Darwin's *Archaeopteryx* prophecy

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The recent controversy about the British Museum's *Archaeopteryx* has brought renewed interest in the early history of the fossil and its importance (Wellnhofer, 1990). Discovered in 1861 in the Solenhoven quarries, this fossil "bird" flew into the storm surrounding Darwin's *Origin of Species*. After the discovery of the more complete Berlin specimen in 1877, *Archaeopteryx* was recognized by many to be a true transition between the classes Reptilia and Aves. Such a find should have been a great boost to Darwin and his theory of evolution by natural selection; however, he was publicly cautious. But an examination of Darwin's correspondence shows his excitement and pleasure with the fossil. Moreover, there is evidence that he predicted the discovery of an *Archaeopteryx*-like fossil over two years before its formal description.

The early history of the fossil is outlined by De Beer (1954) in his critical study of the British Museum's specimen. But details of the original discovery are irrelevant with respect to Darwin since he did not know or correspond with M. Haberlein, the original owner; M. Witte, who first examined the fossil; H. von Meyer, who published a short note naming *Archaeopteryx* in 1861; and A. Wagner, who published a description of the fossil in 1861. Wagner's paper was translated by W. S. Dallas and published in 1862 in the *Annals and Magazine of Natural History*, and this translation was likely Darwin's first information about the fossil since he had a subscription to the *Annals* ... (Burkhardt and Smith, 1985; Burkhardt and Smith, 1990). But Wagner's conclusion that the fossil, which he named *Griphosaurus*, was of a "reptile with the simple tarsal bone of a bird, and with epidermic structures presenting a deceptive resemblance to birds' feathers" would not have given Darwin the impression that the fossil would be the long sought after evidence of evolution. Furthermore, Wagner leveled a charge against a "Darwinian interpretation" of the fossil. He challenged "Darwin and his adherents" to find the transitions between *Griphosaurus* and reptiles and *Griphosaurus* and birds (Wagner, 1862).

Later in 1862, the *Annals* ... published a second paper on *Archaeopteryx*, the English translation of H. von Meyer's description of the isolated Jurassic feather. This paper described the feather as belonging to the species *Archaeopteryx lithographica*, and since the London specimen had feather impressions Meyer thought his isolated feather would have come from a similar animal. Meyer did not, however, deal with the Darwinian implications of the fossil (Meyer, 1862).

There is no evidence that Darwin took exceptional note of these papers. The different taxonomic names given to the fossils may have contributed to Darwin's not realizing that *Griphosaurus* was indeed a fossil bird. *Archaeopteryx* was originally named by Meyer in 1861 in a short note announcing the discovery of the British
Museum’s specimen. Meyer’s paper was published just weeks before Wagner’s paper. Therefore, Wagner’s *Griphosaurus* is a junior synonym of *Archaeopteryx* (De Beer, 1954).

During this time the fossil was being purchased by the British Museum and arrived in London on 1 October 1862 (De Beer, 1954). Richard Owen quickly prepared a study of the fossil and presented a paper to the Royal Society on 20 November 1862. In the audience was Hugh Falconer who wrote Darwin on 3 January 1863 about Owen’s paper. Falconer was not impressed with Owen’s research and he recognized the importance of *Archaeopteryx* to Darwin. Falconer’s letter reads:

21 Park Crescent N.W.
3d Jan 63
My Dear Darwin,

... I was sorry to hear from your brother of the efflorescence which has been troubling you—and which he tells me is one of the reasons that has prevented you from coming to town. You were never more missed—at any rate by me—for there has been this grand Darwinian case of the *Archaeopteryx* for you and me to have a long jaw about. Had the Solenhofen quarries been commissioned—by august command—to turn out a strange being à la Darwin—it could not have executed the behest more handsomely—than with the *Archaeopteryx*. This is sober earnest—and that you should not have been in to town and see it and talk over it with me is a criminal proceeding. You are not to put your faith in the slip-shod and hasty account of it given to the Royal Society. It is a much more astonishing creature—than has entered into the conception of the describer—who compares it with the Raptors & Passeres & Gallinacea as a round winged (like the last) “bird of flight”. It actually had at least two long free digits to the fore limb, and those digits bearing claws as long and strong as those on the hind leg. Couple this with the long tail—and other odd things—which I reserve for a jaw and you will have the gist of the mis-begotten bird creature—the dawn of an oncoming conception à la Darwin but I will not say more about it till you show yourself in town. A ludicrous event has turned up. John Evans appears to have hit upon the very obvious cast of the interior of the skull—undetected by the describer and before Owen’s paper is out. We have Mr. Mackie describing the hemispheres and optic lobes of *Archaeopteryx*! Look to the geologists...

My dear Darwin
Yours ever sincerely,
H Falconer

Darwin responded immediately (Darwin, 1897).

Down
Jan. 5th 1863
My dear Falconer,

... I particularly wish to hear about the wondrous Bird; the case has delighted me, because no group is so isolated as Birds. I much wish to hear when we meet which digits are developed; when examining birds two or three years ago, I distinctly remember writing to Lyell that some day a fossil bird would be found with end of wing cloven, i.e. the bastard wing and other part both well developed...

Ever my dear Falconer
Yours most truly
Ch. Darwin.

Did Darwin predict the discovery of an *Archaeopteryx*-like fossil? The mentioned letter to Lyell was written on 11 October 1859 and dealt in part with the differences between rudimentary and nascent organs.

Oct. 11th [1859]
My dear Lyell

... On theory of Nat. Select. there is a wide distinction between rudimentary organs & what you call germs of organs & what I call in my bigger book, “nascent” organs. An organ should not be called rudimentary unless it be useless,—as teeth which never cut through gums—the papilla representing the pistil in male flowers—wing of Apteryx,2 or better, little wings under soldered elytra. These organs are
now plainly useless, & a fortiori they would be useless in a less developed state. Natural selection acts exclusively by preserving successive slight, useful modifications, hence nat. select. cannot possibly make a useless or rudimentary organ. Such organs are solely due to inheritance ... & plainly bespeak an ancestor having the organ in a useful condition.—They may be, & often have been worked in for other purposes; & then they are only rudimentary for the original function, which is sometimes plainly apparent. A nascent organ, though little developed, as it has to be developed, must be useful in every stage of development. As we cannot prophecy (sic) we cannot tell what organs are now nascent; and nascent organs will rarely have been handed down by certain members of a class from a remote period to present day, for beings with any important organ but little developed will generally have been supplanted by their descendants with the organ well developed ... The small wing of Penguin, used only as a fin might be nascent as a wing; not that I think so; for whole structure of bird is adapted for flight, & a penguin so closely resembles other birds that we may infer that its wings have probably been modified & reduced by nat. select. in accordance with its sub-aquatic habits. Analogy thus often serves as a guide in distinguishing whether an organ is rudimentary or nascent. ... The bastard-wing of birds is rudimentary digit; & I believe that if ever fossil birds are found very low down in series, they will be seen to have a double or bifurcated wing. Here is a bold prophecy! To admit prophetic germs is tantamount to rejecting theory of Natural Selection.—... Yours most truly
C. Darwin (Burkhardt and Smith, 1991).

Darwin's prediction, while not dealing with the evolution of wings for flight, concerned the evolution of a rudimentary structure called the bastard wing, or the alula, which is formed from the much reduced first digit of the forelimb. Archaeopteryx, whose digits were well developed, was consistent with his prediction. Clearly well before the publication of the first German description of Archaeopteryx in 1861, the first English details about the fossil in 1862, and Owen's analysis in November 1862, Darwin predicted an important characteristic about the wing of a yet to be found fossil bird.

In subsequent editions of the Origin of Species, Darwin (1872) downplayed the importance of Archaeopteryx as a transitional fossil. Instead, he focused on how the fossil illustrated the incomplete nature of the fossil record. In the Descent of Man (Darwin, 1871), he refers to evidence by Huxley (1868) that Archaeopteryx is intermediate between the reptiles and the birds, but his presentation is limited to just one sentence rather than trumpeting the discovery.

In his private writings, Darwin was much more enthusiastic about Archaeopteryx. In a letter to Professor James Dana written just after he received Falconer's letter, Darwin wrote:

Jan 7th [1863] Down Bromley Kent
My dear Prof. Dana
... The fossil Bird with the long tail & fingers to its wings (I hear from Falconer that Owen has not done the work well) is by far the greatest fossil of recent times. This is a grand case for me; as no group is so isolated as Birds; & it shows how little we know what lived during former times ... Ch. Darwin³

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NOTES
1 Hugh Falconer to Charles Darwin, 3 January 1863, American Philosophical Society Library. Courtesy American Philosophical Society Library.
2 The Aptyx is New Zealand’s kiwi.
3 Charles Darwin to James Dana, 7 January 1863, American Philosophical Society Library. Courtesy American Philosophical Society Library.

REFERENCES
HUXLEY, T. H., 1868 On the animals which are most nearly intermediate between the birds and reptiles. Annals and Magazine of Natural History ser. 4, 2: 66–75.

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