

Seven Skeletons and a Feather: The Mysteries of Archaeopteryx

by

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Part I – Mistaken Identity

First he was puzzled. Then he was stunned. He had traveled to the Teyler Museum in Haarlem, Holland, to view the type specimen of the pterodactyl *Pterodactylus crassipes*. Here he was, holding the precious fossil in his hands while his host, curator C.O. van Regteren Altena, was off on a brief errand. Professor John Ostrom of Yale University knew the moment he touched the slab and the counterslab of limestone that this was no pterodactyl, for those extinct flying reptiles were his specialty. “If it’s not a pterosaur, what is it?” he thought to himself.

Ostrom pushed himself up from the table and carried the specimen to the window for a better look. The Teyler was a “daylight museum”; public areas were lit only by sunlight, which streamed in through the large windows. There, in the oblique sunlight, Ostrom saw the feathers. They would have been invisible in the harsh glare of the fluorescent lights of a modern museum. Feathers meant bird and not just any bird. This was the famous *Archaeopteryx!*

Ostrom’s pulse was racing. Later, when recounting his discovery, his face would light up. “I knew what I was holding. Oh, I knew it.” Striking his hands together, “Oh, I knew it like that!” Since the first discovery of a feather in 1861 and three fossil *Archaeopteryx* specimens, all from the German Solnhofen limestone, the scientific world knew that this bird was special. And here he was, holding the fifth specimen in his hands, misidentified for over 100 years as a flying reptile. It was truly ironic, for Thomas Huxley, Darwin’s most eloquent supporter, had anticipated this.

The first *Archaeopteryx* fossil found was a feather impression in a limestone slab, announced by Hermann von Meyer in 1860. It was about 6 cm long and 1.1 cm wide. It looked perfectly modern, with its central quill off center, dividing the feather into two asymmetrical veins. It looked like a primary flight feather of a living bird. Nothing special, except that the feather was 150 million years old! It meant this was the first bird. Within a month, von Meyer announced an even more spectacular find, a fossil skeleton of a beautifully preserved bird, which he named *Archaeopteryx lithographica*. He declared that it was a bird in spite of its distinct reptilian features. The fossil skeleton was sold at an exorbitant price to the British Museum of Natural History, while the slab and counterslab of the feather went to museums in Munich and Berlin.

The privilege of describing the skeletal *Archaeopteryx* fell to the prominent anatomist Richard Owen of the British Museum. He was noted for his unpleasant demeanor and for using dishonest and malicious attacks to further his own political position. But he was an outstanding scientist. In fact, Charles Darwin had given him many specimens to describe from his famous voyage around the world. Owen was also noted for being the first person to recognize and name dinosaurs. Since Darwin had written his famous book, *On the Origin of Species*, Owen had appeared decidedly

jealous. His own views, although confusingly stated, were quite evolutionary in tone. He thought species changed through time, but he didn't like the mechanistic approach that Darwin advocated. And he surely didn't like Huxley, the showboating anatomist who was known as "Darwin's Bulldog" because of his vigorous attacks on those who disliked Darwin's views.

Huxley and Owen were old enemies, and *Archaeopteryx* didn't help, for although Owen described the specimen, it wasn't long before Huxley pointed out that Owen had got it all wrong. He had confused the right and left side of the bird and incorrectly oriented the furcula, or wishbone. At the end of Huxley's critical paper, he made two prescient statements. First, he challenged Owen's prediction that *Archaeopteryx* would have a toothless beak like other birds. (The head wasn't intact, so who could know?) Huxley said: Wait a minute, tortoises have fleshy lips and a horny beak and they are certainly reptiles: "If, when the head of *Archaeopteryx* is discovered, its jaws have teeth, it will not the more, to my mind, cease to be a bird, than turtles cease to be reptiles because they have beaks." In other words, to be a bird you don't have to have a beak. When the next specimen of *Archaeopteryx* turned up in 1877 Huxley's backhanded prediction turned out to be correct: *Archaeopteryx* did indeed have teeth.

Huxley's second point was that the pelvis and feet of birds and *Archaeopteryx* resemble those of several dinosaurs that walk on two feet. They especially resemble the small dinosaur, *Compsognathus*, also from the Solnhofen limestone. In fact, he intimated that if it weren't for the fact that *Archaeopteryx* had feathers, it would be easily mistaken for a reptile. These were prophetic words, as John Ostrom would show a hundred years later when he saw that *Archaeopteryx* was misidentified as a pterodactyl. In 1973 and again in 1988, two other specimens of *Archaeopteryx* were discovered hiding under assumed names in collections in Germany. Once again, *Archaeopteryx* had been identified as *Compsognathus*. It appears that Huxley was right: *Archaeopteryx* is a feathered dinosaur.

"Seven skeletons, one feather.... Nearly half of all known skeletons were initially misidentified, one mistaken for a pterosaur, two others mistaken for the small dinosaur *Compsognathus*...."

Questions

1. What were the characteristics of *Archaeopteryx* that caused such confusion? Is it a bird or is it a reptile? List the characteristics that *Archaeopteryx* has that are similar to those of a bird and list those characteristics that are similar to those of a reptile.
2. Whereas evolutionists such as Huxley were delighted with the discovery of *Archaeopteryx*, Creationists (even today) argue that *Archaeopteryx* is no big deal. What is their problem with viewing these specimens as proof that evolution did occur? Why don't they accept the evidence that *Archaeopteryx* is a transitional form?

References

- Gish, D.T., 1978. *Evolution? The Fossils Say NO!* Creation-Life Publishers, San Diego, CA, pp 82–93.
- Wellenhofer, P., 1990. *Archaeopteryx*. *Scientific American*, May 1990, pp 70–77.

Internet Sites

- Nedin, C. Adelaide Univ., Australia. "All About Archaeopteryx." The Talk.Origins Archive. Last accessed June 17, 2010. <http://www.talkorigins.org/faqs/archaeopteryx/info.html>.
- Nedin, C. Adelaide Univ., Australia. "Archaeopteryx: Answering the Challenge of the Fossil Record." The Talk.Origins Archive. Last accessed June 17, 2010. <http://www.talkorigins.org/faqs/archaeopteryx/challenge.html>.

Part II – Ostrom’s Dilemma

Ostrom’s mind was whirling. He had just discovered the fifth specimen of *Archaeopteryx* lying in a museum drawer. It had been there, misidentified as a flying reptile, a pterosaur, for 115 years. In fact, he realized it must have been the very first *Archaeopteryx* found. It was discovered in 1855, six years before the naming of the “first” fossil feather or random specimen. This meant that the name *Archaeopteryx lithographica* was invalid! What a discovery—and what a taxonomic mess.

Archaeopteryx had always been almost magical. It was the world’s most famous fossil. It had served as the linchpin to many arguments. For evolutionists it was the perfect transition species, the first bird, and stuck in the creationists’ craw. But it was a problem for evolutionists as well, for although it was a perfect intermediate between modern birds and reptile ancestors, some of its characteristics seemed quite modern. The flight feathers, for example, were asymmetrical, indicating that *Archaeopteryx* was indeed a flying bird. Yet some experts argued that *Archaeopteryx* didn’t have the wing anatomy for real flight, but must have merely glided.

This gave rise to other questions. How did flight originate? Evolutionists argued it evolved separately four different times: first in insects, then in pterodactyl ancestors, later in the birds, and finally in mammals, when bats originated. Clearly, having the ability to fly was a successful strategy, but were the steps of evolution the same in each case? It appeared to some people that bats had evolved from ancestors that lived in trees, first jumping from tree to tree and gliding like flying squirrels. Was this the route *Archaeopteryx* had taken, evolving from a gliding reptile, an arboreal (“trees down”) ancestry? Or was it from the “ground up”? Did *Archaeopteryx*’s ancestors run across the ground like a modern-day road runner? If so, how did they develop their wings into flight appendages? What did they use their “wings” for before they could fly? And feathers? What could feathers possibly be used for before flight?

Archaeopteryx seemed part of the dinosaur legacy, too. Ostrom was convinced that Huxley was right when he thought birds were descended from a kind of dinosaur. Look how easily *Archaeopteryx* was confused with the bipedal dinosaurs. If it weren’t for the feathers, birds would be classified as reptiles. What an interesting problem it would be if reptiles were found one day with feathers. Perhaps a fuzzy down of feathers covered the skin of some dinosaurs before flight became possible. But if we found such dinosaurs, should we call them birds? If dinosaurs were the ancestors of birds, then surely the “ground up” hypothesis of bird flight must be correct, for dinosaurs run across the ground. They’re not in trees!



Fig. 703.

Archaeopteryx lithographica H. v. Meyer. Nach dem Berliner Skelet aus dem lithographischen Schiefer von Eichstätt. $\frac{2}{1}$ nat. Gr. cl Cavicula, co Coracoid, h Humerus, r Radius, u Ulna, c Carpus.

Ostrom had 10 minutes to think before the museum curator returned. What should he do? Should he tell him what he had found? Would von Regteren Altena let him take the extraordinary specimen away to study if he did? Or would he turn the fossil over to local specialists to describe? Ostrom's golden opportunity would slip through his fingers. Maybe he ought to keep his mouth shut and just ask to borrow the specimen. Later, when he was back at Yale, he could say he found the feathers. But this would be reprehensible, dishonest, selfish. And yet, was he willing to forgo the possible glory of describing the new *Archaeopteryx* specimen just to satisfy a point of honor?

He had no choice. When the curator returned, Ostrom showed him the feather impressions and told him that this was the fifth *Archaeopteryx* specimen. He asked to borrow it.

Van Regteren Altena looked at it a long minute. Ostrom's tension mounted. His heart was racing. Saying nothing, the curator picked up the slab and counterslab and disappeared into the depths of the museum. Ostrom watched his great opportunity vanish with the specimen. He was stunned. "You blew it, John. You blew it!"

Questions

1. Why would there be a taxonomic problem coming out of Ostrom's discovery? How might such a problem be resolved?
2. Who were the ancestors of birds?
3. How do experts today view *Archaeopteryx's* role in the phylogeny of birds?
4. What are the arguments for the "ground up" vs. the "trees down" hypotheses for the origin of bird flight?
5. Should Ostrom have told the curator the truth?



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