this way a time table of reversals of the field during the past four million years was painstakingly built up, the last important detail — the resolution of the Jaramillo event, a short period of normal polarity rather less than one million years ago — being added in 1966.

It is made clear in the author's preface that the book is an outgrowth of a doctoral dissertation, on the history of the elucidation of the reversal time-scale, which was then expanded to include details of the all-important precursor to that work. As a geologist turned historian, Glen is well-qualified to relate this story and he is also well-placed in that these developments largely took place at institutions in the Bay area of California where he and most of the participants still live. Thus the author

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Photograph J.R. Cann.

F.J. Vine and Drummond Matthews at UEA in 1970. Their explanation, using the reversal time scale, of how the sea-floor developed a striped magnetic pattern (a theory developed independently by Lawrence Morley in Canada) eventually triggered the modern revolution in earth science.

was able to draw in particular on the recollections of Jack Evernden and Garniss Curtis — who refined the potassium–argon dating technique at Berkeley in the 1950s — Allan Cox, Richard Doell and Brent Dalrymple — all former Berkeley students, who worked on the definition of the geomagnetic reversal time-scale at the US Geological Survey in Menlo Park, California, in the early 1960s — and their more senior mentors at Berkeley, John Verhoogen and Francis Turner. Many others however were involved not only from the United States but also, notably, from Canada, Australia and Britain. Glen claims to have interviewed over 80 scientists for a total of more than 300 hours, 130 of these being preserved for posterity on tape. In doing this he has performed a valuable service to both scientists and historians; the book captures something of the sociology as well as the history of events before the record has been tidied-up, abbreviated and over-simplified by the passage of time.

Inevitably perhaps, because the book goes into a few topics in great detail, the general reader may find some of Glen's scientific and historical points somewhat esoteric. One might also quibble with the odd minor detail or ambiguity, but in general the treatment is objective and factually correct, the whole constituting a scholarly and authoritative work. As one who was privileged to be involved with the latter part of the work described, I was fascinated by some of the details given earlier in the book which previously I knew only in outline. This is particularly true of the developments in the potassium–argon dating technique in the mid to late 1950s and may, I suspect, be a more general reaction in that the history and significance of these developments has been poorly documented, indeed largely overlooked, in the past. Similarly the sudden growth in palaeomagnetic research, and the eventual divergence in the approach of the English as opposed to the American/Australian schools in the 1950s makes interesting reading. Work in England under the leadership of Keith Runcorn concentrated on the definition of polar wander curves in the past for different continents; by contrast research in the States under Cox and Doell, and in Australia under the direction of Ian McDougall, was largely concerned with the elucidation of the reversal time-scale which was eventually to have such a dramatic impact on the resolution of the continental drift debate.

One is tempted to make comparisons with James Watson's *The Double Helix*, in some respects an analogous book. I suspect, however, that the success of the latter in capturing the popular imagination resides in its autobiographical approach and in its concentration on feuds and personalities. Here one can read about the rivalries, disagreements and personality clashes but they are more deeply buried in objectivity and detail. Indeed this is altogether a more weighty tome, painstakingly annotated, referenced and indexed; at the same time it should be said that the main text is attractively written and is leavened — and enlivened — by numerous photographs, typically of the leading characters in the story.

The road to Jaramillo was far from straight and well signposted and many travellers clearly missed crucial turnings on the way. But they all shared an enthusiasm for the unfettered pursuit of pure science, and had an instinctive faith in the ultimate, if unforeseen, fruits of their work. In this regard a salutary and poignant note is struck in an appendix in which Brent Dalrymple, in a letter to the author, questions whether such triumphs of pure science are as likely or even possible today in an atmosphere of financial stringency and in which the emphasis is on mission-orientated and applied research. □

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Wrendered complete

Carole Stott

The Mathematical Science of Christopher Wren.
By J.A. Bennett.
Cambridge University Press: 1983. Pp.150. £15, $29.95.

ASK THE man in the street to name an English architect and the chances are he'll say Christopher Wren. Follow this by asking for an English astronomer and your money is safe that he'll "pass" rather than answer Wren.

It is understandable why Wren is popularly acclaimed for his architecture. His most obvious legacy, his buildings — St Paul's, numerous churches, the Sheldonian Theatre, Oxford, the chapel at Pembroke College, Cambridge — are there for all to see. Yet before becoming a professional architect Wren had a highly successful career as an astronomer, firstly as Gresham Professor of Astronomy (1657-1661) in London and then as Savilian Professor of Astronomy at Oxford (1661–1673). These two seemingly distinct careers, architect and astronomer, have always been treated separately by historians. *The Mathematical Science of Christopher Wren* by contrast covers Wren's professional life as a whole, explaining what today would be a most unusual transition rather than, in those days, one of job rather than of career.

Whilst at Gresham College, Wren was at the historic centre of mathematical science in England, steeped in tradition concerned with the exploitation of mathematics to practical ends. The philosophy of the mathematical practitioners of the time and Wren's involvement are treated first by Bennett, before covering in successive chapters the mathematical sciences tackled by Wren — astronomy, longitude, cosmology, mechanics, microscopy, surveying, medicine, meteorology and architecture.

An early problem that concerned Wren was that of explaining the different appearances of the planet Saturn. Since Galileo had turned his telescope to the heavens and viewed what he thought was a central globe flanked by two smaller ones, astronomers had put forward various explanations for their observations. Wren observed the planet too and hypothesized that Saturn was circled by an elliptical ring the width of which varies from a maximum at the two points where it is furthest from the body to zero at two points where it touches the planet. Although this was a considerable advance on any previous explanatory attempt, Wren soon abandoned his theory in favour of Christian Huygens' model.

Self-devised improvements in the telescope helped Wren in his astronomical

work, including that on Saturn. He also used micrometers in the mid-1650s, he proposed lens grinding apparatus, the application of telescopic sights and the use of a double-telescope. The latter he described as two telescopes joined like a sector to measure angular distances and to be used in an astronomical method for finding longitude at sea. In all Wren was the compleat scientist and his other interests — such as the anatomy of the brain, muscular action, respiration and designs for weather clocks — are all meticulously detailed by Bennett.

This is no light-weight tome, being the distillation of a doctoral thesis in the Department of the History and Philosophy of Science at Cambridge University. Some 20 pages are taken up by references, underlining the fact that it is aimed at the professional scientific historian. The reference section is excellent and alone is ample reason for buying the book. The overall quality of production is up to usual Cambridge University standards and illustrations are good considering the limited availability of material. The author's assumption that his readers are familiar with scientific problems and personalities of the day, however, means that we are presented with a skeleton of a book. The present format unfortunately has an effect similar to force feeding; it is very rich food indeed and is only palatable in small quantities. One hopes that Bennett will in due course find time to fatten up his account. □

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Science through the scientist

Nicholas Wade

Scientific Temperaments: Three Lives in Contemporary Science.
By Philip J. Hilts.
Simon & Schuster: 1983. Pp.302. $15.95.

PHILIP Hilts writes on science and kindred matters for the *Washington Post*. In *Scientific Temperaments* he has applied the reporter's art to describing the work and character of three contemporary practitioners of science. The result is a rich tapestry in which the substance and oral history of science are skilfully interwoven with the personal lives of individuals.

The book is composed of three essays, the first devoted to modern physics and Robert Wilson, the second to molecular biology and Mark Ptashne, and the third to computer science and John McCarthy. Each essay is based on a wealth of gracefully sketched background material, against which the subject's own career and outlook is presented. Perhaps because of the comparative youth of computer science, McCarthy is the member of the trio who stands out most clearly and strongly against his background.

Lord Rutherford, as is well known, pronounced in 1933 that the idea of nuclear power was moonshine. Less well known, at least to me, is that this was the year in which H.G. Wells had predicted (in 1914) that the means to tap the energy of the nucleus would be found. The prediction, as Hilts tells the story, deeply impressed Leo Szilard, but not until Szilard happened to attend the conference at which Rutherford declared nuclear power to be impossible did he determine to prove that it wasn't. A few days later he conceived the idea of the chain reaction for which he filed his patent application of 1934. Historians may describe the epiphenomena, but the root cause of the nuclear age, it would seem, was Szilard's itch to prove Wells a prophet and Rutherford an ass.

Against such anecdotage Hilts describes with feeling the aesthetic and practical sense which Wilson brought to his great creation, the building of Fermilab. From that great cathedral on the Illinois plain miracles may come, one day. On one occasion a friendly Senator, seeking to justify the expense, pressed Wilson to describe how Fermilab contributed to the national defence. Wilson persistently but politely declared it made no such contribution. At the third prompting, he delivered the fine reproof, "It has nothing to do directly with defending our country except to make it worth defending".

Hilts uses the vehicle of Mark Ptashne, part *enfant* and part *terrible*, to recount the tumultuous public history of DNA from Asilomar to Wall Street. Harvard's ill-fated idea of setting up a company in conjunction with its professors is particularly well described. The subject of the final essay, John McCarthy of Stanford, the son of a Boston labourer, has made important contributions to the field of artificial intelligence. Hilts's method of blending science and scientist reaches its acme in this subtly drawn portrait.

Scientific Temperaments is presumably aimed at the general reader but contains much that will be fresh to many scientists. There is, however, lack of conclusion as to how these three vignettes should be interpreted and what, if anything, they have in common. A brief preface suggests that they show "a clear play between science and personality", and that passion, not dispassion, is a trait that many scientists share in common. If there is any room for cavilling at this excellent piece of writing, it is that such interesting assertions deserved fuller treatment. □

Nicholas Wade is a Member of the Editorial Board of the New York Times. *His most recent book, written with William Broad, is* Betrayers of the Truth *which was published earlier this year.*