PALEONTOLOGY

Dinosaur Nostrils Get A Hole New Look

When a snarling *Tyrannosaurus rex* fills the screen at your local multiplex this summer, here's a tip for remembering that the beast's not real: The nostrils are all wrong. You can even feel smug, since most paleontologists would miss the error.

Dinosaur artists have always placed the fleshy nostril relatively high and back from the tip of the snout. But Lawrence Witmer of Ohio University College of Osteopathic Medicine in Athens argues on page 850 that the sniffers ought to be farther forward and closer to the mouth. "It may appear dramatic and bizarre, but from a scientific point of view, it's a much more conservative hypothesis," Witmer says. "It basically says that dinosaurs are like almost all other animals today."

Witmer ought to know. He's been studying animal noses of all kinds for several years, as part of his DinoNose project. His interest is more than aesthetic. The position of the nostril matters, Witmer says, because something important was happening in the noses of many dinosaurs. *Triceratops*, for example, devoted half the volume of its skull to its nasal cavity, perhaps to cool its brain (*Science*, 5 November 1999, p. 1071). "It certainly is important to know where the fleshy nostril is," says Jeffrey Wilson of the University of Michigan Museum of Paleontology in Ann Arbor.

Still, locating the nostrils was a daunting prospect. Some ceratopsian dinosaurs had nasal openings in their skull, also called nostrils, more than half a meter long—and the fleshy nostril could theoretically have been anywhere along there. "The nostril project was one I was almost scared to get into," Witmer confesses.

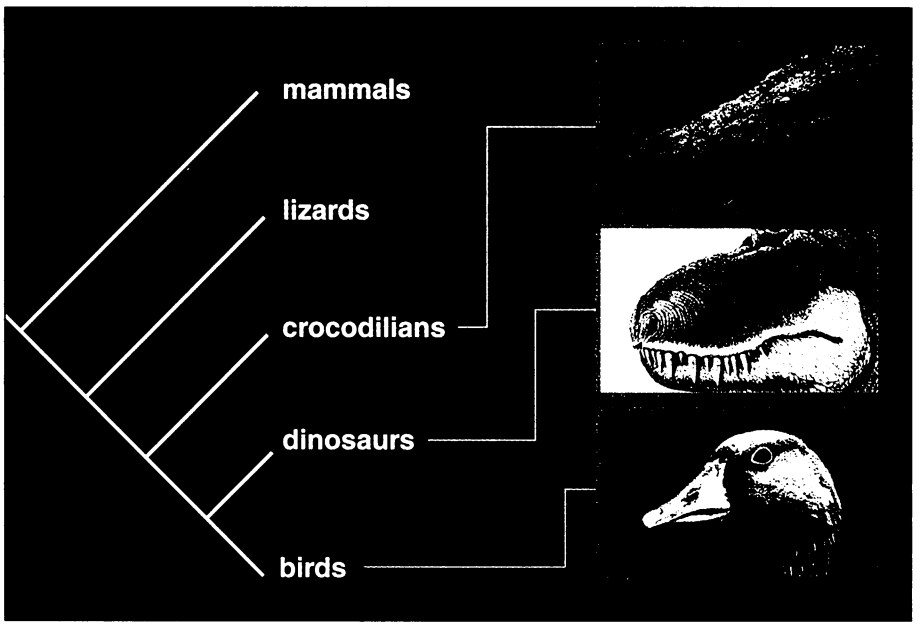
His first step was to look at the location of the fleshy nostril in birds and crocodiles—the closest living relatives of dinosaurs—as well as other animals. The challenge was to find the relation between the position of the fleshy nostril, which is not preserved in dinosaurs, and the nasal opening. To do this, Witmer painted the fleshy nostrils of modern animals with latex and barium sulfate to make them opaque to x-rays. Then he x-rayed the heads. "What was neat is that a picture started to emerge that was surprising," Witmer says. Time and again, the fleshy nostril was located toward the front of the bony nostril.

If the pattern was true of the dinosaurs' closest living relatives, it was probably also the case for the dinosaurs themselves, Witmer says. But to be sure, he looked for additional evidence preserved in the skulls. Modern crocodiles and lizards have erectile tissue inside the nose, next to the fleshy nostril. The blood vessels that feed this tissue leave distinct marks in the bone. When Witmer checked dinosaur skulls of many kinds, he found similar traces of blood vessels near the front of the bony nostril. His conclusion: "The nostrils were pretty much like everybody else's, parked out in front."

Why is that design so popular? Having fleshy nostrils positioned forward on the snout, Witmer says, might enhance the sense of smell. It would also give creatures who depend on smell, such as shrews or tapirs, more information, because the nostril would cut a wider swath as they sweep their heads from side to side. Fleshy nostrils near the mouth might also improve the sense of taste. Not least, the position of the nostril is important for determining how air flows through the nose. A nostril toward the back of the bony nostril would mean dead air in the nose.

So why did artists put dinosaurs' nostrils far backward? Witmer believes the idea dates back to the 1880s, when scientists thought that the gigantic sauropods must have lived in water to support their weight. Sauropods have large, bony nostrils that are close to the top of the skull; this seemed perfectly suited to be a sort of snorkel. But the bony nostrils actually extend farther down the sauropod's snout, and near the front, Witmer found the diagnostic marks of blood vessels.

Wilson and others say Witmer's evidence for moving the nostrils is strong and credit him with setting the record straight. "He's looking at something that a lot of us took for granted and applying some common sense to it," says paleontologist Christopher Brochu of the University of Iowa in Iowa City. "It really demonstrates the need to look at assumptions carefully and how they work in other animals." And that's nothing to sneeze at. **–ERIK STOKSTAD**



Pick a nose. X-rays and dissections of living relatives suggest that dinosaurs' fleshy nostrils were located at the front of a bony opening, near the end of the snout in crocodiles and dinosaurs.

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GENETIC ENGINEERING

Imperial College Fined Over Hybrid Virus Risk

HERTFORDSHIRE, U.K.—One of the United Kingdom's top research institutes has been ordered to pay almost $65,000 in fines and legal fees for risking the release of a potentially deadly hybrid virus. Government inspectors had charged Imperial College, London, with failure to follow health and safety rules in a study that involved the creation of a chimera of the hepatitis C and dengue fever viruses, both of which cause severe illness. On 23 July, a crown court judge upheld the charges and found the college guilty of failing to adequately protect laboratory workers and the public.

Hepatitis C, which infects about 200 million people worldwide, has proved difficult to study because it does not replicate well in the lab. The molecular biology group based at Imperial College's St. Mary's Hospital campus was trying to create a stable form of hepatitis C to speed research into vaccines and new drugs. The group—headed by molecular biologist John Monjardino—hoped to coax the virus to grow by splicing in a number of key dengue fever virus genes. But the experiment ended after inspectors from the Health and Safety Executive (HSE) filed a devastating report on

safety violations, following a laboratory inspection in 1998. Specialist Inspector Simon Warne says HSE found inadequate safety cabinets, a lack of proper equipment to fumigate the laboratory, poor facilities for waste disposal, and "confused, inadequate, and apparently untested" onsite lab rules.

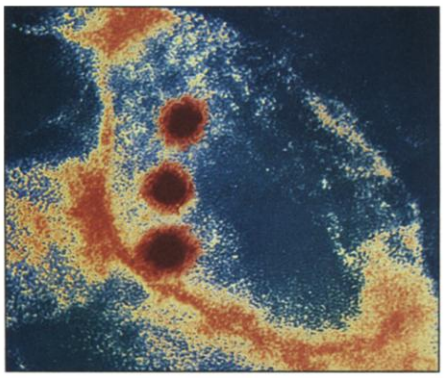
Although other researchers concur with the aims of the project, they backed the government's action. "I am very supportive of this kind of research, but there is never any excuse to take risks with health and safety," says John Oxford, a virologist at St. Bartholomew's and the Royal London School of Medicine and Dentistry.

Scientists in the project declined comment, but Imperial College issued a statement expressing regret and emphasizing that no one was hurt. A spokesperson says that since the safety breach was identified, the college has hired extra staff devoted to monitoring and safety and that it does not intend to continue work in this area.

Predicting the virulence of a hybrid virus is tricky, scientists say, and for that reason this work requires the highest safety standards. "The problem," says Richard Sullivan, an expert on bioweapons issues at University College London, is that "no matter how cautious you are, you get situations where you create something of a far higher risk than predicted." Usually a hybrid virus is less virulent than either of its parents, says Warne. But there are exceptions. A striking example: In January, Australian researchers accidentally created a highly deadly mousepox virus (*Science*, 26 January, p. 585). "We are all on a big learning curve; the golden rule is always to assume the worst and have much greater security than you think you should have," concurs Oxford.

The court ruling is the second major embarrassment this year for Imperial College, which was fined about $28,000 in March after a similar court hearing for exposing the public to unacceptable risk by manufacturing the HIV virus in an inadequately sealed hospital laboratory. However, Warne does not see a deeper safety problem. Noting that the college has recently incorporated many disparate institutes, he says "it's inevitable that in a large research organization standards will vary across the board."

–JOHN PICKRELL



CREDITS: (TOP TO BOTTOM) AP PHOTO/SEVANS; SPL PHOTO RESEARCHERS

Dangerous liaisons? Researchers hoped to splice dengue fever virus (above) and hepatitis C virus.

NATIONAL SECURITY

MIT Military Critic Rejects Secrecy Claims

Physicist Ted Postol—a relentless critic of missile defense schemes—is fighting a Pentagon allegation that he has given away classified information. This is not the first time Postol has been targeted for a security investigation. But it may be the first time that he has accused his superiors at the Massachusetts Institute of Technology (MIT) of agreeing to help the Pentagon.

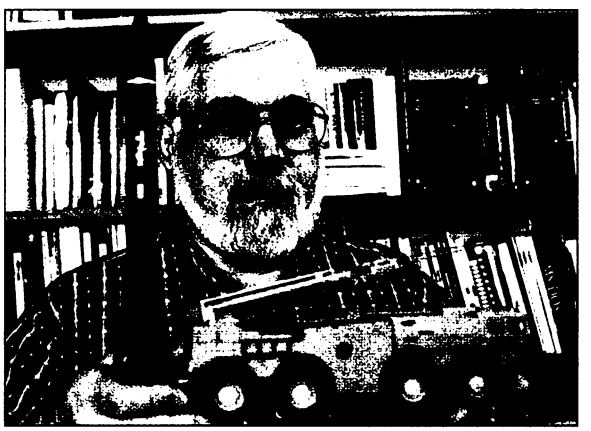
In mid-July, Postol says, he learned by chance that he was being investigated by the U.S. Defense Security Service (DSS) for distributing a report on a defensive missile test. Although the report was labeled "unclassified draft" last year when Postol obtained it, the government has since ruled that it includes secret information. Postol rejects the notion that he can be held accountable for a retroactive decision like this—especially since the material has "gone around the world" on the Internet.

Postol claims the Pentagon is trying to silence him. He also charges that Defense officials pressured MIT to search his office and "retrieve" materials. Pentagon officials say they're just trying to protect national secrets. When the dispute surfaced in *The New York Times* on 27 July, MIT President Charles Vest issued a careful statement noting that MIT "abides by the laws that protect national security" but also defends Postol and "the right of our faculty to serve as responsible critics within the limits of the law."

Postol is not reassured.

The contretemps has roots in Postol's decades-old battle with the military over access to data on weapons design and testing. During the Persian Gulf War, for example, Postol argued that the U.S. defensive weapon, the PATRIOT missile, was unable to stop Iraq's SCUD missiles. Afterward, military agents began investigating him for a possible security violation but later dropped the inquiry when Congress intervened. During the past year, Postol has been publicly accusing scientists at MIT's Lincoln Laboratory in Lexington, Massachusetts, a research center largely funded by the military, of giving "fraudulent" support to a contractor's claims about missile testing. He brushed off a warning that he was at risk of violating his security clearance. Then on 17 April, Postol sent detailed fraud allegations—including data from the now-secret report—to the Government Accounting Office (GAO), a congressional agency. The GAO forwarded his letter to the Pentagon and Lincoln Laboratory, apparently provoking the Pentagon to seek a formal investigation of Postol.

Postol says he learned of the inquiry a few weeks ago from a campus security official. DSS wrote to MIT and Lincoln Laboratory on 10 July, informing them that the U.S. Ballistic Missile Defense Organization (BMDO) had reported Postol for a security breach—sending out a report "that BMDO has determined to be classified SECRET." The Pentagon asked MIT to make Postol stop sharing the report, to "retrieve" it, and investigate the violation. Postol appealed to Vest for support.



Self defense. Postol (with model SCUD) refuses to cooperate with security investigation.

Vest responded to Postol on 24 July that he had been "scoping out" possibilities that would "maximally defend" Postol's rights "without violating our contractual obligations" to enforce security. Vest warned that MIT "may be contractually obligated to move forward with at least the initial steps that we have been ordered to take by DSS." Indeed, Vest sought to have an MIT attorney explore how to recover the report. Vest noted, however, that if the report is as widely available as claimed, "the Provost and I intend to work privately through the best channels" to have the government withdraw "what seems to be a pointless request to MIT to take action."

Claiming Vest "was ready to throw me to the dogs," Postol has refused to cooperate and threatened to go to court. He accuses MIT of risking the freedom of "other scholars who don't have the notoriety that allows me to fight back." Vest had no comment beyond last week's prepared statement, withholding a full discussion "until MIT has learned all the necessary facts."

–ELIOT MARSHALL