

Journal from the James

Solving the mystery of the bird family tree ...

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Greetings and best holiday wishes from the James Reserve. In our last column, John gave you a peek into the world of mountain lions. In this article, I will share a breaking discovery about another top predator, the common ancestor of all birds. Here's the spoiler — it had teeth.

And also — wait for it — forget how your bird guide is organized. More than 200 scientists, including the Avian Phylogenetics Consortium, just finished locating and analyzing shared bits of DNA from 48 species of birds to reconstruct the bird family tree and finally solved the puzzle about how avian groups are related to each other — their evolutionary history.

Before we had the power to sequence whole genomes (roughly five years ago), bird systematics were determined by partial DNA sequencing, anatomical and behavioral characters. Science is a work in progress and as well as new discoveries, we continuously refine and deepen our

understanding of natural systems and organisms. Researchers sequenced an array of birds, at least one species from every major bird lineage, from crows to flamingos, penguins and ibises.

First things first: A meteor is thought to have hit planet earth, which caused the last mass extinction 66 million years ago that wiped out non-avian dinosaurs and almost everything else — 71 to 81 percent of all species. A handful of birds survived and without big dinosaurs, they thrived and diversified rapidly to occupy many ecological niches both on land and sea.

The birth of so many bird species is the reason it has been difficult for researchers to tease apart bird evolutionary relationships. The common ancestor of all birds alive today was a top predator, an apex predator, which is the term for a species at the top of the food chain such as mountain lions, sharks and Komodo dragons.

Birds had teeth? The ancestor of all present-day bird species had teeth in the back of its mouth but a beak at the front. In 1861, paleontologists found a fossil called *Archeopteryx*. This winged dinosaur was a clumsy flyer, more of a glider like a flying squirrel. And it had teeth, but when and how birds lost teeth was only now discovered.

Losing teeth meant that birds had to adapt to macerate food with another

means, the gizzard. Birds eat little stones, which help break down food in the gizzard before it is passed to stomach and the remaining digestive system.

Which bird today is most closely related to the original prehistoric bird? It's a toss-up between chickens and ostriches. Here's why. Chickens have the most ancestral chromosomal organization (same packaging of DNA, where the books are stored). Ostriches have the most similar "library" of DNA (what books are in the library).

What other surprising results arose from this study? Falcons are more closely related to parrots than to hawks and eagles. Killing is a trait that obviously can be gained and lost over a geologic timescale.

What else? Flamingos are most closely related to western grebes. Both make a living in the ocean, but they have very different strategies to find food. The elegant flamingo filter feeds, sort of like a baleen whale. They scoop up mouthfuls of water and with specialized bills, strain it for yummy crustaceans and other small marine invertebrates and plants. Western grebes dabble and dive for food, such as fish. You can't always judge a book by its cover — or a bird by its bill.

Interested in learning more? Results were published in 28 journals, including www.sciencemag.org/con.