How did they all get that way?

R.J.P. Williams

Silicon and Silicones: About Stone-age Tools, Antique Pottery, Modern Ceramics, Computers, Space Materials and How They All Got That Way. By Eugene G. Rochow. Springer-Verlag: 1987. Pp.181. Pbk DM 24.80, \$16.95.

EVERY now and then one comes across something different and what a blessing it is. This book is overtly about silicon, its chemistry and physics, and yet it is about something quite other. It is almost an autobiography.

Professor Rochow wants to educate us in a gentle way about silicones and he does this wonderfully well; any student could learn with pleasure from him about silicon, silicates, organosilanes and so on as they are described here. But the book is also about the excitement, challenge and fun of being a chemist and discovering chemicals. Here is a man who is not afraid to tell stories, quote poems, and laugh at

himself (and you). He literally loves silicon and treats his subject with reverence. While engaged in the description of this chemistry you are suddenly told how to make a 5MHz NMR spectrometer (for nothing) just in order to look at silicon NMR. Elsewhere the book meanders sweetly into fields of stone-age flint, semiconductors, insulators, glasses, ceramics — in fact anywhere the river silicon flows. "Sweet silicon run softly till you end your song."

At the end of the book Professor Rochow turns to silicon in biology. Only here does he miss a trick, for while he knows the inanimate silicon the lively variety is apparently less familiar to him. I'd like the chance to show him another glory of his love, the silicon of the radiolaria, of the nettle hair, of the protozoa.

I do not wish to close on this seeming criticism but rather to stress how this book reminded me of what has been lost — fun and enthusiasm for chemistry. Do read it and forget about granting agencies. □

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Hidden agenda

Tony Sudbery

Quantum Implications: Essays in Honour of David Bohm. Edited by B. J. Hiley and F. David Peat. Routledge & Kegan Paul: 1987. Pp.455. £25, \$49.95.

A STRIKING feature of the history of quantum mechanics is that among those who have done most to formulate the theory are those who have been the loudest in dissent from it. David Bohm is known to generations of students as the author of one of the clearest and most thoughtful textbooks of quantum mechanics, in which he gave the theory in its orthodox form (the 'Copenhagen interpretation') a reasoned and careful account which still, after nearly 40 years, serves as a standard. But he is also famous as the man who challenged the doctrine that alternatives to the Copenhagen interpretation were impossible, and his name is attached to a form of quantum mechanics (the 'causal' or 'hidden variables' version) which few students will learn in conventional courses. The interplay of conventional and unconventional is evident throughout this collection of essays, published to honour Professor Bohm on the occasion of his retirement from Birkbeck College.

The essays have been neatly arranged by Basil Hiley and David Peat to form a continuous fantasia on the themes that

have concerned Bohm throughout his life as a physicist. After an introduction in the form of an intellectual biography by the editors, Bohm himself describes the origin of his interest in hidden variables as a way of supplementing and making intelligible the usual version of quantum mechanics, and the development of this interest into his current concept of the 'implicate order'. We are then taken back to an early interest of Bohm's, many-particle quantum systems, in papers by his students Eugene Gross and David Pines on collective phenomena. Both are lucid and interesting, and accessible to the non-specialist.

There is a possible link between many-particle theory and the foundations of quantum mechanics, if A. J. Leggett is right in his theory that the puzzles of quantum mechanics will be resolved by the emergence of new laws which apply only to complex systems. Leggett describes this speculation in the course of a beautifully written article in which he reflects, with rare clarity, on the paradox that quantum mechanics, while purporting to describe phenomena consisting of discrete events, presents a theory in which events don't happen.

Links between quantum mechanics and macroscopic systems are also discussed by T. D. Clark, in a more technically detailed article than most on the construction of 'macroscopic quantum objects', and Roger Penrose, who speculates on the possible relevance of two apparently totally different topics, of gravity and

consciousness. Other papers on the foundations of quantum mechanics are contributed by Bernard d'Espagnat, John Bell, Richard Feynman, Geoffrey Chew and Henry Stapp. D'Espagnat's article is characteristically and judiciously philosophical, Feynman's characteristically and boldly pragmatic: let us, he suggests, simply allow that probabilities can sometimes be negative.

The papers by Bell on the one hand, and Chew and Stapp on the other, interestingly hint at a possible convergence of ideas on quantum mechanics. Although they are associated with rather different positions, they arrive here at what seem to me to be closely related formulations in their search for a conceptually satisfactory form of quantum field theory.

In Bohm's causal version of quantum mechanics, particles have definite trajectories in space and time, and their motion is controlled by a 'quantum potential' whose effects do not diminish with distance. This approach has been vigorously developed by groups led by Bohm and Hiley at Birkbeck and J.-P. Vigiér in Paris. Vigiér and some of his co-workers contribute a long article surveying their recent work in this area. To many physicists this work is reminiscent of nineteenth-century work on the structure of the ether, and there is indeed a paper by P. R. Holland and C. Philippidis on electromagnetic potentials as dislocations in a relativistic ether.

Conceptual problems in quantum mechanics are closely related to problems concerning time and irreversibility; such problems are the subject of papers by Ilya Prigogine and Yves Elskens, and by Y. Aharonov and D. Albert. David Finkelstein muses in a delightfully elegant and stimulating way on time, space and physics, and Robert Rosen contributes an excellent essay, cogent and clear-headed, on the relation between physics and biology.

In recent years Bohm has been concerned with his concept of 'the implicate order', a view of quantum physics based on the metaphors of the hologram and of ink drops in glycerine. The notion of implicate order is brought to bear here on neurology, psychiatry, meditation and aesthetics, and is finally the subject of a conversation between Bohm and Renée Weber. The meaning and significance of this part of the book remain, to this reader at least, appropriately implicate.

Quantum Implications is a fitting tribute to one of the most searching thinkers in modern physics, and will become a standard reference work on the concepts of quantum mechanics. □

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