BOOK REVIEWS

Hoyle's World

Home Is Where the Wind Blows. Chapters from a Cosmologist's Life. FRED HOYLE. University Science Books, Mill Valley, CA, 1994. xiv, 443 pp., illus., + plates. $32.50.

Were experts asked to name those mainly responsible for the dramatic developments in theoretical astronomy after World War II, Sir Fred Hoyle would surely top most lists. His visionary 1946 paper, "The synthesis of the elements from hydrogen," laid the foundations for the new and far-reaching field of nuclear astrophysics; his later successful prediction of a hitherto unknown energy level in ^{12}C spectacularly demonstrated its potential. Hoyle also turned stellar structure and evolution into a dynamic part of modern physics and cosmology. He initiated the automatic computation of stellar evolution and, with Martin Schwarzschild in 1955, showed how stars become red giants—one of the key achievements that won them the richly deserved International Balzan Prize, awarded 16 November in Rome.

Hoyle has now published his autobiography—and a compelling, beautifully written, and rollicking good read it is. As I read certain sections, my frequent guffaws threatened to disturb an entire apartment block. Hoyle describes the cut and thrust of scientific research and academic politics in a refreshingly frank and engaging way—so frank that Cambridge University Press "couldn't touch it with a ten foot pole." Warm and humorous recollections of many of the century's great physicists and astronomers appear throughout. In 1944, while traveling in the United States for the British Admiralty, Hoyle made a typically "unauthorized" weekend visit to see Walter Baade in Pasadena. His fascinating account of this and other threads that led to his 1946 paper should help dispel once and for all the belittling myth that he became interested in nucleosynthesis merely as a secondary prop for the later steady-state theory.

But the book is much more than a scientific life. Part 1, 34 Primrose Lane, reprints his earlier description of his boyhood, *The Small World of Fred Hoyle*. It is a marvellously evocative and literary account, replete with social insight, of growing up in Yorkshire as an intellectually independent if not rebellious student (he managed to evade much early formal schooling). Ultimately Hoyle would win Cambridge's top prizes in theoretical physics and applied mathematics, the Mayhew and Smith's prizes, achievements that ranked him with England's most distinguished theoretical physicists. As war clouds loomed he began research first with Rudolf Peierls, then with Maurice Pryce and, briefly, Paul Dirac, who had never wanted a student but "simply couldn't resist the circular counterlogic of a supervisor who didn't want a research student who didn't want a supervisor." The story of Hoyle's war-shortened and self-deprecating courtship of Barbara Clark, his energetic and loyal partner in all that was to come, will bring a smile to many lips.

Fred Hoyle, 1964. [The Bettmann Archive]

Part 2, The Larger World of Science: 1939–1958, forms the heart of the present book. Its sympathetic and balanced portrait of Eddington, stressing his essential fairness, may go some way toward correcting another too-oft repeated account. On a technical level, however, I was surprised that Hoyle emphasized Eddington's use of effective temperature in eliminating (mild) uncertainty in the stellar mass-luminosity relation. Surely his realization of the dominant role of radiative transport (and therefore *atomic* physics) in determining the luminosities of stars, and the almost miraculously apposite "standard model" (with "Eddington quartic") were the fundamental insights—as I thought I had learned from Hoyle himself—with T_e a convenient but necessary additional parameter, absent precise knowledge of central energy sources. Nevertheless, Hoyle's approach lets him describe quite modestly how he and Ray Lyttleton (whose pithy aphorisms pepper the book) achieved a major first by demonstrating analytically how nuclear physics primarily determines the radii of stars. Published in England during the war, their significant paper was perhaps less noticed than it should have been.

Hoyle did work of practical importance on radar during World War II. Just as his account of a relatively impoverished boyhood had resonated, I was also struck by his matter-of-fact description of thecivilian privations of that time. Yet his seizure of limited wartime scientific opportunities and a fortuitous series of outspoken BBC talks, during which he somewhat derisorily coined the term "Big Bang," propelled him to major postwar prominence. In 1957 the monumental classic on nucleosynthesis, B^2FH (for Burbidge, Burbidge, Fowler, and Hoyle), was published. That same year, Hoyle's election to the prestigious Cambridge Plumian Chair took him to the very top of the British astronomical establishment.

Part 3, Home Is Where the Wind Blows: 1959— , describes not only major achievements but also the increased buffeting Hoyle endured from small-minded academic and political opponents and the solace he found in climbing his beloved "Munros." (These peaks inspire some wonderfully reflective writing, though the reader would do well to have a large-scale map of Scotland handy.) For 15 years Hoyle was the champion of British astronomy, scientific policy, and fund-raising. He proved decisive as chair of the Anglo-Australian Telescope Board; while detailing the convoluted politics of that project, he modestly refrains from mentioning his key identification of a design flaw in the original plans for the telescope.

The Institute of Theoretical Astronomy (as it was first called), founded by Hoyle at Cambridge in 1966, was an instant success. With a rapidly growing number of sabbatical and summer visitors and a vigorous program of international conferences, it became an obligatory mecca for young U.S. astronomers in particular. Many feel that the Institute fostered their best work in the magical six years that followed. Yet Hoyle shows that the Institute was almost stillborn. His account is long on the politics of its birth and life but surprisingly short on its achievements. Nevertheless, it helps explain how he could walk away with some relief when the university's gray men (one described by Lyttleton as "rusted in" to a supposedly rotating position) achieved an underhanded victory in 1972. But even Hoyle's accurate description cannot do justice to puerile academic spite. Years after his successor Martin Rees generously named the Hoyle Building, a resentful opponent continued literally to excise his name—with a razor blade—from posters announcing the location of seminars.

Aptly subtitled "Chapters from a Cosmologist's Life," the book hardly touches some of the contributions, scientific, educational, and cultural, of this extraordinarily creative man. It is particularly ironic that his work on interstellar organic molecules and their implications for the origin of life was downplayed in the year when the amino acid glycine was found at the center of the Milky Way. Many present-day astronomers worldwide could attest to the youthful inspiration his unmentioned classic *Frontiers of Astronomy* provided them. Some stories, however, only Hoyle could have told. One wishes, for example, that he had chosen to describe his co-discovery of a star of first magnitude—the then unknown Royal Academy of Dramatic Arts student Julie Christie—for his "A for Andromeda" sci-fi TV series. It would seem several chapters still remain to be revealed. Nevertheless, all working astronomers and others seeking rich and controversial insights should read this book—for then they will partly know the mind of Hoyle.

John Faulkner
Lick Observatory,
University of California,
Santa Cruz, CA 95064–1077, USA

Vignettes: Instructions for Authors

Avoid digressing into diatribes and areas, especially controversial issues, not central to your research. You may never complete a scientific crusade if you stop to lop off the head of an innocent peasant on the way. . . .

Remember that the review process has a big random element. . . . Be philosophical—remember that sometimes you will be unfairly rejected and at other times undeservedly accepted. Write enough articles so that it averages out! . . .

Carefully read the editor's rejection. It may in fact be a request for resubmission after major changes. The editor doesn't want to appear generous because that would encourage you to resubmit a poorly revised manuscript, and he would feel obligated to accept it. A little humor helps: A politician says "yes" if he means maybe, "maybe" if he means no, and if he says "no" he's not a politician. An editor says "no" if he means maybe, "maybe" if he means yes, and if he says "yes" he's not an editor! . . .

Reviewers may be defensive about a manuscript that provides too large a deviation from received wisdom and perhaps even threatens the reigning paradigm. If you are brilliant enough to come up with such material, it may be wise to publish it in less shocking increments or in a book.

—*Tesfa G. Gebremeddhin* and *Luther G. Tweeten*, in *Research Methods and Communication in the Social Sciences* (Praeger)

Machinery of Learning

Long-Term Potentiation. Vol. 2. MICHEL BAUDRY and JOEL L. DAVIS, Eds. MIT Press, Cambridge, MA, 1994. xiv, 409 pp., illus. $85 or £76.50. A Bradford Book. Based on a meeting, Gif-sur-Yvette, France, 1992.

Leaving aside the major neurological disorders, interest in how we learn and how we remember has arguably drawn more of us to neuroscience than any other subject. Despite the attention these phenomena have received, biological models of memory and learning circuits that have proven mechanistically fruitful are few and therefore precious. These models include reflex sensitization to a noxious stimulus in *Aplysia*, olfactory learning in *Drosophila*, and long-term potentiation (LTP) in mammals. LTP is a long-lasting enhancement of synaptic strength that is produced at certain synapses by high-frequency activation of the afferent nerve. By presenting recent findings addressing two of the three major questions surrounding the phenomenon, the 20 contributions included in this successor to a 1991 book on the subject paint an accurate and interesting picture of our understanding in the early 1990s.

The first question concerns the machinery responsible for the maintained increase in synaptic effectiveness during LTP: does it reside on the pre- or on the postsynaptic side of potentiated synapses, or somehow on both? A derivative question, though not so well developed experimentally in the book, involves the locus of long-term depression (LTD) of synaptic transmission produced by lower-frequency stimulus trains. LTD is suggested to provide a mechanism by which synapses are "reset" and may explain why all of our synapses are not maximally potentiated. Artola's chapter raises the idea that whether a particular synapse undergoes LTP or LTD, or neither, may depend on the postsynaptic calcium concentration reached during repetitive synaptic transmission (LTP requiring more than LTD). Experiments that convincingly demonstrate the need for a transient postsynaptic calcium surge in LTP induction are presented by Manabe, Nicoll, and colleagues. Malinow and coworkers then exhaustively evaluate their quantal analysis of potentiated synapses, which implicates either an increased likelihood of transmitter release or unmasking of postsynaptic receptor clusters.

If release is increased, it follows that retrograde chemical signals that instruct the nerve terminal to release transmitter more reliably must exist. What might these signals be? Nitric oxide (NO) is one of the latest offerings in the menu of retrograde messengers we have been served over the past six years and takes center stage in this debate. The pharmacological arguments of Madison and Schuman supporting a role for NO in the induction of LTP in the hippocampal slice are contested by Barnes and co-workers, however, who have examined LTP in the whole animal. The discrepant