear was good for fighting, snorkeling, smelling, cooling the brain, or signaling to other lambeosaurs with loud, resonant honks.

At the meeting, a group presented the most sophisticated evidence yet that the nasal passages within the crests were indeed used for vocalizing, not smelling. Computed tomography scans of lambeosaur skulls revealed that the brains weren't geared toward olfaction but that the inner ears were attuned to the frequencies the crests most likely produced. "Honking still survives" as a hypothesis, says David Weishampel of Johns Hopkins University in Baltimore, Maryland, who studied vocalization in the lambeosaur *Parasaurolophus* in the early 1980s.

At 10 meters long and weighing in at some 3 metric tons, lambeosaurs would have been some of the larger animals in the swampy floodplains of western North America, Asia, and Europe toward the end of the dinosaur era. They roamed around, mostly on their hind legs, grabbing vegetation with their toothless bills, then grinding it to a pulp with hundreds of small teeth in the back of their mouths. Fossil trackways suggest that flat-headed hadrosaurs lived in herds, and lambeosaurs may have, too.

Some early ideas about lambeosaur crests proved short-lived. The crests are too thin and brittle to have served as effective weapons, and the physics of breathing underwater through them turned out to be unworkable. Among the more plausible theories, vocalizing was first proposed in 1931 by a Swedish scientist who likened lambeosaurs to trumpeter swans. In the 1960s, paleontologist John Ostrom floated the ideas that the long, looping chambers inside the crests could have functioned as air-cooled radiators or heightened the animals' sense of smell. James Hopson of the University of Chicago in Illinois suggested in 1975 that the crest evolved its large size for visual display to attract mates.



Sound of sinus. *Corythosaurus*'s inner ear (red) could detect honks from the nose (green).

David Evans of the Royal Ontario Museum in Toronto, Canada, studied the olfactory system of lambeosaurs and the nerves associated with it, looking at impressions of these nerve pathways that remain in skull bones. His findings, published in *Paleobiology* in January 2006, suggested that only a small part of the nasal cavity within the crest was used for smelling. But no one had actually looked at the entire brain of a lambeosaur. Working with Lawrence Witmer of Ohio University in Athens and others, Evans used computed tomography to scan the skulls of four species of lambeosaurids that lived about 75 million years ago.

The olfactory region turned out to make up less than 2% of the lambeosaurs' brains. In contrast, a crestless hadrosaur called *Edmontosaurus* had at least double that, whereas the predatory dinosaur *Tarbosaurus* devoted 9% of its brain to olfaction. "When you put it all together, the smell hypothesis can be rejected," Evans said.

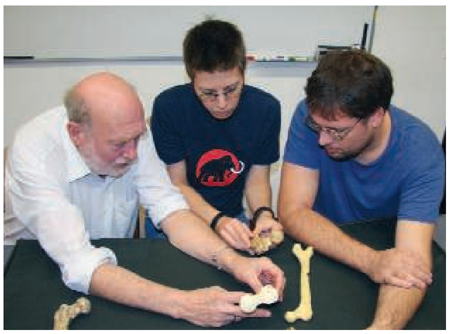
Still, the crest does seem to be important. The elaborate nasal ductwork of the lambeosaurs points to a "strong selective pressure" for evolutionary adaptation, the team concludes. The inner ear, as revealed by the scans, suggests what advantage the odd organs might have offered. The clue is part of the cochlea called the basilar papilla. In living birds, studies have shown that its length correlates with the range of frequencies an animal can best hear. If the same relationship held in lambeosaurs, Evans and colleagues conclude, their optimal frequency in adults was 400 hertz, about the mid-range of a modern cornet. That's close to the frequencies an acoustic computer model has generated from the crest of *Parasaurolophus*. Hadrosaurs could have used their calls to attract mates, help keep the herd together, or warn one another of approaching predators, the researchers say. Other evidence from the skull suggests that hadrosaurs might have been particularly social, smart animals: Their cerebral hemispheres make up about 43% of the entire brain—more than in any group of dinosaurs except the small birdlike dromeosaurs, thought to be the brightest, most behaviorally complex ancient dinosaurs. The findings are in press at *The Anatomical Record*.

–ERIK STOKSTAD

Two Legs Good

Our famed ancestor "Lucy" walked upright in the grasslands of Ethiopia 3.2 million years ago. But what of *her* ancestors? Researchers have glimpsed only bits and pieces of even older hominins, the group that includes humans and our ancestors. At the meeting, Bence Viola of the University of Vienna presented a single bone, the thighbone of an ancient australopithecine from Galili, Ethiopia, that may add an interesting piece to the puzzle of how Lucy's two-legged gait evolved. "It's a window into a time when key evolutionary changes are happening—it's exactly what you'd want," says J. Michael Plavcan of the University of Arkansas, Fayetteville, who was not involved in the work.

Although the femur was broken off at its lower end, its size suggests an owner slightly



Making strides. Horst Seidler (*left*) and Bence Viola (*right*) help study an early hominin thighbone.

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