Darwin Scholars at Work

The Darwinian Heritage. DAVID KOHN, Ed. Princeton University Press, in association with Nova Pacifica, Princeton, NJ, 1986. xii, 1139 pp., illus. $95. Based on a symposium, Florence, June 1982.

Remember the story about the retiring brain surgeon announcing that he is to devote his autumn years to the history of science, and the historian's reply that on retiring he is going to take up brain surgery?

A joke, yes; but one that betrays the fierce territorial feeling of a professionalizing discipline—and history of science is professionalizing fast. In 1959, on the centenary of the *Origin of Species*, the brain surgeons (or at least the biologists) were still making the "historical" running: Darwin's icon was paraded to legitimate modern evolutionary science, as Huxley's provided the excuse to go on slaying creationist dragons. *The Darwinian Heritage* is a reminder of how successfully the historians are reclaiming the Darwin standard, and how they are changing the emphasis. The collection of essays is the outcome of a conference marking the centenary of Darwin's death. It testifies to the massive capital investment in the Darwin industry over the last two decades—to the sponsorship of a huge research program, tuned to ever finer analyses of Darwin's 1837–39 transmutation notebooks. Indeed it is hardly still an industry, but more a multinational, with the present 32 authors, penning half-a-million words, resembling a who's who at the central and regional headquarters. The business is still very diversified in its holdings, as this volume demonstrates. However, Kohn's wise directive, to place Darwin in "the context of Victorian science," does give some coherence to the whole.

The book is divided into four parts: Darwin's scientific production, his work in social context, the comparative reception of the *Origin*, and philosophical issues. The way the papers cluster is revealing: exact textual analysis and deep social history are the most exciting developments, with the older-style intellectual history losing ground. Parts 1 and 2 show how vigorously new techniques are being explored and new methodologies established. Perspectives now range from Howard Gruber's application of cognitive psychology, through Frank Sulloway's computerized "content analysis" (revealing the "thematic patterns" in Darwin's writings), to Gillian Beer's literary analysis of Darwin's thicket of metaphors; from Silvan Schweber's contextual approach, with its emphasis on political economy and Scottish philosophy, to Robert Young's constitutive one, in his plaintively titled "Darwinism *is* social." ("Constitutive" meaning that for Young socioeconomic factors are implicit in Darwin's theory and ratify a certain social order. Young apart, though, there is little on sociology. It is surprising how widely Darwin studies still differ from other areas of research on British science in this respect.) The post-*Origin* writings receive less attention, though Darwin's later work on mental and behavioral continuity in man and other animals is the theme of another important cluster of papers, by John Durant, Janet Browne, and Richard Burkhardt.

Much of part 1 concentrates on the 1837–39 notebooks. Here too a new emphasis is striking. We now see Darwin emerging as a "lifelong generation theorist" (in M. J. S. Hodge's title). The key to this new approach is Philip Sloan's *tour de force* on Darwin's development during his Edinburgh University years (1825–27). Sloan is surely right that not enough attention has been paid to the 17-year-old's Edinburgh experiences, to the student societies he joined, or to the phrenologists and Lamarckians who befriended him. Indeed, Sloan's thesis is that the local Lamarckian Robert Grant—a fierce democrat and friend of Geoffroy St. Hilaire—started Darwin working on the "laws" of invertebrate generation (particularly of the little-known bryozoans and gorgonians), thus setting him on a train of research that culminated in his own evolutionary speculations in 1837–39. Sloan offers a convincing analysis of Darwin's and Grant's initial differences, showing how on a key Grantian point—the unitary origin of plants and animals—Darwin moved into agreement only after the *Beagle* voyage. By chronicling these changes, Sloan has enabled scholars for the first time to relate Darwin's Edinburgh debt to the crucial 1837–39 developments. In fact Hodge, in a corroborating essay, now considers Darwin's Grantian and Lyellian inheritances "decisive for the origins and character" of his evolutionary program.

The rise of the professional science historian is reflected most obviously in the welcome provision of a section on social history. To my mind the two other landmark essays in the volume sit here: pioneering pieces that open up entire new vistas. One is James Secord's essay on Darwin's penetration of the plebeian world of pigeon fanciers and poultry breeders. Secord's attempt to demarcate a new "social geography" of Darwinian science is spectacularly successful. He unravels Darwin's "network of informants," tackles his reading of the breeders' weeklies. He shows Darwin extracting specialist lore on variation from the fanciers and husbandrymen. And just as important, he explains why the yokels actually welcomed the attentions of a gentleman naturalist, keen for acknowledgment from the lord of the scientific manor. Most naturalists avoided the hoi polloi. These fanciers were after all plying a tawdry trade, mutilating nature for pride and profit (producing "nature's bastards," as Gillian Beer puts it), not proffering the key to creation. They were not fit for a gentleman's attention. Yet here was Darwin hobnobbing with the breeders, sparking off controversies among beekeepers, and pestering silkworm specialists to breed silkless worms. With the publication of Darwin's correspondence now under way, this kind of study is surely going to be representative of a major new approach. We are going to see a three-dimensional Darwin, not the disembodied jotter of abstruse notes: the stockholder, clubgoer, and family man secure in his wealthy Whig world. The emergent picture will allow us to make much more sense of his utilitarian science.

And in that vein, I pass to the *pièce de résistance*: James Moore's beautiful evocation of Darwin as the "incumbent"-naturalist of Down, the pillar of the parish. I declare this the best essay written on Darwin's attitude toward the clergy. But then few others have attempted to see his views in terms of the social expectations of provincial Whig society. Moore's portrait of the unreformed Cambridge attended by young Charles is exquisite: a Cambridge to which even the freethinking gentry sent their sons to prevent their becoming wastrels. A Church career for Charles was not an inappropriate choice. It required "no intimation of a divine 'calling' " but offered respectability and leisure enough for the most ardent beetle hunter. But Darwin never did take holy orders. From 1837 to 1842 he lived in "vile smoky" London, with its "running sores" and Malthusian "war" among the street poor. Here he secretly articulated his "new theodicy, justifying the divine laws that lead to 'death, famine, rapine, and the concealed war of nature' " in terms of their benefit to the species. His angst was apparent: his fear of being cast as another "devil's chaplain"—of being lumped with the atheist demagogues tramping the country throwing

down challenges to the Christian establishment. The move to the tranquil ex-vicarage of Down in 1842 was an attempt to emulate his favorite role-models, the clerical naturalists, so respectable and secure. It was his parson's lifestyle and parish duties here that Moore now brings out so vividly. He shows us the little-seen Darwin: the village patron, the squire discharging his duties, running benefit societies and clothing clubs, complaining about curates making off with school money or village maids.

In short, Moore provides another fix for locating Darwin in Secord's "social geography." The improving squire becomes a transitional figure in an industrializing culture, supporting the rural clergy and old order even while redesigning creation along more competitive, naturalistic lines. Darwinism was to help sustain the switch in power from the Church-and-corporation élite to the rising liberal-industrial order in Britain. How it was then adapted to other European political contexts is shown in part 3 by Paul Weindling and Pietro Corsi (on the German and Italian reactions) and Francesco Scudo and Michele Acanfora (on the Russian response). Ultimately, Moore's work raises a fundamental question: how could a respectable Whig educated to tradition and privilege knowingly commit a treasonable act against the old Oxbridge clerisy? In showing us "parson" Darwin Moore makes the problem more acute than ever.

For the future, Kohn suggests that we switch the focus from Darwin himself to the "conceptual debates and institutional structures" of his day, in order to understand the contemporary meaning of evolution. How much remains to be done in this respect is evident from *The Darwinian Heritage*. It is surprising, for example, that despite a 76-page bibliography there is no listing for Morris Berman's study of the Royal Institution, *Social Change and Scientific Organization* (1978), which explores the utilitarian ethos of Darwin's London—a book that surely gives an insight into Darwin's potential audience. Correlating the political and scientific outlooks of London's various social groups will certainly enable us to put Darwin into better perspective.

For the moment, though, no one can doubt that *The Darwinian Heritage* stands as a monumental achievement. Not least it is a superb feat of organization on Kohn's part. With its seminal papers, state-of-the-art techniques, commentaries, and stock-taking, it is sure to remain a centennial landmark.

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A Debate in Solar Physics

Confronting Nature. The Sociology of Solar-Neutrino Detection. TREVOR PINCH. Reidel, Dordrecht, 1986 (U.S. distributor, Kluwer, Norwell, MA). xii, 268 pp., $49.50. Sociology of the Sciences Monographs.

In *Confronting Nature*, Trevor Pinch presents a sociology of the detection of solar neutrinos. Working within the research program of "social constructivism," he wants to "learn something about the social processes whereby consensus is reached in science" (p. 3) and to evaluate the "interpretative flexibility" of evidence and theory. The notions of "negotiation," "interpretative flexibility," and "evidential context" used by Pinch are important, for they make it possible to address in sociological terms questions usually discussed (by philosophers) in epistemological terms like "theory-laden" or "truth-value." Thus, the ultimate goal of constructivists—or relativists—is to show that in science epistemological problems are in fact social problems, "the social grounding of beliefs" being not, according to them, "predicated upon their truth-status" (p. 3).

With this project (presented in the first two chapters) in mind, Pinch reconstructs the history of an important experiment in modern physics that led to the measurement of the flux of neutrinos coming from the sun. Obtained in 1967, the first results of the experiment indicated a flux much lower than the one predicted by theory, and the discrepancy—still unexplained—has given rise to an important debate on the quality of the experiment and on the value of theoretical models of the sun used to make the prediction. It is this state of debate and uncertainty that makes the history of the "solar-neutrino problem" an interesting research site for a sociologist who wants to "observe," so to speak, how scientists achieve consensus in science.

To structure the narrative, Pinch introduces an important distinction between the apparatus *per se* and the "evidential context"—that is, the "context in which the results of the experiment are held to gain significance" (p. 49). In this way the link between the experiment and, for example, the theory to be "tested" cannot be taken for granted and must be established by the actions and interactions of the scientists involved. In the case of neutrino detection, the apparatus—constructed by Ray Davis, a chemist at the Brookhaven National Laboratory—was essentially a tank of perchloroethylene in which the chlorine-37 isotope could interact with a neutrino to produce a radioactive isotope of argon. Collected after a certain period of time, the argon atoms were then counted by a Geiger counter, which detected the Auger electrons emitted during their decay. The resulting number was then used to infer the number of neutrinos interacting in the tank. Davis began to work on this project in 1949 and thought he could use an appropriate tank to detect free neutrinos. He soon realized, however, that the sensitivity of the apparatus was not adequate given the large cosmic-ray background. He then decided to use his apparatus to set an upper limit to the flux of neutrinos that, according to nuclear astrophysics, was coming from the sun. Though his first result, published in 1955, was many orders of magnitude higher than the predicted flux and thus not really useful, it put Davis on a potentially important track, for his apparatus could serve to test nuclear reactions going on in the sun.

The link between Davis's apparatus and nuclear astrophysics was forged in 1958 when new experimental results on nuclear cross sections suggested that the flux of neutrinos coming from the sun might be higher than expected. It was consolidated in 1964 when a $600,000 grant was obtained from the Atomic Energy Commission (AEC) to build a 100,000-gallon tank to test the new predictions. It was during this period that Davis came into contact with the nuclear astrophysicists of the Kellogg Radiation Laboratory at Caltech, especially William Fowler, whose reputation did much to give credibility to the enterprise, and John Bahcall, who made the necessary calculations and stayed in close contact with Davis. Like an ethnographer, Pinch describes in detail, in chapters 4 and 5, the many activities of Davis and the Caltech group to secure the realization of the experiment. He shows that the activities of the experimenter and the theoretician are not limited to nuts and bolts or calculations and include such activities as, in this case, negotiating with companies for the construction of the apparatus, lobbying to get funds from the AEC, and visiting the experimental site. For Pinch, all these activities consolidated the multiple links between Davis and Bahcall (personal, scientific, and professional) that were the social basis of the "intellectual" links between the experiment and the theory and that made possible the success of the whole enterprise.

Having shown how the links between theory and experiment are socially constructed, Pinch addresses the question of the "interpretative flexibility" of experimental results and theoretical predictions by examining the fate of the data and models produced by the collaboration of Davis and Bahcall. Here again, the analysis is very fine-grained, and to make a long story short, let us say that while, at the end of 1967, Davis