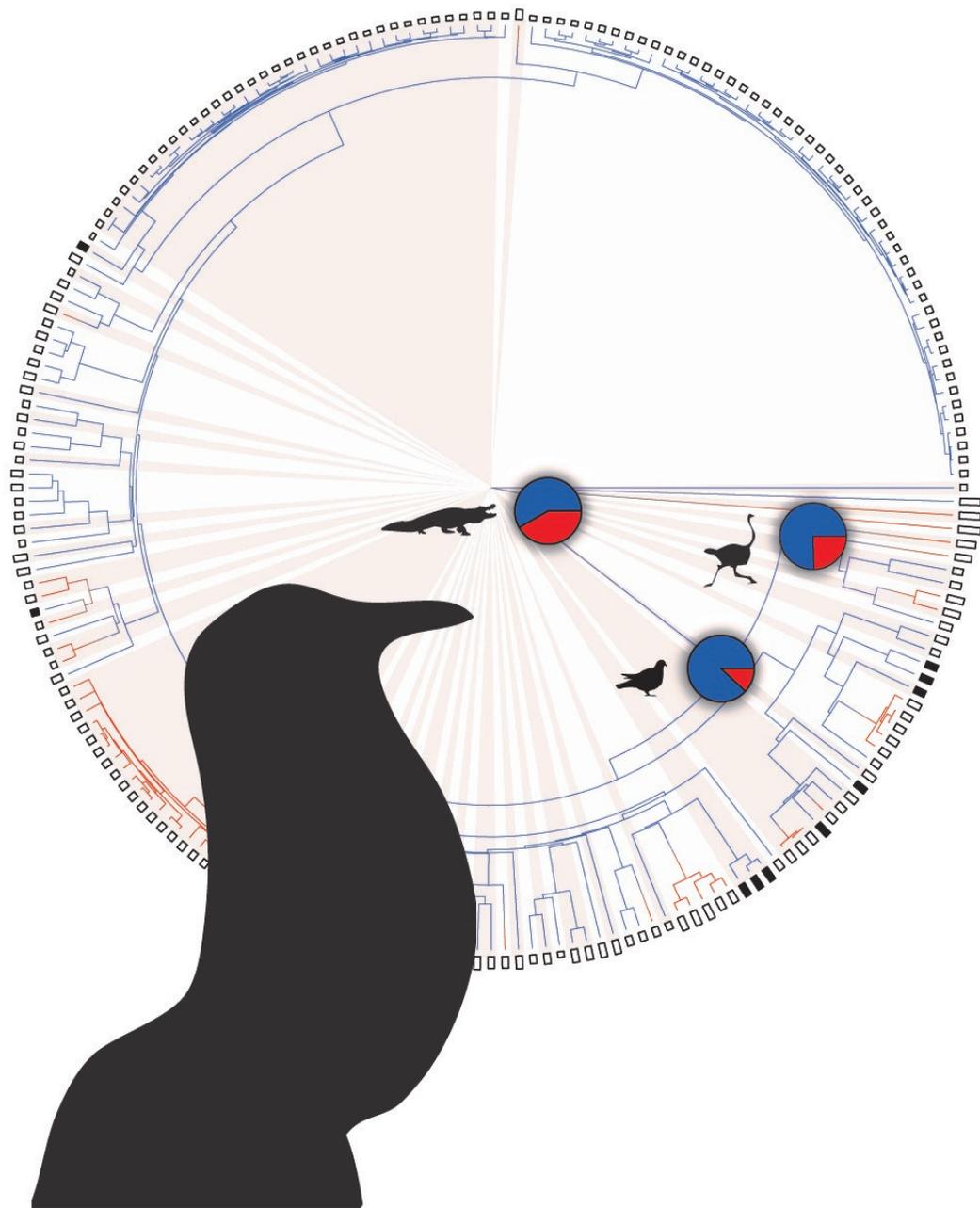


Bird research suggests calling dinosaurs may have been tight-lipped

July 11 2016



Colors show probability of each branch being an open-mouth vocalizer (blue) or a closed-mouth vocalizer (red). Pies show the probabilities that the ancestors of birds and crocodiles, palaeognath birds, and neognath birds used closed-mouth vocalization. Credit: Tobias Riede

Dinosaurs are often depicted in movies as roaring ferociously, but it is likely that some dinosaurs mumbled or cooed with closed mouths, according to a study published online in the journal *Evolution* that will be in the August print edition.

The research examines the evolution of a specialized way birds emit sound—closed-mouth vocalization. The study emerges from a new collaboration, funded by a grant from the Gordon and Betty Moore Foundation, to understand the origin and evolution of the unique vocal organ of birds and the large array of sounds it can produce. Because birds descended from [dinosaurs](#), the research may also shed light on how dinosaurs made sound.

Closed-mouth vocalizations are sounds that are emitted through the skin in the neck area while the beak is kept closed. To make them, birds typically push air that drives sound production into an esophageal pouch rather than exhale through the open beak. The coos of doves are an example of this behavior. Compared with sounds emitted through an open beak, closed-mouth vocalizations are often much quieter and lower in pitch. Birds making closed-mouth vocalizations usually do so only to attract mates or defend their territory. At other times, they emit sounds through an open mouth.

To understand when and how closed-mouth vocalization evolved, researchers with The University of Texas at Austin, Midwestern University in Arizona, Memorial University of Newfoundland and the University of Utah used a statistical approach to analyze the distribution of this vocal ability among birds and other reptilian groups. In total, the researchers identified 52 out of 208 investigated bird species that use closed-mouth vocalization.



A dove's coo is an example of a closed-mouth vocalization. Credit: Tobias Riede

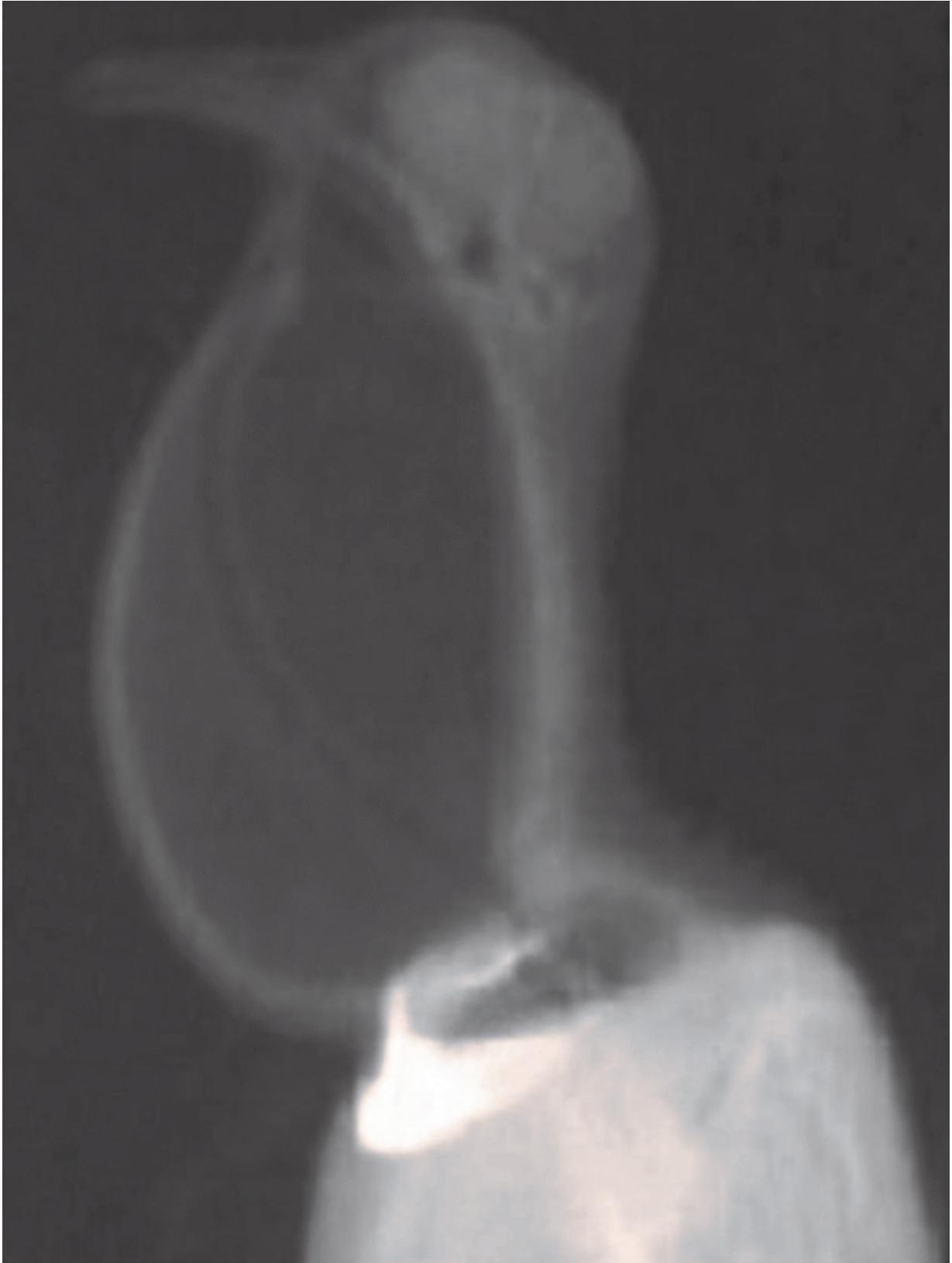
"Looking at the distribution of closed-mouth vocalization in birds that are alive today could tell us how dinosaurs vocalized," said Chad Eliason,

a postdoctoral researcher at The University of Texas Jackson School of Geosciences and the study's co-author. "Our results show that closed-mouth vocalization has evolved at least 16 times in archosaurs, a group that includes birds, dinosaurs and crocodiles.

Interestingly, only animals with a relatively large body size (about the size of a dove or larger) use closed-mouth vocalization behavior."

Tobias Riede, a physiology professor at Midwestern University and the study's first author, said the association with large bodies is a matter of physics.

"The inflation of an elastic cavity could present a size-dependent challenge," Riede said. "The lung pressure required to inflate a cavity depends on the tension in the wall of the cavity, and this tension increases for smaller body sizes."



X-ray image of a ring dove (*Streptopelia risoria*) producing cooing sounds with a closed mouth. Credit: Tobias Riede

Researchers still are not certain about how the ancestors of modern archosaurs vocalized. But the occurrence of closed-mouth vocalization across birds and crocodiles—the two surviving groups of archosaurs—indicates that closed-mouth vocalization can emerge in diverse archosaur species depending on behavioral or environmental circumstances, Riede said.

"A cool thing about this work is the demonstration that closed-mouth behavior evolved many times," Riede said. "That suggests it can emerge fairly easily and be incorporated into mating displays."

Because dinosaurs are members of the archosaur group, and many had large body sizes, it is likely that some dinosaurs made closed-mouthed vocalizations in a manner similar to birds today, perhaps during mating displays. However, at this point in time, no direct fossil evidence exists to reveal what dinosaurs sounded like.

Julia Clarke, a professor at the Jackson School of Geosciences and co-author, said the study offers clues.

"To make any kind of sense of what nonavian dinosaurs sounded like, we need to understand how living [birds](#) vocalize," she said. "This makes for a very different Jurassic world. Not only were dinosaurs feathered, but they may have had bulging necks and made booming, closed-mouth sounds."

Future research by this collaboration will integrate information from fossils, experimental physiology, gene expression and sound modeling to

understand the sounds that extinct early avian species, and perhaps their dinosaur ancestors, produced.

More information: Tobias Riede et al, Coos, booms, and hoots: the evolution of closed-mouth vocal behavior in birds, *Evolution* (2016).

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