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INTERVIEW

Scholar's Dilemma: "Green Darwin" vs. "Paper Darwin," An Interview with David Kohn

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When David Kohn retired from Drew University in 2005 as Oxnam Professor of Science and Society, his "golden years" quickly turned green. After an influential career focused on what he calls the archival, "paper Darwin," Kohn planned to spend more time riding his bicycle and maybe settle down at his kitchen table to write a book or two. But what Kohn calls his "graduation" from academia brought him back full circle to his original fascination with Darwin's botany—and an exciting new "green Darwin" phase. Even before he left Drew, in 1998, Kohn was capping a full quarter century of close work on such textual matters as editing the extensive *Correspondence of Charles Darwin* and collaborating on the publication of *Charles Darwin's Notebooks: 1836–1842*, when he took a final sabbatical to chase Darwin papers in the Cambridge University Library. There he encountered Charles Darwin's great-great-great grandson Randal Keynes, who is a board member of the Charles Darwin Trust, then and now committed to restoring and preserving Darwin's home and the neighborhood around Down House.

If age has its privileges, expertise has its obligations. With his PhD in botany and his deep knowledge of Darwin's work on plants, Kohn soon agreed to help reconstruct the gardens and greenhouse at Down and to help reproduce the many plant experiments which contributed so greatly to Darwin's overarching grasp of evolution (Fig. 1). The much-neglected house and grounds were purchased in 1996 as a national monument by the government foundation English Heritage, and after Kohn came on board, a beautifully restored Down House now stands gloriously surrounded by the kitchen gardens, the flowerbeds, and the greenhouse laboratory of Darwin's plant studies.

Then, in 2003, when Niles Eldredge, the American Museum of Natural History (AMNH) curator of the 2005 *Darwin* exhibition, crossed paths with Randal Keynes at Down House, Keynes recommended Kohn to be the botany consultant for the AMNH. Not only did Kohn manage to inject a good deal of botany into the exhibition, he and Eldredge hit it off as fellow Darwin scholars. As a result, Eldredge was instrumental in establishing Kohn at the AMNH as a Research Associate. In 2006, they shared top billing as lecturers on a two-week AMNH-sponsored cruise around the Galapagos Islands, and Kohn was able to touch base with botanical contacts he had already made there. On a series of return trips to the Galapagos, Kohn is pursuing another "green Darwin," post-retirement project there, following up on his long interest in endemic plants. Ultimately, he plans to publish the results of his study of a hard-to-identify and even harder to find Galapagos endemic plant called *Bourreria* (Figs. 2 and 3).

Kohn's cultivation of what he calls "the living Darwin" literally blossomed forth last spring with a spectacular three-part show at the New York Botanical Garden (NYBG) that ran from April 25 to June 15, 2008. With much informed advice from Dr. Kohn, designers and gardeners at NYBG recreated Darwin's spring-blooming garden inside the Enid Haupt conservatory (Fig. 4). It was a complete tour-de-force, staged with a representation of the wall of Down House overlooking its garden. Inside, next to the window stood a workbench holding some of the simple tools of his momentous study: tweezers, quills, brushes, and sealing wax. On the outer side, a classic English country garden grew, filled with the spicy scents of stocks and the glowing colors of blue forget-me-nots and delphiniums,

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Fig. 1 David Kohn stands in the recreation of Darwin's garden that he helped to design and mount, April, 2008, at the New York Botanical Garden. Credit: NYBG

towering red hollyhocks, and outsized pink foxgloves. Also, there were many of Darwin's famous primroses, the plant that led to his insights about the sexuality of plants (Figs. 5, 6, and 7). Another display featured morning glories and other climbing plants whose twining ways led Darwin to the discovery of auxins, the chemical basis of such plant behavior.

Kohn mounted an equally impressive part of the show in the NYBG's Mertz Library's exhibition gallery that gloriously illustrates Darwin's long romance with botany. Kohn recalls the joy of "rummaging" through the NYBG's

Fig. 2 David Kohn in the Galapagos, in hot pursuit of *Bourreria*, subject of a Kohn & Tim Motley endemism study. Credit: Tim Motley

Fig. 3 David Kohn (and unidentified fellow botanist) zero in on *Bourreria.* Credit: M. Eldredge

stellar collection of nineteenth century botanical works, and he also made good use of his Cambridge University Library (CUL) contacts to assemble a riveting visual record. There were Darwin's own writings, including such treasures as his field notes on the vegetation of Brazil and Tierra del Fuego and his correspondence with major botanists of his day: Joseph Hooker, Director of the Royal Botanic Gardens at Kew and his greatest American apologist, Asa Gray at Harvard University. Of course, there were spectacular botanical prints of the orchids that so fascinated Darwin and some of the original herbarium sheets that preserved specimens of the plants he gathered on the Galapagos Islands. The extensive research Kohn did for this show powerfully advanced his major thesis that to fully understand how Darwin came to his ideas about natural selection we must acknowledge the central importance of his plant studies all along.

Fig. 4 Darwin's spring garden as recreated at the New York Botanical Garden. Credit: NYBG

Fig. 5 Cross-sections of *Primula vulgaris* showing the sexual variation that Darwin discovered and analyzed in his quest to uncover the dynamics of evolution. Credit: NYBG

In addition to special children's exhibits about Darwin's life and plant experiments, a third part of the NYBG Darwin show traced a living pathway of evolution through the Garden, mapping out the descent and modification of botanical life over time with appropriate stops along a schematic "tree of life" at plants from cycads to oaks that exemplify the relationships and diversifications first explained by Darwin. By coincidence, this path could be seen as a walkable chart of the meandering avenues Kohn himself wandered in his quest to discover all that led to his PhD thesis, *Darwin's Path to Natural Selection*. Although,

Fig. 6 *Primula elatior*, the oxlip variety of primrose Darwin used in his plant hybridization experiments. Credit: NYBG

Fig. 7 *Primula veris*, the cowslip variety of primrose Darwin used in his plant hybridization experiments. Credit: NYBG

unlike Darwin, Kohn was not raised as a creationist, he started Queens College as a humanities student who now recalls that even after a senior-year switch to pre-med, he had learned little enough about evolution in school: "Evolution wasn't taught *per se*, so it was a kind of field of ignorance."

Looking back, Kohn observes that when he went to New York City's Stuyvesant High School in the late 1950s, it was only 30-odd years since the Scopes trial, and American textbooks mostly skirted the subject of evolution. Even in college, he says of Darwinism, "I had a vague idea about descent, but it was more like a political, ideological groundwork than it was a scientifically structured explanation." But like Darwin and bright kids everywhere, Kohn found that his passions transcended his early education. There wasn't much nature to explore in Queens (Fig. 8), but somehow Kohn managed to find his way by subway and bus to the Palisades cliffs of New Jersey where, one fateful spring afternoon during his senior year of high school, he encountered a clump of daffodils in bloom on the bluffs. There began what Kohn calls "my intrigue forever," as he sat overlooking the Hudson River and dissected the flowers to peer and marvel at their sexual organs. When Kohn's parents bought property in New Hampshire shortly thereafter, that sealed the deal with nature, and David recalls many happy rambles with his father across the New England countryside.

Still, the rambling bypassed more scholarly avenues for many years, and only after a low-budget grand tour of Europe and a 2-year stint working on an Israeli kibbutz and learning Hebrew did Kohn finally begin his botany studies at a Harvard summer school course in plant genetics. Here was the start of a path, but the 1967 Arab–Israeli Six-Day War called him back to Israel, although "eventually, it wasn't clear what I was doing there," so he returned to the US and found work in Boston.

Fig. 8 Not immersed in nature: David Kohn ventured out of his boyhood residence, an apartment building in Woodside, Queens, to seek out greener fields of botanical interest. Credit: D. Kohn

Fig. 9 Poster celebrating the first Earth Day, acquired by David Kohn at the event in Cambridge, MA. Credit: N. Eldredge

Kohn's employer in Boston was BBN, the company established in 1948 by Bolt, Beranek, and Newman as a US military defense contractor. Their specialty was acoustics and computing—they were the folks who analyzed the 18.5-minute gap on the Nixon tapes—and they were in on the inception of web technology, working with the air force on DARPA, the Defense Research Projects Agency where the internet was born. Kohn was hired as a technical editor, learned the finer points of writing and editing, and got familiar with the digital world long before Apple was even a twinkle in Steve Jobs' eye. It is a wonderful example of how the prepared mind is furrowed in readiness for future seeds of knowledge. Close to a decade later, a conversation overheard in the Cambridge University Library (CUL) tea room led Kohn to seek out one of the early nurseries of digital publishing, Cambridge's Literary and Linguistic Computer Centre. Literally, the rest is history, since thanks to Kohn's efforts then, sixteen beautiful, fat volumes of Darwin's correspondence have been published digitally: "From the very beginning, it's been typeset by computer, and the editing process has been under computer control," Kohn says. After he took his PhD, Kohn served for five years as associate editor of the Darwin Correspondence Project in Cambridge. That is the "paper Darwin" in depth.

Back in 1970, still uncertain of where he was headed, Kohn left BBN following an "aha" moment of ardor for ecology and environmentalism during the first celebration of Earth Day along the Charles River in Cambridge (Fig. 9). He got a job as a research assistant in phytochemistry at Harvard's Gray Herbarium, where his work for an English phytochemist, Tony Swain, in the laboratory of the renowned plant paleontologist Elso Barghoorn plunged him into a lively, Darwin-oriented environment. He learned that there was such a thing as plant taxonomy, what endemism was, and published with his mentor and two other authors his first paper, "Geocarpon: Aizoaceae or Carophyllaceae?" He decided that botany was his métier.

It was a path, but a rocky one: Accepted into the botany program at the University of Massachusetts, Kohn recalls a repeat of his college days, bouncing from subject to subject and one advisor to another until his course work was almost done. Meanwhile, Kohn's ventures into hands-on, bench science were a flop since, "I could never get it to work right, was just really klutzy in the laboratory." Fortunately, one inspiring teacher introduced Kohn to the history of evolutionary biology. So he had readings in Alfred Russel Wallace, Lamarck, and Darwin's *Origin* well under his belt by then. This was a road map he could follow: "I was getting interested in history, definitely interested in the theory of evolution and then the fact that it had a history." And he realized it could also be the kernel of a career as it "really opened up the possibility that people do this, maybe you could make a living at history of science."

Here the narrative becomes a mystery story, and the path is a paper trail that leads—surprise!—to the Cambridge University Library. Once decided on his course, Kohn found an obliging thesis advisor, who helped him form a joint history of science and botany committee, and looked for an original topic to work on. Then, he remembers spending an entire semester doing nothing but reading Darwin's notebooks, especially looking in them for the beginning of Darwin's botany. What he found in Notebook C was the mention of a letter from Darwin to his professor at Cambridge, John Stevens Henslow, that Nora Barlow

fails to mention in her work based on the Darwin–Henslow correspondence, *Darwin and Henslow.* Kohn dared to send a letter of inquiry to Barlow:

> And I got a letter back from a man named Sidney Smith, who actually was the doyenne of Darwin scholars in Cambridge and worked closely with the Darwin family on their materials that they deposited to the library. Sidney's letter to me was, I have to say, very curt: 'We've never heard of anything like this. It doesn't exist, and you should know that the person you are addressing is *Lady* Barlow.' It was not welcoming; it was real huffy, but a measure of how powerful Barlow was in the world I would actually end up inhabiting.

Like any good detective, Kohn arranged to investigate further, flew to Cambridge University Library (CUL) to meet his future friend and Darwin guide Sidney Smith, and was duly taken to tea in the CUL tea room. As Kohn tells it, Smith graciously conceded, saying,

> 'We found what you're looking for. We looked harder. And basically, you've predicted the existence of something. It isn't exactly what you thought it was, but we've found a sheet of correspondence between Darwin and William Herbert,' (who was a leading plant hybridizer at the time, and Henslow was the go-between. Basically, Henslow's was the cover letter transferring notes between Darwin and Herbert.) 'We have a hand-written set of questions by Darwin for Herbert'

"I had actually predicted the existence of something from three thousand miles away!" Kohn marvels, as if he is still amazed 37 years later. "it was a treasure trove," one that touched on "every single topic that Darwin was thinking about with respect to what we today call genetics and heredity. He is asking Herbert about what we would call Mendelian ratios, about the understanding that we today call dominance, and recessiveness. One of the questions is also about the idea that he had formulated at this point that flowers are organs of evolution, that the function of the flower is to insure outcrossing. And he's testing this question on Herbert."

Naturally, Kohn took the opportunity to explore as much of CUL's Darwin holdings as possible in search of his tentative PhD topic on Darwin's botany. He recalls that "what I pretty soon figured out is that there is just an enormous amount, acres of notes and drafts and letters. I had too much." Kohn went home somewhat overwhelmed, half elated and half depressed. "Then I realized that I could not find in the literature anybody who had explained Darwin's path through all of the subjects of natural history that he was interested in to natural selection." Kohn saw that starting with the idea that evolution is a fact in the first evolution-oriented notebook—Notebook B—through Notebooks C, D, and E, Darwin becomes a selectionist. Kohn found that Darwin went through a succession of stages, that he had a very strong Lamarckian stage and after Malthus, "it changes basically from being Lamarck's theory of evolution to Darwin's theory, thanks to Malthus." But at the same time, viewing Darwin in the social context, Kohn found that his long dalliance with the humanities in college, from esthetics to philosophy, proved useful at last. He observes that Darwin "was always very reflective about the religious implications of his theory. He was always trying to see how it made him look: does this look like an atheist? Because if you look like a materialist, it's really leading towards an atheist."

Kohn took a pile of file cards and Darwin's notebooks to Cape Cod one summer and followed out some 20 themes. He worked through all four notebooks that touch most closely upon evolution, called the *Transmutation Notebooks*, and came home with a thesis, *Darwin's Path to Natural Selection.* Kohn had become a certified Darwin scholar. Professionally, he says, "I've done nothing else after being the most ambling, rambling, meandering person, to becoming someone who just loved that archive." Sure enough, the following summer found Kohn back at the library in Cambridge working for Sidney Smith helping to put the final touches to Robert Stauffer's edition of Darwin's work on *Natural Selection* and pursuing an ambitious new explication of the "paper Darwin." After much close study of the Darwin's notebooks for his thesis, Kohn saw great room for improvement of the published edition released in 1960 by Gavin de Beer. "There were lots of mistakes, and I could see there was one fundamentally old-fashioned thing about it…de Beer was basically editing the way he might have done in the nineteenth century, in this very clean way which dropped the deletions and was silent about the insertions, and I knew this was wrong." Unlike Darwin's letters, which were clearly written at some fixed date, Kohn explains, Darwin always held on to his manuscripts, reworking them, annotating them, often cutting pages out. The notebooks were a record of intense thinking. "This is genuinely a mulling over, a kind of development of ideas. Some ideas are passed out, are rejected, and other ideas go forward. He circles back to ideas."

All Kohn's detective skills were now bent to the archivist's task. Kohn probably knows as much as anybody about the English nineteenth-century watermarks found on paper that Darwin used. He can recognize the difference between the colors of ink Darwin dipped his pen in and will tell you how Darwin wrote with a gray-colored ink for only a short period right at the time he read Malthus. To Kohn, these are the clues needed to interpret the raw data of the

notebooks, with their multitude of notes, additions, deletions, overwritings, and excised pages. "There is always a path; it can be very circuitous. You see something, he adds a word someplace, you have to decide, 'did he do it contemporaneously, or did he do it significantly later?' If you can't answer those questions, you're stuck because there is the data, and it's uninterpretable. I just got really preoccupied with all this stuff."

It so chanced that the scholar working across the library table from Kohn that summer was an American, Frederick Burkhardt, general editor of the edition of *The Works of William James* supported by the American Council of Learned Societies, from which he had just retired as president. Burkhardt was then embarking on his second life's work, destined to occupy him for some 30 years, until his death in 2007. It was the vast, nearly endless Darwin Correspondence Project, the definitive edition of some 15,000 letters exchanged by Darwin and nearly 2,000 correspondents. Burkhardt's years as President of Bennington College were not wasted, and he was a gifted fundraiser. By the time Kohn returned to Boston that fall, Burkhardt had secured an NSF grant, and Kohn signed on as associate editor of *The Correspondence of Charles Darwin*. The project in its entirety is expected to run to 30 volumes.

Kohn moved to Cambridge and delved into the correspondence for the next five years. But one working day a week was always reserved for Kohn's own revision of the notebooks. Together, he and Burkhardt hammered out a style manual for the correspondence project. "He really did raise the standards," Kohn observes, and credits his colleague for introducing him to the experts in the world of Darwin. The experience helped Kohn understand how the notebooks differed from the letters and how the notebooks needed a different, more complex style manual. Long after Kohn left Cambridge and started teaching at Drew, the work continued. He was personally responsible for editing all five of the *Transmutation Notebooks* in the 1987 publication of *Charles Darwin's Notebooks: 1836–1842.*

Today, the culmination of Kohn's ability to effect a union of modern digital publishing and old-fashioned archival scholarship may be found online at his latest address, the American Museum of Natural History (AMNH), where he is general editor of The Darwin Digital Library of Evolution (DDLE). The intention of this vast project is to make available all of Darwin's writings and everything important that has been written about him. Of course, Kohn's office is part of the library's space, to his delight. It's wonderful, he marvels, "kind of a playground. Giving me an office right next to the stacks of the library… that's dangerous." Visit him there and Kohn will be delighted to show you how the "electronic Darwin" can finally do justice to the many-layered complexities of those key pages about evolution in Darwin's manuscripts that Kohn has pored and puzzled over for so long. He pulls up the website: http://darwinlibrary.amnh.org, and clicks on a page from the CUL publication *Portfolio of notes for* Natural Selection *and* On the Origin of Species, *first sorted 1854*. This is part of Kohn's pet retirement project and focus of scholarship within the DDLE, The Darwin Manuscript Project, "a comprehensive edition of Darwin's scientific manuscripts to the highest standards of textual editing." There's a printed page on the screen, with footnotes and interlineal editorial annotations. With two keystrokes, you're looking at the same page, handwritten by Darwin. Place the cursor over a crossed-out deletion or insertion, and you see the editorial comment or indication right under the passage in question. It's brilliant, if mind-boggling when you think of the work involved in transcribing all this.

But Kohn is content to follow Burkhardt's example, hoping to work within the same 30-year timetable, although despairing of his fundraising talents. Like the Correspondence Project, it is sure to take a lifetime and more. Kohn estimates there are upwards of 73,000 documents by and concerning Darwin that belong in the DDLE. Kohn was encouraged by one AMNH Library director to establish a home base for the DDLE there and by his successor to apply for a grant to write the book about Darwin's Evolutionary Botany that was always latent in Kohn's thesis and earlier research. Kohn got the grant and has moved his base of operations from the kitchen table to his AMNH office. "It kind of sews up every piece of my life together," he thinks. From now on, the "paper Darwin" and the "green Darwin" will always walk hand in hand: "I think that you can't understand how Darwin gets to the *Origin of Species* unless you've told the story of his interest in plants, and that's been totally missing."