

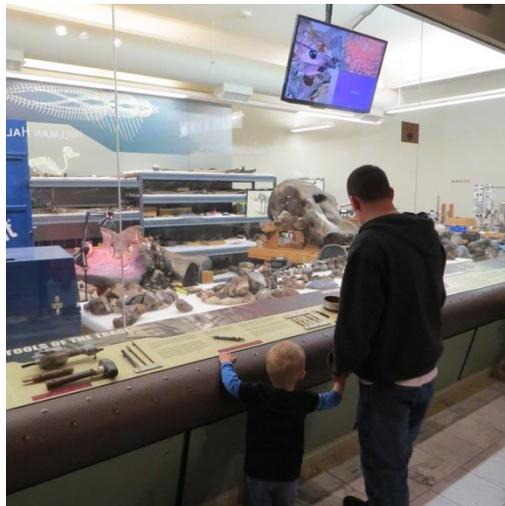
The “Dinosaurs in Their Time” and “Pterosaurs: Flight in the Age of Dinosaurs” Exhibits at the Carnegie Natural History Museum, Pittsburgh, PA Michael Hutchins

As Director of the American Bird Conservancy's Bird-Smart Wind Energy Campaign, I traveled to the 2016 Wildlife and Natural Resources Conference in Pittsburgh, PA from 13-17 March. I had gotten up early that morning to catch a direct flight out of Regan National Airport and arrived in Pittsburgh around noon. I took a taxi to my hotel, checked in and immediately inquired about the location of the Carnegie Natural History Museum, which is located near the University of Pittsburgh campus. I took a 10-minute cab ride to the entrance and asked the driver for his card so that I could get back to the hotel following my visit.

Upon arriving at the museum, I made a bee line to the world famous “Dinosaurs in Their Time” Exhibit, a \$36 million masterpiece that opened in 2007 and places replica and natural dinosaur skeletons in immersive landscapes reminiscent of their natural habitats. The museum houses an impressive collection, including examples of some of the largest dinosaurs that ever lived, such as *Diplodocus*.

The Carnegie Museum of Natural History was established by the wealthy industrialist Andrew Carnegie, who developed an early interest in paleontology. The “Dinosaurs in Their Time” exhibition is the third largest collection of mounted, displayed dinosaurs in the United States. First and second are the Smithsonian's National Museum of Natural History in Washington, DC and the American Museum of Natural History in New York City.

Just outside the exhibit entrance are displays that focus on answering basic questions, such as “what is a fossil?” and how old are they? Visitors can also peer into a large fossil preparation lab, where they can see Museum staff and volunteers preparing specimens for study and exhibition.



*Display explaining the origin of fossils (left) and the fossil specimen preparation lab (right).
(Note: all photos by M. Hutchins).*



Massive skeleton of Diplodocus carnegii at the "Dinosaurs in Their Time" Exhibit.

Diplodocus carnegii was discovered by Museum paleontologists working in the Morrison Formation of Utah. This giant Jurassic sauropod stood 12 feet tall at the hips, and at 85 feet long, weighed in at around 15 tons.

The Utah portion of the Morrison Formation apparently once consisted of a low-lying floodplain crisscrossed by several rivers. Periodic flooding of the region presumably drowned many dinosaurs, their bones being preserved in the silt for the next 150 million years. Additional specimens from this location exhibited in the main hall include *Ceratosaurus nasicornis*, a large carnivore, 20 feet long, and weighing around 1,500 pounds and *Stegosaurus armatus*, a large herbivore, and the smaller *Dryosaurus altus*. *Dryosaurus*, also a herbivore, weighed only around 200 pounds.

Carnegie Museum paleontologists had a virtual monopoly on collecting in Utah's Morrison Formation in the early 20th century. The site was discovered by a Carnegie paleontologist, and over the next decade and more, many tons of fossils were shipped back east, including nearly-intact specimens of *Allosaurus*, *Apatosaurus*, and *Stegosaurus*. Carnegie tried to purchase the land, but President Woodrow Wilson beat him to it in 1915, turning this stretch of rocky, barren landscape into Dinosaur National Monument and preventing the fossil treasure trove from falling into private hands.



Stegosaurus armatus skeleton displayed next to an artist's life-like rendering of the animals.

Many ancient creatures other than dinosaurs also inhabit the great hall. On one wall, for example, was a trio of ichthyosaurs, large marine reptiles. On another were numerous extremely well-preserved fish specimens from late Jurassic seas and lagoons, all from the world famous Solnhofen limestone quarries in Germany.



A trio of ichthyosaurs, ancient marine reptiles, graces one wall adjacent to the great hall housing the Carnegie dinosaur collection.

Before leaving the Museum, I decided to run upstairs to view the special exhibit "Pterosaurs: Flight in the Age of Dinosaurs." I've always been fascinated by these creatures and had paid the extra \$24.95 adult entry fee when I entered the Museum. The special exhibit opened on January 30, 2016 and runs through May 22.



The entry area to the special exhibit Pterosaurs: Flight in the Age of Dinosaurs.

Hovering over the exhibit's entrance is a model of a large pterosaur *Tropeognathus mesembrinus* ("keel-jawed") from the Cretaceous of Brazil. Pterosaurs are often also referred to as "pterodactyls", especially by the popular media. However, "Pterodactyl" refers only to members of the genus *Pterodactylus*, and more broadly to members of the suborder Pterodactyloidea of pterosaurs.

Pterosaurs are the earliest known vertebrates to have evolved powered flight. Like birds, they had hollow bones to reduce weight and allow lift. Their wings consisted of a leathery membrane of skin, muscle, and other tissues stretching from the ankles to a very long, modified fourth finger. Early forms had long, fully toothed jaws and long tails, while later varieties had reduced tails, and some lacked teeth altogether. Pterosaurs varied greatly in size, ranging from, from the very small Anurognathids to the largest known flying creatures of all time, including the impressive *Quetzalcoatlus*, having a wingspan of 33-36 feet.

There has been considerable debate as whether pterosaurs walked as quadrupeds or as bipeds when on the ground. Paleontologist Kevin Padian suggested that smaller pterosaurs with longer hind limbs, walked or even ran bipedally, in addition to flying. Pterosaur trackways were later found with a distinctive four-toed hind foot and three-toed front foot, which provided solid evidence that pterosaurs walked on all fours. Footprints indicate that pterosaurs stood with the entire foot in contact with the ground (plantigrade), like many mammals.



Amazingly preserved pterosaur fossil from the Solnhofen lime stone quarries in Germany, site of the first known pterosaur discoveries in the late 1700s.

The exhibit, with its associated educational graphics, specimens, and animated videos, filled several large rooms, focused on various aspects of pterosaur biology, including anatomy, diet, reproduction, and flight. Replicas and actual fossils were interspersed throughout the exhibit to illustrate various aspects of pterosaur biology. Among the most interesting displays were those focused on pterosaur reproduction, which included a cast of fossilized egg, clearly showing the developing young inside, and of a juvenile pterosaur. The degree of advanced wing development that can be seen in the unhatched young seems to suggest that flight was possible soon after hatching. Pterosaur egg shells were apparently soft and leathery, like those of modern snakes and lizards and some turtles, and not hard, like those of modern birds.



Casts of a fossilized pterosaur egg from the early Cretaceous of China around 125 million years old (left) and a juvenile pterosaur from the late Jurassic Solnhofen Formation in Germany.

Little is known about the details of pterosaur behavior. However, some pterosaurs had elaborate, and in some cases, large crests on the top of their heads, which likely played some function in social interactions or courtship. At least some pterosaurs had hair-like structures called "pycnofibers" on their head and body, similar to, but not the same as mammalian hair. The presence of these structures suggests that pterosaurs were endothermic (warm-blooded). The wings were absent any covering, which probably reduced drag and allowed for more efficient energy use during flight.



A young girl models the flight of a pterosaur in front of an interactive video display.

Toward the end of the exhibit, there were several large video screens showing animations of pterosaur flight and behavior. It was at this time that a Museum employee approached and told me that I was not allowed to take photographs in the exhibit. By that time I had already photographed most of the displays. I told her that I had not seen any signs restricting photography. I checked on my way out and the only sign I saw was a small 4 x 4 inch announcement on the front of the podium where an attendant was standing checking for tickets, which

I did not see on the way in. I should have complained further because \$24.95 was not a cheap entry fee, and no explanation was given for why photography was restricted. That being said, the Carnegie Museum collection and special exhibit were worth the visit and I would highly recommend stopping by if and when you get the chance.