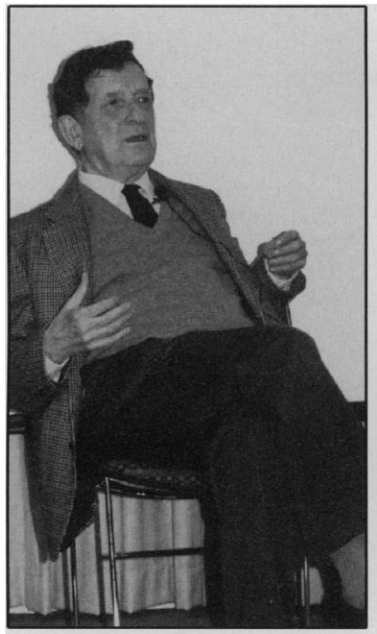
# BOOK REVIEWS

## A Theorist Ignored

**Infinite Potential.** The Life and Times of David Bohm. F. DAVID PEAT. Helix (Addison-Wesley), Reading, MA, 1996. x, 353 pp. + plates. $25 or $C34. ISBN 0-201-40635-7.

"I seem to have only one strong emotion left—and that is hatred for the forces that have destroyed so many human beings, including myself. For relative to what I could have been, I regard myself as destroyed." So wrote the physicist David Bohm, who was perhaps our most profound thinker about the nature of quantum reality, in a letter written from Brazil at about the middle of his life in 1954.



David Bohm. *Left*, "When speaking Bohm employed delicate movements of his hands, almost as if they were the extension of his thinking process." *Right*, "Bohm with the Dalai Lama during the Amsterdam conference 'Art Meets Science and Religion in a Changing Economic Environment.'" [From *Infinite Potential*]

It would be natural to conclude that the passion expressed here was a response to Bohm's treatment by the House Committee on Un-American Activities, which in 1949 cited him for contempt of Congress for his refusal to testify against his colleagues concerning their possible communist connections; and to the treatment by the powers of American academia, which, despite his acquittal in 1951, cut short his employment as a professor at Princeton University, made him persona non grata at the Institute for Advanced Study, and prevented him from obtaining serious employment as a physicist anywhere in the United States.

But that conclusion would not be entirely correct, at least not with regard to the story told by David Peat in this fascinating biography. Rather, the deeper cause of Bohm's unhappy state of mind was the reaction of the community of physicists to what he regarded as his great achievement: a clear deterministic alternative to the indeterministic and, frankly, incoherent Copenhagen interpretation of quantum mechanics. Prior to the publication of his theory in 1952, he had been "enormously excited by what he felt was a major discovery" and wrote, "I can't believe that I should have been the one to see this," while "anticipating that the physics community would react with enthusiasm."

But his anticipation was not without anxiety. Indeed, Bohm feared that "the bigshots will treat my article with a conspiracy of silence; perhaps implying privately to the smaller shots that while there is nothing demonstrably illogical about the article, it really is just a philosophical point, of no practical interest."

To a very great extent that is what happened. The physicists Abraham Pais and J. Robert Oppenheimer declared Bohm's theory "juvenile deviationism," with Oppenheimer, who was Bohm's mentor, suggesting that "if we cannot disprove Bohm, then we must agree to ignore him." Niels Bohr's associate Leon Rosenfeld found Bohm's theory "very ingenious, but basically wrong," while for Wolfgang Pauli, according to Peat, "Bohm's whole approach was 'foolish simplicity,' which 'is of course beyond all help.'"

Having anticipated this sort of response, Bohm nevertheless had not been emotionally prepared for it—how could he have been?—and found that "the total indifference of the physics community to an important new idea 'cut at one's insides like a hot knife being twisted inside your heart.'" The philosopher Paul Feyerabend, who throughout his career relished the role of provocateur in characterizing science and scientists, was only being straightforward when he remarked that "the fact . . . that Bohm's model was pushed aside while all sorts of weird ideas flourished is very interesting, and I hope that one fine day a historian or sociologist of science takes a close look at the matter."

Peat does a splendid job of weaving into his presentation this central episode in the life of a remarkable man, one of the most imaginative and controversial physicists of the 20th century, who died in 1992 at the age of 74. Bohm's version of quantum mechanics, and the reaction of the physics community to it, is a subject to which Peat repeatedly returns as he beautifully develops the progression of Bohm's thought, in ever more speculative directions, over the last four decades of his life.

However, Peat's treatment of the relevant physics is not always entirely accurate. For example, concerning Bohm's theory, it is not really true that Bohm "did not develop its full implications until the late 1970s and 1980s," or, concerning nonlocality, that he "did not fully appreciate the revolutionary nature of this aspect of his theory," or that the measurement problem was "solved by Bohm's approach in the 1970s." All these things were dealt with clearly, I would say almost definitively, in Bohm's original 1952 articles. Thus, remarkably, the behavior of the physics establishment in the matter of David Bohm was even more shameful than

is conveyed here. As John Bell remarked (*Speakable and Unspeakable in Quantum Mechanics*, Cambridge Univ. Press, 1987, p. 191), the de-Broglie–Bohm "idea seems . . . so natural and simple, to resolve the wave-particle dilemma in such a clear and ordinary way, that it is a great mystery . . . that it was so generally ignored."

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## Geomagnetism

**Magnetic Stratigraphy**. NEIL D. OPDYKE and JAMES E. T. CHANNELL. Academic Press, San Diego, 1996. xiv, 341 pp., illus. $95 or £75. ISBN 0-12-527470-x. International Geophysics, vol. 64.

Earth's internally generated magnetic field is a most unlikely geological clock. Its dial has only two readings: "N" (for normal, when the field vector everywhere points northward) and "R" (for reverse, when it points southward). What's more, there is only one hand, which remains stuck on either N or R for periods ranging from 10,000 to 40 million years. Then, with astonishing swiftness and essentially perfect global synchrony, the hand can change its setting and become stuck again. Fortunately for Earth scientists (and those interested in their findings), a wide variety of stratified rocks preserve remarkably robust and continuous records of these arrhythmic tickings of the main field. In *Magnetic Stratigraphy*, Opdyke and Channell have produced a comprehensive summary of the three-decade-old scientific enterprise that exploits these paleomagnetic fingerprints to infer very-high-precision, global-scale correlations of stratified rocks—the very framework of geological time.

This book has much to offer. First, it serves as a succinct and practical introduction to those aspects of geomagnetism and paleomagnetism that are relevant to magnetostratigraphy. Second, it provides an up-to-date discussion of the polarity-reversal history derived from remote sensing of the magnetization of the oceanic crust. This continuous record constitutes a master "template" with which the magnetization of deep-sea core samples or terrestrial rock sequences younger than 160 million years can be correlated. Third, the authors have produced a grand synthesis of existing magnetostratigraphic data. This compilation (certainly the most important contribution of the book) is summarized in a set of 15 tables and corresponding correlation charts that cover nine time intervals, from the Plio-Pleistocene (last 5 million years) to the Ordovician (which began about 510 million years ago). The quality of the data is roughly assessed with a "reliability index" (ranging from 0 to 10) that the authors have devised and that is likely to become widely used. In the discussions accompanying the tables, the authors are not shy about expressing their opinions: they rate as "classic" the papers describing the magnetostratigraphy of the famous deep-sea limestone sections exposed near Gubbio, Italy; they are clearly much less enthusiastic about some reports of short reverse-polarity intervals during the last 780,000 years or during the 40-million-year-long normal interval of the Cretaceous. And finally, they step back and see what can be learned about the behavior of the geomagnetic field from the long record they have reconstructed. They observe that the last 65 million years of field behavior closely resembles that in the interval 65 to 330 million years ago: the lengths of polarity intervals peak at 100,000 to 200,000 years, the average reversal rate is about two per million years, and the balance between normal and reverse polarity is indistinguishable from 50:50. This final observation, in particular, is one that has been hotly debated over the years. *Magnetic Stratigraphy* is handsome, very readable, and persuasive; most readers will wonder (as the authors do occasionally) why more boundaries in the geologic timescale are not tied directly to our planet's geomagnetic pulse.

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## Vignettes: Human Fitness

Imagine two men competing with each other to be chosen by a mate. One has a naturally healthy complexion. The other is actually terminally ill but has recourse to bright ochers. He uses some belladonna to dilate his pupils and dabs oil of muskrat behind his ear. Through this clever sexual culture, it is possible that the ill man can outdo the healthy one in the display-and-attraction stakes and be chosen as the woman's mate. Of course, this may turn out to be bad news for the woman, as she may have to raise the child alone, but her consolation is that the child will have clever, culture-using genes on board.

—*Timothy Taylor*, in *The Prehistory of Sex* (Bantam)

In human social life quite different levels and criteria of success come to the fore; these cannot be represented by a single set of numbers in computer games. There is always variety, and seldom extinction. No doubt dominant members of a society have more chances to raise their children successfully; but it appears that again and again special elites rose to power who produced fewer children but, through an elaborate culture, kept control over their inferiors who produced more children. Should this be called a lack of fitness of the ruling class?

—*Walter Burkert*, in *Creation of the Sacred: Tracks of Biology in Early Religions* (Harvard University Press)

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## Browsings

**How Writing Came About**. Denise Schmandt-Besserat. University of Texas Press, Austin, 1997. xiv, 193 pp., illus. Paper, $19.95. ISBN 0-292-77704-3. Abridged edition of *Before Writing: Volume 1, From Counting to Cuneiform* (1992).

A work reviewed in *Science* **260**, 1670 (1993) adapted for a general audience.

**Yerkes Observatory, 1892–1950**. The Birth, Near Death, and Resurrection of a Scientific Research Institution. Donald E. Osterbrock. University of Chicago Press, Chicago, 1997. x, 384 pp., illus. $40 or £31.95. ISBN 0-226-63945-2.

The story of the University of Chicago's observatory, recounting its founding by the pioneering George Ellery Hale, its decline after Hale's departure, and its resurgence in the 1930s under the directorship of Otto Struve, with attention to the relations among the astronomers and others involved.