



AMERICAN MUSEUM OF NATURAL HISTORY

Media Inquiries: Kendra Snyder, Department of Communications
212-496-3419; ksnyder@amnh.org
www.amnh.org

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DINOSAURS AMONG US OPENS AT THE AMERICAN MUSEUM OF NATURAL HISTORY

**NEW EXHIBITION EXPLORES THE LINK BETWEEN BIRDS—LIVING DINOSAURS—AND THEIR EXTINCT
ANCESTORS**

FROM MARCH 21, 2016, TO JANUARY 2, 2017

The next time you dodge a pigeon on the sidewalk, watch a sparrow eat from a feeder in a backyard, or order chicken for dinner, know that you just had an encounter with a modern dinosaur. Dinosaurs never really vanished from Earth. Most did go extinct, but their evolutionary legacy lives on all around us, in birds. The American Museum of Natural History's new exhibition *Dinosaurs Among Us* will highlight the unbroken line between the charismatic dinosaurs that dominated the planet for about 170 million years and modern birds, a link that is marked by shared features including feathers, wishbones, enlarged brains, and extremely efficient respiratory systems. The fossil record of this story and the biological research it inspires – much of which is being done by scientists trained or working at the Museum – grows richer by the day. So rich, in fact, that the boundary between the animals we call birds and those we traditionally called dinosaurs is practically obsolete.

“With this new exhibition, we invite visitors to question what they think they know about dinosaurs – how they looked and behaved and even whether all of them actually became extinct,” said Ellen V. Futter, President of the American Museum of Natural History. “While paleontology has been a proud part of this institution’s legacy for more than 100 years, we live today in an exciting new era of advancement in dinosaur research. There has never been a more interesting time to enjoy dinosaurs or a more fascinating time to learn about their behavior, appearance, and connection to current life, specifically modern birds.”

Living birds belong to a group, or clade, called the Dinosauria. It includes the extinct dinosaurs and all their living descendants, which is why most scientists now agree that birds are

(more)

a kind of dinosaur just like we are a kind of mammal. Fossils, genes, behavior, and the anatomy of living animals tell us that birds share a common ancestor with dinosaurs that weren't birds – and that alligators and crocodiles are birds' closest living relatives.

"The idea that birds are dinosaurs isn't a new one – it was first proposed by Thomas Huxley about 150 years ago," said Michael Novacek, the Museum's Senior Vice President and Provost for Science. "But now it's taken on a whole new dimension as different technologies, and as a result, different ideas, are being applied to the field."

Dinosaurs Among Us will feature ancient, rarely seen fossils and life-like models, including a 23-foot-long tyrannosaur (*Yutyrannus huali*) with a shaggy coat of filaments called proto-feathers and a small dromeosaur (*Anchiornis huxleyi*) with a 22-inch wingspan and vivid, patterned plumage on all four limbs. Visitors will encounter a tiny dinosaur whose sleeping posture precisely echoes that of a living bird; a fossilized dinosaur nest containing remains of the adult that guarded the hatchlings; and a relative of *Triceratops* that had simple plumes on its body.

The exhibition, which comes on the heels of the unveiling of a [122-foot-long titanosaur](#) cast on permanent display in the Museum's Miriam and Ira D. Wallach Orientation Center, is part of a series of events, public programs, exhibitions, and digital offerings highlighting dramatic developments in paleontology (*see release on the changing field of paleontology*).

"This exhibition is based on lots of new evidence amassed over the last two decades," said *Dinosaurs Among Us* curator Mark Norell, Macaulay Curator in the Division of Paleontology and the division's chair. "I think this is really going to shake up the way people think of dinosaurs."

NESTS, EGGS, AND BABIES

Making nests, laying eggs, and tending to babies aren't just bird traits. Crocodiles do these things, and some extinct dinosaurs did, too. Today, scientists use observations of living relatives to learn about the lifestyles of animals that have been extinct for more than 65.6 million years. That includes *Citipati osmolskae*, whose fossilized nest visitors can see on display as a cast in *Dinosaurs Among Us*.

The humble eggshell is the structure that allowed animals to colonize the land. A complete life-support system, the eggshell holds water and food for the developing embryo, while letting oxygen in and carbon dioxide out. Similarities between the eggshell structure of

some groups of dinosaurs and living birds are now another link in the chain of evidence connecting them.

One extraordinary fossil on view in *Dinosaurs Among Us* preserves a recently hatched troodontid dinosaur – a member of a group of small, feathered, non-bird dinosaurs with large brains – atop the eggs of what would have been its nest mates. In that fossil, the eggs are not paired, suggesting the parent had only one egg tube – as modern birds do – as opposed to the two present in their ancient ancestors. Young visitors to the exhibition will also get the chance to get up close and personal with a climbable, full-scale model of a nest with 20 eggs discovered in China, likely laid by one of the largest oviraptorosaurs ever found, *Gigantoraptor*.

Exhibition visitors can look through a microscope to discover more about eggshell layers – which can tell scientists what kind of dinosaur laid the egg – and growth rings, which allow researchers to track maturation in dinosaurs and their relatives. Learning more about prehistoric eggs like these and how they differ in size, shape, composition, and more can teach researchers about the transition from non-bird dinosaurs to modern birds.

FEATHERS

Feathers come in different colors, sizes, and shapes, and serve a wide range of functions. Peacocks display them to attract mates, penguins rely on them to reduce drag underwater, and herons create shade with them. Today, birds are the only feathered animals alive, but 150 million years ago, it was a different story. Early birds had feathers, but so did dinosaurs of all shapes and sizes. One reason? Feathers are one of the most useful skin coverings that ever evolved.

Thousands of feathered dinosaurs have been discovered, with most belonging to the theropod branch of the family tree. Researchers have also found evidence of feathered ornithiscians – a branch only distantly related to birds that includes familiar dinosaurs like *Triceratops* and *Stegosaurus*. Some scientists think all dinosaurs, including sauropods like [The Titanosaur](#), had feathers, just as all mammals have at least some hair. Mammals like elephants, though, have very limited hair. Similarly, sauropods may not have had many feathers, making them unlikely to be preserved in fossils.

Paleontologists are continually discovering new examples of feathered fossils. Discoveries in the Liaoning Province of China, which tend to be exquisitely well preserved, have transformed our understanding of the transition from feathered dinosaurs to birds. Thousands of feathered dinosaurs have been discovered there in the last 15 years, and fossil casts and models of some of

the most important ones are on display in *Dinosaurs Among Us*. Finding fossils in the field is just the beginning of the discovery process for modern paleontologists. Using tools ranging from particle accelerators to genetic analysis, researchers are figuring out what color feathers were in life, investigating the relationship between scales and feathers, and learning more about the genes that control feather development (*see release on the changing field of paleontology*).

BRAINS AND LUNGS

Fossilized dinosaur feathers and eggs are clear signs that these extinct animals and living birds are tightly linked. But this kinship goes much deeper. High-tech views inside fossils and close study of birds and their closest living relatives, crocodiles, reveal that the insides of dinosaurs were a lot like those of living birds and crocodiles.

The size and shape of an animal's brain tells us a lot about how that animal experiences and gets around in the world. Birds have very large brains for their body size – 6 to 11 times bigger than those of equivalent-sized reptiles. Much of the increase in size is in the cerebrum, the part of the brain responsible for learning. In birds, the cerebrum and optic lobe – which governs sight – tend to be large and advanced, while the olfactory region, which is connected to the sense of smell, is less well developed.

Using techniques like CT scans, modern paleontologists can compare the braincases of modern birds to their relatives, including theropod dinosaurs (*see release on the changing field of paleontology*). This research has shown that one group of theropods displays the trend toward inflation of the “thinking” brain we see in living birds, suggesting that some non-bird theropod dinosaurs were probably capable of advanced learned behavior.

The brain isn't the only place where an unbroken line between birds and dinosaurs is on display. The large hearts, high body temperature, and powered flight of birds are all driven by a set of extremely efficient lungs. But birds aren't the only ones to have such “super lungs.” Extinct dinosaurs and living crocodylians have them, too. This likely means the last common ancestor of birds and crocodiles, which lived over 240 million years ago, also had birdlike lungs, suggesting the trait evolved at least 100 million years before the oldest known bird.

Even the position of some fossil dinosaurs thought to be sleeping in a birdlike position – sitting on folded hind limbs, forearms held close to the body, and head tucked under one arm – makes us wonder. Birds sleep this way to preserve warmth. Was this birdlike dinosaur warm-blooded, too? The evidence seems to point that way.

BONES, BEAKS, AND CLAWS

Making comparisons to living birds can help researchers draw new conclusions about extinct dinosaurs. In *Dinosaurs Among Us*, visitors will be able to see two fossilized specimens of *Khaan mckennai* known as Sid and Nancy. These animals are oviraptorids, a group of fairly small, birdlike dinosaurs with toothless beaks, wishbones, and skulls filled with air pockets.

While these animals are nearly identical, scientists suspect that one is a male, based on the presence of large structures beneath its tail that have a triangular, spearheaded shape. Those structures are smaller in the other animal, and lack the triangular, or “chevron,” shape, suggesting that the larger structures could have supported the muscles used in a tail-feather display, much like those still put on by the male sage grouse and peacock.

Birds have hollow bones, and some have assumed this trait evolved along with flight: lighter bones should make it easier to fly. But studies have shown that the primitive theropod *Allosaurus* also had hollow bones. *Allosaurus* was a big animal with tiny arms, so it wasn’t flying anywhere. Like so many other bird traits, hollow bones appear early in the dinosaur family tree.

Hollow bones are among several traits that made early birds well prepared for flight before they could take to the skies. Another is the development of the furcula, or wishbone. Once thought unique to birds, wishbones are now known to occur in some bipedal, meat-eating non-bird dinosaurs. In *Dinosaurs Among Us*, visitors will see the cast of a *T. rex* wishbone, making it clear that the mere presence of a furcula doesn’t mean an animal could fly.

Once you start seeing the resemblance between non-bird dinosaurs and living birds, it’s hard to stop. The similarities are especially striking when it comes to legs, feet, and claws. The four-inch talons of the harpy eagle, for instance, are as large as those of a *Velociraptor*, and enable this modern predator to carry off prey weighing up to 20 pounds.

FLIGHT

How did feathered dinosaurs finally take to the air and become birds? This dramatic transition didn’t happen all at once, and feathers were just the beginning. Those awkward in-between stages include some of the most fascinating animals that ever lived: bushy, feathered tyrannosaurs; birds with lizard-like tails, teeth, and claws; and even some small, leaping creatures with four wing-like limbs.

Full-size wings evolved in stages, each of which must have served a useful function to

persist. But before flight evolved, early wings might have been used to glide from tree to tree or make a gentle descent. And small wings could provide a big boost when leaping out of reach of predators or pouncing on prey, or help dinosaurs run up steep slopes and tree trunks.

Animals capable of true flight can keep themselves in the air by their own power, supporting their weight by flapping; in contrast, gliding is more like a slow, controlled descent, as if guiding a parachute. Many so-called flying animals, including frogs, lizards, and squirrels, are really just gliders. Wings capable of supporting true, powered flight evolved in three vertebrate groups: birds, bats, and pterosaurs. All have light, flexible wings that can support the animal's weight in the air.

In *Dinosaurs Among Us*, visitors can explore the dynamics of flight through a large-scale media interactive called "Will It Fly?" By varying the wings, breastbone, and body size, visitors can build eight different dinosaurs, ranging from *Archaeopteryx lithographica*, often called the "first bird," to *Velociraptor mongoliensis*, and digitally launch them to see whether they will fly.

Fully modern birds already filled the skies at least 50 million years ago, and many were almost indistinguishable from living birds. Their modernity means that the key adaptations for powered flight were already present, including full-size wings, shoulders that permit them to flap to a near 180-degree arc, and fused skeletons to transfer energy from flapping into flight.

THE NEW AGE OF DINOSAURS

More kinds of dinosaurs live on Earth today than have ever been described by paleontologists. We call them birds, and there are perhaps up to 18,000 living species. The mass extinction that erased most dinosaurs about 65 million years ago left a few bird lineages unscathed, and in only 15 million years – an evolutionary heartbeat – all of the familiar groups we know today were flourishing. *Dinosaurs Among Us* highlights some of these amazing species.

Hoatzin are the only living representatives of one of the most ancient lineages of birds, with origins about 64 million years ago. Young hoatzin have two claws on the bones that support their flight feathers – that is, on their hands. If a chick falls from the nest, which is a common cause of death among many baby birds, it can claw its way back to safety.

The shaggy-throated giants of the crow family, common ravens are social, highly intelligent hunters and scavengers. Some ravens and crows have even been observed using tools and solving complicated problems in the wild.

White-bellied Storm Petrels frequent the world's wildest oceans, rarely approaching land

except to breed on remote islands. These little birds often feed by surface pattering, hovering with their feet touching the water while picking at the surface for small crustaceans and fish.

These extraordinary living dinosaurs provide a vivid link to the ancient past in ecosystems all over the planet, from tropical forests to frozen tundra. Their diversity and success across the planet can mean only one thing – the new Age of Dinosaurs is now.

EXHIBITION ORGANIZATION

Dinosaurs Among Us is curated by Mark Norell, Macaulay Curator in the Division of Paleontology and the division's chair. The exhibition will be open to the public from Monday, March 21, 2016, through January 2, 2017. Members will be able to preview the exhibition on Friday, March 18, through Sunday, March 20.

The exhibition is designed and produced by the American Museum of Natural History's award-winning Exhibition Department under the direction of David Harvey, senior vice president for exhibition.

The Museum gratefully acknowledges the **Richard and Karen LeFrak Exhibition and Education Fund**.

Dinosaurs Among Us is proudly supported by **Chase Private Client**.

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AMERICAN MUSEUM OF NATURAL HISTORY (AMNH.ORG)

The American Museum of Natural History, founded in 1869, is one of the world's preeminent scientific, educational, and cultural institutions. The Museum encompasses 45 permanent exhibition halls, including the Rose Center for Earth and Space and the Hayden Planetarium, as well as galleries for temporary exhibitions. It is home to the Theodore Roosevelt Memorial, New York State's official memorial to its 33rd governor and the nation's 26th president, and a tribute to Roosevelt's enduring legacy of conservation. The Museum's five active research divisions and three cross-disciplinary centers support approximately 200 scientists, whose work draws on a world-class permanent collection of more than 33 million specimens and artifacts, as well as specialized collections for frozen tissue and genomic and astrophysical data, and one of the largest natural history libraries in the world. Through its Richard Gilder Graduate School, it is the only American museum authorized to grant the Ph.D. degree and the Master of

Arts in Teaching degree. Annual attendance has grown to approximately 5 million, and the Museum's exhibitions and Space Shows can be seen in venues on five continents. The Museum's website and collection of apps for mobile devices extend its collections, exhibitions, and educational programs to millions more beyond its walls. Visit amnh.org for more information.

Hours

The Museum is open daily, 10 am–5:45 pm. The Museum is closed on Thanksgiving and Christmas.

Admission

Museum admission is free to all New York City school and camp groups.

Suggested general admission, which supports the Museum's scientific and educational endeavors and offers access to the Museum's 45 halls including the Rose Center for Earth and Space, is \$22 (adults) suggested, \$17 (students/seniors) suggested, \$12.50 (children) suggested. All prices are subject to change.

The Museum offers discounted combination ticket prices that include suggested general admission plus special exhibitions, giant-screen 2D or 3D film, and Space Shows.

- Museum Plus One includes one special exhibition, giant-screen 2D or 3D film, or Space Show: \$27 (adults), \$22 (students/seniors), \$16 (children)
- Museum Supersaver includes all special exhibitions, giant-screen 2D or 3D film, and Space Show: \$35 (adults), \$28 (students/seniors), \$22 (children)

Visitors who wish to pay less than the suggested Museum admission and also purchase a ticket to attend a special exhibition, giant-screen 2D or 3D film, or Space Show may do so on-site at the Museum. To the amount they wish to pay for general admission, they add \$25 (adults), \$20.50 (students/seniors), or \$13.50 (children) for a Space Show, special exhibition, or giant-screen or 3D film.

Public Information

For additional information, the public may call 212-769-5100 or visit the Museum's website at amnh.org.

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