EUREKA! AND THEN "DELAY"

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> ***WHEN on board H.M.S. 'Beagle,' as naturalist, I was much struck with certain facts in the distribution of the inhabitants of South America, and in the geological relations of the present to the past inhabitants of that continent. These facts seemed to me to throw some light on the origin of species—that mystery of mysteries, as it has been called by one of our greatest philosophers. On my return home, it occurred to me, in 1837, that something might perhaps be made out on this question by patiently accumulating and reflecting on all sorts of facts which could possibly have any bearing on it. After five years' work I allowed myself to speculate on the subject, and drew up some short notes; these I enlarged in 1844 into a sketch of the conclusions, which then seemed to me probable: from that period to the present day I have steadily pursued the same object. I hope that I may be excused for entering on these personal details, as I give them to show that I have not been hasty in coming to a decision.***[1]

This quotation is the beginning paragraph of the first edition of *The Origin of Species*, published in 1859. The full title of this ground-breaking book was *On*

the Origin of Species by Means of Natural Selection, or The Preservation of Favoured Races in the Struggle for Life. After Charles Darwin returned to England from the *Beagle* voyage in late 1836, he received reports in early 1837 from specialists on the fossils he had collected in South America and on the finches and mockingbirds collected in the Galápagos Islands, as well as many other collections. Soon thereafter he embarked on a detailed research project that eventually led to the publication of *The Origin of Species*.

Persistent questions surround Darwin's research leading up to *The Origin of Species*, among which are principally: 1) when were the crucial discoveries first made that led Darwin to his concepts of evolution and natural selection, and 2) after coming to the theory of natural selection in 1838, why did it then take him until 1859 to publish his theories?[2] Conventional answers to these questions have the character of persistent myths. The first, oft quoted, is that recognition of the diversity of the Galápagos finches, different from island to island and derived from mainland South America, led to a "Eureka moment" in the Galápagos in which Darwin was instantly converted to evolutionary ideas. The second is that after conceiving the theory of natural selection early on and preparing unpublished manuscripts of his theory in 1842 and1844, he then delayed publication for fifteen years, until he was forced to publish on receiving Alfred Wallace's independently derived manuscript on natural selection in 1858. The discussion of these myths is the focus of the present essay. But first it is necessary to summarize Darwin's background prior to the *Beagle* voyage.

Charles Darwin embarked on the H. M. S. *Beagle* on December 27, 1831. He was then nearly 23, having been born on the same day as Abraham Lincoln on February 12, 1809. He attended day school in Shrewsbury, England starting from the age of 8 upon the death of his mother. Prior to that, he was tutored by one of his older sisters, Caroline. At 16 starting in October 1825 he attended medical school at Edinburgh University for two years at his physician father's suggestion and wishes. In his autobiography, Darwin states that he was repelled when he witnessed only two operations (before the days of anesthesia) and considered all of the lectures "intolerably dull," except those by a professor of chemistry. He expressed the general view that "there are no advantages and many disadvantages in lectures compared with reading." [3]

Although uninterested in the pursuit of medicine, he befriended several colleagues who were also deeply interested in natural history and he studied with the zoologist, Robert Grant, who was doing research on marine invertebrates. Grant was a committed follower of the early French evolutionist, Lamarck; Grant probably chose Darwin to work with him because of his grandfather, Erasmus Darwin, a contemporary of Lamarck who published a book, *Zoonomia*, advocating evolution. On a walk one day, Darwin was surprised by an outburst from Grant strongly expounding on Lamarck's evolutionary views:

> **"I listened in silent astonishment, and as far as I can judge, without any effect on my mind. I had previously read the *Zoonomia* of my**

grandfather, in which similar views are maintained, but without producing any effect on me. Nevertheless it is probable that the hearing rather early in life such views maintained and praised may have favoured my upholding them under a different form in my *Origin of Species.*" [4]

Although Darwin claims in his autobiography, written in 1876, not to have accepted these views during his time in Edinburgh, it is probably significant that he was aware of what was then the minority view of "transmutation" (as evolution was termed at the time) against the prevailing one among naturalists regarding the immutability or permanence of species.

Thus, the period in Edinburgh ended with Darwin unwilling to pursue a career in medicine. "He would become himself only by leaving medicine behind," in the words of the excellent biography by Janet Browne. For the first time, Darwin's father was furious with him: "You care for nothing but shooting, dogs, and rat-catching, and you will be a disgrace to yourself and all your family." [5] Charles spent the rest of 1827 cramming with a tutor to recover his knowledge of Latin and Greek, first learned at school, in order to enter Cambridge University to prepare for the clergy, following his father's proposal that he must find a suitable profession and not become "an idle sporting man."

In his autobiography, Darwin wrote that his three years at Cambridge were "wasted, as far as the academical studies were concerned, as completely as at

Edinburgh and at school." [6] But consider that this was written in 1876, long after the experience. On the contrary, he came under the personal influence of a mentor who proved to be pivotal for his later career in natural history. This was John Stevens Henslow, Professor of Botany, who was widely versed in a number of sciences including having earlier been a professor of mineralogy. Darwin attended Henslow's lectures in botany and eventually became a personal friend. These lectures represented "the only formal instruction in natural science undertaken during his entire Cambridge career." [7] Darwin passed his degree examinations in January 1831. During the final months there he came to know Henslow closely, taking long walks with him and joining family dinners. Some of the other Cambridge dons spoke of Darwin as "the man who walks with Henslow." [8]

In the early part of 1831, Darwin dreamed of an expedition to the Canary Islands and made tentative plans to go there. Henslow thought that Darwin needed instruction in geology in order to study the volcanic terrain of the Canaries. Darwin had been unimpressed with Robert Jameson's lectures on the subject at Edinburgh and had little exposure to geological instruction up to that time. Thus, it was Henslow who recommended that Adam Sedgwick, the first professor of geology at Cambridge, take Darwin along as his assistant during his field work in north Wales in August 1831. Mapping the complicated ancient rocks of Wales, sometimes with Sedgwick and sometimes independently, was Darwin's real introduction to geological research. On returning to his home in Shrewsbury, he

found a letter waiting from Henslow, announcing an once-in-a-lifetime opportunity.

Crucially, it was Henslow who recommended that Captain FitzRoy take on Darwin as his unpaid, scientifically inclined gentleman companion on the H.M.S. *Beagle*, and additionally stressed his potential as a naturalist.[9] There is the minor myth that Darwin was hired as the ship's naturalist, but that position in the royal navy was officially that of the ship's surgeon, in this case Robert McKormick.[10] FitzRoy thought he needed a companion at meals, because of the solitude of the captain's situation – he could not share mess with the officers under him. Furthermore, during the previous South American voyage of the *Beagle* the captain had committed suicide, forcing FitzRoy to assume command. McCormick resigned early in the voyage because of Darwin's prodigious collecting abilities (he collected thousands of specimens shipped and carried back to England).

The offer to Darwin had been made previously to two individuals, Henslow himself who may have briefly considered accepting but could not leave Cambridge and Leonard Jenyns, Henslow's brother-in-law, a Cambridge graduate, curate, and naturalist, who decided he could not leave his parish so soon after being appointed.[11] At first Darwin was forced to turn it down also, because of pressure from his father who thought of it as further backsliding on his son's part. But Robert Darwin reconsidered and relented to the extent that if Charles could find any man of common sense who advised him to accept, Robert

would agree. That proved to be Charles' uncle Josiah Wedgwood II, who wrote a convincing letter detailing eight reasons why he should accept the offer of sailing on the *Beagle*. Thus, these contingencies enabled Darwin to sail on the five-year *Beagle* voyage, a momentous turning point in intellectual history. For would he have developed his demonstration of evolution and would we have ever heard of him, had he not gone?

The *Beagle* sailed from Plymouth on December 1831 and returned in October 1836, its primary purpose being to survey the eastern and western coasts of southern South America. In contrast with the common view, it can be argued that Darwin did not embark holding a conceptual blank slate on the subject of creationism versus transmutation (= evolution). Rather that he went with the idea of gathering empirical evidence to shed light on the question.

The first significant evidence on the question came at Bahia Blanca in Argentina in September and October, 1832, where Darwin discovered gigantic, extinct fossil mammals related to present day, smaller South American ground sloths and armadillos.[12] Later in 1833 and 1834, he observed geographic replacement in living species from north to south in Patagonia of the *Rhea*, a South American ostrich-like bird and the distinction between the West and East Falkland Islands fox. Thus, he had observed replacement both in time and space of species restricted (endemic) to South America, evidence collected first hand falling on the side of transmutation.

Darwin kept extensive notes and diaries during the voyage. He was plagued by seasickness while on the ship but spent the majority of the time in South America in his own expeditions on land. Besides the notes and diaries, he wrote an essay termed **February 1835**, discussed at length by the paleontologist and Darwin scholar, Niles Eldredge.[13] In this essay, Darwin briefly summarized the implications of his fossil discoveries supporting species replacement through time and he made the analogy between the birth and death of species with that of individual organisms.

> **If the existence of species is allowed, each according to its kind, we must suppose deaths to follow at different epochs, & then successive births must repeople the globe. . . There is no more wonder in extinction of species than of individuals.**[14]

In *The Origin of Species*, Darwin titled this concept: "On the Succession of the same Types within the same areas."[15] In his reading of the **February 1835** essay, Eldredge comes to the following conclusion:

> **The importance of Darwin's explicit analogy between the deaths of individuals and the deaths of species cannot be overemphasized. . . At stake here is nothing less than the origin of Darwin's transformational views—as made explicit 2 years later in the second half of the famous "Red Notebook"(Darwin, 1836a-1837).**[16]

Eldredge's is a remarkable conclusion because it contrasts with much Darwin scholarship, which places Darwin's acceptance of evolution to a later period not before early 1837, after his return to England when he received the opinions of London specialists on the identity of his South American fossil and Galápagos bird collections.

Charles Darwin set foot in the Galápagos on Chatham Island (Isla San Cristobal) on September 16, 1835. Darwin spent a total of nineteen days, some just a partial day, on land in the archipelago.[17] He was on three other islands (Charles=Santa Maria, Albemarle=Isabela, and James=Santiago) in the Galápagos, which lie on the equator about 600 miles west of the western coast of South America. Two subjects, the finches and the mockingbirds, relate to the myth that Darwin experienced a "Eureka" moment concerning evolution during this part of the Beagle voyage. *First, the finches*:

In exceptional contrast to his otherwise consistent collecting practice throughout the voyage, Darwin did not label from which island the finches came.[18] This was apparently due to the fact that he observed "a confusing mélange of variation that is more or less the same on each island he visited."[19] "Darwin was more impressed by the apparent differences than by the similarities among these unusual finch species" such that he "correctly identified *as finches* only six of the thirteen species" [20] presently recognized in the Galápagos. Some he thought belonged to other kinds of birds, such as grosbeaks, wrens, and a group related

to orioles and blackbirds.[21] In March 1837 (nearly a year and a half after Darwin had left the islands and returned to England), John Gould, England's leading ornithologist, recognized all of these as thirteen new finch species, which are endemic to the Galápagos.[22]

Contrary to the myth of Darwin's eureka-like conversion to evolution due to his observations on the variation and distribution of the Galápagos finches, they were nowhere specifically cited, let alone given prominence in *The Origin of Species*.[23] After Gould convinced Darwin of his view of the thirteen species of finches, an attempt was made to unscramble the geographic distribution of each species by reference to Captain FitzRoy's meticulously labeled collections and those of two other *Beagle* shipmates. That there was remaining doubt about the exact locality of Darwin's own collections is probably one reason why they did not serve as a prime illustrative example in *The Origin of Species*. Another perhaps more important reason is that the finches do not represent a simple case of each species being confined to just one island.

The Galápagos *mockingbirds*, however, are a different story, and although they are not directly part of the "Eureka" myth, they bear on the question of when did Darwin become a transmutationist? Darwin recognized three different kinds of mockingbirds, two each restricted to one island and the third restricted to two other islands. With these collections he labeled the specimens carefully as to

their source. He also recognized that the three were related to, but different from mainland South American mockingbirds:

> **These birds are closely allied to the *Thenca* of Chile. . . . The specimens from Chatham and Albemarle Isd appear to be the same; but the other two are different. In each Isld. each kind is *exclusively* found; habits of all are indistinguishable. . . . When I see these Islands in sight of each other, & possessed of but a scanty stock of animals, tenanted by these birds, but slightly differing in structure and filling the same place in Nature, I must suspect they are only varieties. The only fact of a similar kind of which I am aware, is the constant/asserted difference—between the wolf-like Fox of East and West Falkland Islds.—If there is the slightest foundation for these remarks the zoology of Archipelagoes—will be well worth examining; for such facts (would) [inserted later] undermine the stability of Species.**[24]

This quote is from Darwin's Ornithological Notes written sometime in the summer of 1836 when the *Beagle* was on its last leg back to England. Ambiguity comes with the phrase "I must suspect they are only varieties." Most authors have interpreted this phrase literally, to mean that Darwin considered the three kinds of mockingbirds to represent varieties [that is, intraspecific variants within a species

or geographic subspecies in the modern sense]. However, a recent interpretation of the phrase states:

> **He could mean he is now *suspicious* of the idea that they are merely varieties. Thus they may be species, which would indeed "undermine the stability of Species". Or he could be going one step further. He could also mean that they are "only varieties" and that is what "would undermine the stability of species" – in which case we are witnessing the birth of Darwin's most fundamental view, namely that varieties are incipient species.**[25]

The majority of authors have taken the ambiguous phrase at face value, but if the paragraph just quoted is at all or in part accurate, Darwin is stating an evolutionary view before he returns to England and receives the opinion of John Gould in March 1837 that the three kinds of mockingbirds are indeed separate species. So, in contrast with the majority consensus that Darwin became an evolutionist only after learning the London specialists' opinions on the birds, fossil mammals, and other collections, he embraced an evolutionary interpretation at least by the time of writing of the Ornithological Notes, or even earlier in the unpublished February 1835 essay as discussed by Niles Eldredge.[26]

In summary, Darwin recognized three patterns that led him to the understanding that species were not forever immutable, that they had evolved. And this

realization was probably acquired during the *Beagle* voyage. The three patterns observed in South America and the Galápagos and Falkland islands were replacement in geologic time of the large fossil mammals at Bahia Blanca, the replacement in space of the living species of the ostrich-like *Rhea*, and the geographic isolation from island to island in the Galápagos mockingbirds and tortoises, and the West and East Falkland fox.[27] Darwin in the autobiography mentions these same three patterns, which deeply impressed him.[28]

So much for the questions of when Darwin accepted the concept that evolution of species had occurred and of the "Eureka" myth surrounding the finches. As to the discovery leading to the theory of natural selection as the causal mechanism of evolution, this was acquired starting in 1837 when he wrote the second half of the Red notebook and began the series of Transmutation notebooks, culminating in the key reading in September 1838 of Malthus' *Essay on the Principle of Population*, which Darwin interpreted as analogous to the struggle for existence in nature. How he developed this theory has been exhaustively treated in the scholarly literature on Darwin and is not repeated here.

This brings us to the second myth or legend. Why after discovering the two theories that evolution had occurred and that the mechanism was natural selection, writing a sketch in 1842 and expanding it into a fuller essay in 1844 (intended for publication only in the event of his early death as the sealed letter with it instructed his wife, Emma), did he then delay in publishing at least from

1844 to 1858? This is “the period of unexpected behavior that has been called ‘Darwin;s Delay’.“[29] *One must immediately note that this may not be a legend at all but actually is true.* Many Darwin scholars have accepted that there was this delay in publication and this is widely discussed in the twentieth century literature up to the present, although it was not mentioned as a problem by nineteenth century authors after Darwin’s death in 1882.[30]

Many explanations for the supposed delay have been presented by numerous authors, and often they emphasize just one reason as the causal factor. Robert Richards[31] has classified these explanations into five categories: 1) Darwin developed the hypothesis of natural selection in 1838 and then intensively collected facts, primarily through his reading and experiments, to bolster support over a twenty-year period; 2) He gathered facts from close colleagues such as the botanist Joseph Hooker and the geologist Charles Lyell, as well as a vast legion of correspondents (a variant of no. 1); 3) Darwin was delayed by his commitments to complete a series of other publications; 4) The wide criticism of a popular book on evolution, *Vestiges of the Natural History of Creation*, by an anonymous author (actually the Edinburgh writer and publisher, Robert Chambers), a book that was severely criticized in published reviews by his early geological mentor, Adam Sedgwick, and another close colleague, Thomas Huxley. *Vestiges* was published in 1844 shortly after Darwin had finished his essay of the same year; and 5) Darwin feared to publish for many years because the materialistic philosophy represented by natural selection would give offense

to society, and to his beloved wife, Emma, a devout religious believer. Many authors have supported the last explanation; here is an eloquent example:

> **[Darwin's notebooks, M and N] include many statements showing that he espoused but feared to expose something he perceived as far more heretical than evolution itself: philosophical materialism—the postulate that matter is the stuff of all existence and that all mental and spiritual phenomena are its by-products. No notion could be more upsetting to the deepest traditions of Western thought than the statement that mind—however complex and powerful—is simply a product of brain.**[32]

In an article attempting to refute the entire notion of a deliberate delay, John van Wyhe[33] notes that between 1839 and 1846 Darwin published 10 books: two editions of the *Journal of Researches* (popularly known now as *The Voyage of the Beagle*), five massive volume on the zoological specimens collected during the voyage, which he planned, edited, and contributed to, two volumes on the geology of South America and volcanic islands, and a third on his theory of the formation of coral atolls, plus 20 journal articles. This does not support "delay" but rather the fulfilling of commitments made prior to the inception of writing *The Origin of Species*. Wyhe also argues that there is no explicit evidence to support the explanation of fear on Darwin's part:

> **He nowhere remarks that expected criticism might influence publishing on the subject. In fact, on the contrary, every one of his statements declares that he would publish despite what others might think of him.**[34]

However, it is probable that the negative reception of the *Vestiges of the Natural History of Creation*, spurred Darwin into continuing to accumulate evidence to bolster the theories of evolution and natural selection, an effort reinforced by his perfectionist tendencies, which are apparent from the barnacle studies.[35]

In the eight years between 1846 and 1854, Darwin did research and eventually published four monographs on all the known living and fossil barnacles.[36] This started with the intention of writing a short paper on the remaining undescribed zoological specimens from the voyage, an abnormal barnacle species, but developed into a comprehensive study of the entire group, which was then poorly known. Darwin estimated that one to two years of this period were lost to debilitating illness—he was partially an invalid during much of this period, typically working only a few hours each day.

The barnacle research resulted in Darwin attaining great expertise as a systematic zoologist, which he thought was necessary before writing *The Origin*. In an 1845 letter to Darwin, Joseph Hooker had criticized a French pamphlet on species saying how much labor was required to establish a valid species and

how much skill and judgment were involved in grouping species into a useful classification.[37] Darwin replied:

> **How painfully (to me) true is your remark that no one has hardly a right to examine the question of species who has not minutely examined many.**[38]

One of the principal results of the barnacle research was that Darwin was able to observe for the first time a comparable degree of variation in natural populations of species, as he had observed in domestic populations due to artificial selection.[39]

In a deep analysis of Darwin's research from 1838 to 1859, Dov Ospovat has demonstrated how the theory of natural selection evolved and was substantially transformed from the essay of 1844 to the writing and publication of *The Origin* in 1859.[40] From this I interpret Ospovat's book to mean that *The Origin* as we know it could not have been published in 1844. If he is correct, this argues strongly against the idea of a "delay." Although it is a complex problem, I think that Darwin's effort not only to refine but to strengthen the theories with more evidence was a major factor in why publication took so long.

After gathering all his notes starting in late 1854, Darwin started to write his big book on species and natural selection in 1856. By 1858 when he received the

momentous manuscript from Alfred Russel Wallace, he had completed 10 chapters of *Natural Selection* projected to encompass two volumes.[41]

As is widely known and discussed in the scholarly literature, in June 1858 Darwin received a manuscript sent from the Malay Archipelago laying out Wallace's independently conceived theory of natural selection. "Darwin was stunned." [42]

> **I never saw a more striking coincidence. If Wallace had my MS sketch written out in 1842 he could not have made a better short abstract.**[43]

Wallace requested that Darwin, provided he thought the MS worthwhile, to forward it to Charles Lyell to consider recommending it for publication. Darwin wrote to Lyell and forwarded it on. Lyell and Joseph Hooker, with Darwin's agreement, presented Wallace's MS, together with extracts from Darwin's 1844 essay and his 1857 letter to Asa Gray, botanist of Harvard, at the next meeting of the Linnean Society of London. These were published in the Linnean Society Journal in August, 1858.[44]

Then in a matter of some 15 months Darwin condensed what he had written in *Natural Selection*, as well as adding further material, into what he always regarded as an "abstract." This was *The Origin of Species* published in

November, 1859, numbering 490 pages. It is no exaggeration to say that this was a book that changed the world.

To end this essay, permit me to quote from a beautiful poem.

He softly shuts the door,
And leans against it for a spell before
He climbs the stairs, holding the banister,
Up to their room: there
Emma sleeps, moored
In illusion, blown past the storm he conjured
With his book, into a harbor
Where it all comes clear,
Where island beings leap from shape to shape
As to escape
Their terrifying turns to disappear.
He lies down on the quilt,
He lies down like a fabulous-headed
Fossil in a vanished riverbed,
In ocean drifts, in canyon floors, in silt,
In lime, in deepening blue ice,
In cliffs obscured as clouds gather and float;
He lies down in his boots and overcoat,

And shuts his eyes.

This is the last stanza of *Darwin in 1881* by Gjertrud Schnackenberg[45]

Endnotes:

[1]Darwin, Charles, 1859, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle of Life*: John Murray, London, Introduction, p. 1. See *On the Origin of Species*, A Facsimile of the First Edition, with an Introduction by Ernst Mayr: Harvard University Press, Cambridge, MA, 1964, 18th printing 2003, p. 1. Also available on the web at: http://darwinlibrary.amnh.org/index.php?globalnav=manuscripts&sectionnav=toc&document_id=185

[2]Note that there are at least two separate theories involved: 1) Evolution as such, "that organism are transformed in time," and 2) the proposal of the causal mechanism, natural selection. See Mayr, Ernst, 1991, *One Long Argument; Charles Darwin and the Genesis of Modern Evolutionary Thought*: Harvard University Press, Cambridge, MA. Mayr (p.36, 37) discriminated five separate theories in *The Origin of Species*, but the two cited here are the principal ones for the purposes of this essay.

[3]Barlow, Nora, ed., 1958, *The autobiography of Charles Darwin*, 1809-1882: W. W. Norton & Company, New York, p. 47-48. With regard to his preference for reading, the following quotation emphasizes this point: “As a fledgling student at Cambridge University in the late 1820s, Darwin read all seven volumes and 3,754 pages of Humboldt’s *Personal Narratives*. He was so enamored of Humboldt’s descriptions of the Tropics that he read them over and over, committing parts to memory and reciting them aloud until he drove his friends crazy” (Carroll, Sean B., 2009, *Remarkable Creatures: Epic Adventures in the Search for the Origins of Species*, Houghton Mifflin Harcourt, Boston, New York, p. 8).

[4]Barlow, ed., p. 49.

[5]Browne, Janet, 1995, *Charles Darwin: Voyaging*, volume I of a Biography: Alfred A. Knopf, New York, p. 88, 89.

[6]Barlow, ed., p. 58.

[7]Browne, p. 118.

[8]Browne, p. 123.

[9]Browne, p. 151.

[10]Gould, Stephen Jay, 1977, *Ever Since Darwin*: W. W. Norton & Company, New York, p. 28-31.

[11]Browne, p. 152. Jenyns, however, was so close to accepting that he had packed his clothes (Thomson, Keith, 2009, *The Young Charles Darwin*: Yale University Press, New Haven, p. 133).

[12]Eldredge, Niles, 2009, *Experimenting with Transmutation: Darwin, The* Beagle*, and Evolution*: Evolution: Education and Outreach, v. 2, no. 1, p. 37-39 [http://www.springerlink.com/content/54n5418h4g7676wu/fulltext.pdf: DOI 10.1007/s12052-008-0103-2].

[13]Eldredge, p. 43-47. See also Herbert, Sandra, 2005, *Charles Darwin, Geologist*: Cornell University Press, p. 310-311.

[14]Darwin, Charles, 1835, February 1835. Dar 42+97-102. Cambridge (UK): Darwin Archive, Cambridge University Library; quoted in Eldredge, p. 43, 49.

[15]Darwin, 1859, Chapter X, p. 338-341.

[16]Eldredge, p. 44.

[17]Sulloway, Frank J., 1984, *Darwin and the Galapagos*: Biological Journal of the Linnean Society, v. 21, p. 33, caption to figure 1.

[18]Sulloway, Frank J., 1982a, *Darwin and his finches: The evolution of a legend*: Journal of the History of Biology, v. 15, no. 1, p. 1-53. Darwin wrote "Unfortunately most of the specimens of the finch tribe were mingled together." (Darwin, 1845, *Journal of Researches into the Natural History and Geology of the Countries Visited during the Voyage of H.M.S.* Beagle *round the World, under the command of Capt. Fitz Roy, R. N.*, 2d edition. London: John Murray, p. 395. This volume is now generally known as *The Voyage of the Beagle*.): http://darwin-online.org.uk/content/frameset?itemID=F14&viewtype=text&pageseq=1

[19]Eldredge, p. 48.

[20]Sulloway, 1984, p. 42. Emphasis in the original.

[21]Browne, p. 304.

[22]Sulloway, 1984, p. 45. There is a fourteenth species that is restricted to Cocos Island offshore of Costa Rica.

[23]Sulloway, 1984, p. 41 and footnote 9. It is true, however, that Darwin mentioned the finches in his second edition of *The Voyage of the Beagle* published in 1845, illustrating four of the species, and commenting: “Seeing this gradation and diversity of structure in one small, intimately related group of birds, one might really fancy that from an original paucity of birds in this archipelago, one species had been taken and modified for different ends.” (Darwin, 1845, p. 379, 380).

[24]Eldredge, Niles, 2005, *Darwin: Discovering the Tree of Life*: W. W. Norton & Company, New York, p. 64. Also quoted by Sulloway, 1982b, *Darwin’s Conversion: The Beagle Voyage and its Aftermath*: Journal of the History of Biology, v. 15, no. 3, p. 327-328. See Herbert, 2005, p. 316, figure 9.3, for Peter R. Grant’s different distribution and taxonomy of the mockingbird species.

[25]Kohn, David, Murrell, Gina, Parker, John, and Whitehorn, Mark, 2005, *What Henslow taught Darwin: How a herbarium helped to lay the foundations of evolutionary thinking*: Nature, v. 436, p. 645.

[26]Eldredge, 2009, p. 43-47.

[27]Eldredge, 2005, p. 59-65.

[28]Barlow, ed., 1958, p. 118-119.

[29]Quammen, David, 2006, *The Reluctant Mr. Darwin: An Intimate Portrait of Charles Darwin and the Making of His Theory of Evolution*: W. W. Norton & Company, New York, p. 84.

[30]Wyhe, John van, 2007, *Mind the Gap: Did Darwin avoid publishing his theory for many years?*: Notes & Records of The Royal Society, v. 61, p. 177-205.

[31]Richards, Robert, 1983, *Why Darwin delayed, or interesting problems and models in the history of science*: Journal of the History of the Behavioral Sciences, v. 19, p. 46-47.

[32]Gould, Stephen Jay, 1977, *Ever Since Darwin*: W. W. Norton & Company, New York, p. 23, 24.

[33]Wyhe, p. 189-190.

[34]Wyhe, p. 192.

[35]For a balanced view giving both sides of the question of the "Delay," see Quammen, p. 84-92.

[36]Stott, Rebecca, 2003, *Darwin and the Barnacle*, W. W. Norton & Company, New York. Stott, Rebecca, 2002, *Darwin's barnacles: mid-century Victorian natural history and the marine grotesque*, *in* Transactions and Encounters: Science and Culture in the nineteenth century, ed. by R. Luckhurst and J. McDonagh: Manchester University Press, Manchester, p. 151-181. Bowler, Peter J., 1990, *Charles Darwin: The Man and his Influence*: Basil Blackwell Ltd, Oxford, p. 101-103.

[37]Browne, p. 470.

[38]Quoted on the same page as [37].

[39] The barnacle studies gave Darwin "new insights into the problems of adaptation, classification, and the relationships between embryonic and adult forms." (Bowler, Peter J., 2007, *Monkey Trials and Gorilla Sermons: Evolution and Christianity from Darwin to Intelligent Design*: Harvard University Press, Cambridge, Massachusetts, p. 94.)

[40]Ospovat, Dov, 1981, *The Development of Darwin's Theory: Natural History, Natural Theology, and Natural Selection, 1838-1859*: Cambridge University Press, Cambridge, U.K. Also Bowler, 1990, p. 99.

[41]Stauffer, R. C., ed., 1975, *Charles Darwin's Natural Selection*: Cambridge University Press, Cambridge, U.K.

[42]Browne, Janet, 2002, *Charles Darwin: The Power of Place*, volume II of a Biography: Alfred A. Knopf, New York, p. 15.

[43]Burkhardt, Frederick, Smith Sydney, et al., eds., 1983-2001, *The correspondence of Charles Darwin*: Cambridge University Press, Cambridge, U.K., v. 7, p. 107. Quoted in Browne, 2002, p. 15.

[44]That there are striking differences in the papers published by Darwin and Wallace in 1858 has been emphasized by Kutschera (Kutschera, U., 2003, *A comparative analysis of the Darwin-Wallace papers and the development of the concept of natural selection*: Theory in Biosciences, v. 122, p. 343-359).

[45]Schnackenberg, Gjertrud, 1985, *Darwin in 1881*, *in The Lamplit Answer*: Farrar, Straus, and Giroux, New York, p. 45.