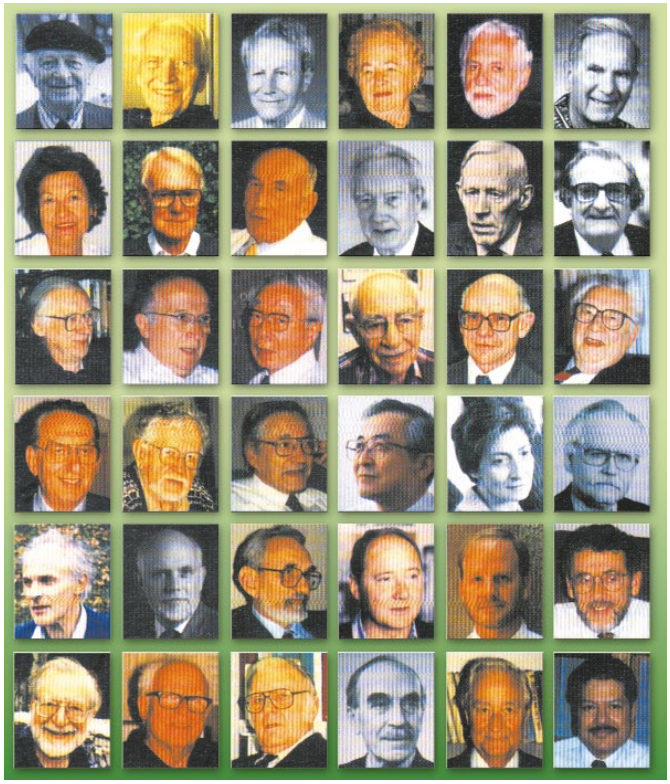
drug-resistant tuberculosis, has written such a first-hand account, *The Tuberculosis Survival Handbook* (XLR8 Graphics, London, 1999). It is a slender but revelatory volume whose jokey title does it no justice; it should be read by anyone involved with this still terrible disease. ■

Thomas Dormandy is at 16 St Albans Road, London NW5 1RD, UK.

Reactions of a chemical kindred

Candid Science: Conversations with Famous Chemists
edited by István Hargittai
Imperial College Press: 2000. 516 pp. £25 (pbk)

Gautam R. Desiraju



A cornucopia of chemists: words from Pauling through to Zewail.

Science, one would like to think, is always candid, and here we have a collection of candid scientists who speak at length about themselves and their work. Just about every one of the 40-odd chemists interviewed by István Hargittai could be termed famous, at least within the chemical community. Around half are Nobel laureates, and the editor has chosen well in that, taken together, the conversations provide a broad overview of the development of chemical thought in the second half of the last century.

The interviews have appeared individually in *The Chemical Intelligencer*, a journal which itself owes much to Hargittai as its founding chief editor. The present book is a lightly edited collection of this material. The interviews are not published in any particular sequence, but, having read them individually in *The Chemical Intelligencer*, I must admit to a feeling of satisfaction in seeing them all together. The whole is greater than the sum of its parts.

A third or so of those interviewed are native-born Americans, another third are scientists of European extraction, mainly Jewish, who migrated to the United States around the tumultuous times of the Second World War, while the remaining interviewees spent a large part of their working lives in the countries of their birth, whether in Europe or elsewhere.

The American influence is pervasive in this book, as it is in modern chemistry. Although the editor does not mention the circumstances that led to his choice of these particular chemists, the very complete picture that emerges only highlights the dominance of the US academic–industrial synergism in establishing trends and setting priorities in contemporary chemical research. Carl Djerassi comments about the fashion orientation of American chemistry, but is quick to admit that he speaks as an outsider. This brings one to the next question — does the outsider have in-built advantages as a researcher? According to Erwin Chargaff, each pioneer is *eo ipso* an outsider. Going by the interviews here, one can safely turn the aphorism around.

Indeed, a significant theme of this book is what it takes to make an outsider into a pioneer. Gertrude Elion, Paul Scheuer, Vladimir Prelog, Michael Dewar, Roald Hoffmann, Herbert Brown, George Olah, Eiji Osawa and Ahmed Zewail have much to say on this matter, in addition to Chargaff and Djerassi. These chemists come across clearly as outsiders with respect either to the establishment, to their adopted country, to society and its conventions, or more poignantly, with respect to their families. But in every case, self-perception as an outsider seems to have triggered vital chemical reflexes. Can internal unrest spark scientific imagination? Clearly, yes, although other equally stimulating reasons are apparent from the conversations with, say, John Pople, John Roberts, Stephen Berry and Kenneth Pitzer. In the end, though, all major scientific progress arises from "gap jumping", to quote Derek Barton. To do this, however, one must recognize the gap and then want to jump. Pioneers do both.

Science is dispassionate in its aims and international in its scope, and yet the activity of scientists is strongly influenced, even limited, by society. Take, for instance, Roald Hoffmann and Kenichi Fukui. These chemists shared the 1981 Nobel Prize in Chemistry for their theories, developed independently, concerning the course of chemical reactions. Hoffmann would clearly like to convey a broader message to society through his poems, films and general writing, but recognizes his limitations when he concedes that, in the United States, scientists and their achievements are generally ignored.

Fukui, in contrast, is uncomfortable about communicating with the lay public on scientific matters, but is inundated with requests to do so. Is his austerity, quite typical of Asian cultures, a result of society's admiration or does it actually accentuate it? Again, is Hoffmann's obvious enthusiasm a response to the general lack of interest in science among the American public, or does a proactive stance, quite common in the West, induce the general apathy? The truth probably lies somewhere in between, but it would still be interesting to record the reactions of Nobel laureates from the United States and Europe to the near-hysterical adulation they receive in Asian settings, almost as a matter of course.

Another theme that emerges is that the most successful chemists appear to be able to change their research interests effortlessly, in some cases many times over, during their careers. Sherwood Rowland refers to the yawning gap between being "in the groove" and "in the rut". Philip Eaton, who synthesized cubane in the 1960s using a stepwise route, is sure that synthesizing the similar but far more complex buckminsterfullerene using a similar approach today would be a waste of time. Fukui switched completely from experiment to theory.

Many of those interviewed also seem to

be concerned with the general shortcomings of the chemical community. Olah feels that chemists just don't think about the broader picture; he also admits that they are not the most interesting of people — surely, there is a connection. Hoffmann states blandly that any piece of junk can be published somewhere, and that even in the *Journal of the American Chemical Society*, the acceptance rate is around 60% for full papers. These and many other comments need to be read carefully and assimilated, especially by newcomers to the subject.

With the rapidly changing research scene, one is almost wistful about the past — when Djerassi exalts Robert Woodward and Robert Robinson as generalists, when one compares Elion's gentle and thoughtful approach to drug design with today's high-throughput screening procedures, when one savours the complete picture of marine natural products obtained from Scheuer's work, and when Hoffmann laments the lack of teaching content in a research paper, one feels that perhaps the golden age of classical chemistry is over.

Research is and will always be exciting, but the conversations in this book encapsulate a time that is past, and leave the reader with a comforting glow. The main protagonists have told their tales, and the editor has conducted his interviews with sympathy and collected his material with care. For this, he is to be commended. His book will be enjoyed by chemists and non-chemists alike. ■

Gautam R. Desiraju is in the School of Chemistry, University of Hyderabad, Hyderabad 500 046, India.

Putting science in its place

The Architecture of Science
edited by Peter Galison & Emily Thompson
MIT Press: 1999. 576 pp. $65, £43.50

David N. Livingstone

Scientific knowledge is made in many different places; does it really matter where? To put it another way, can the location of scientific endeavour affect the conduct of science and, even more importantly, its content? The contributors to the present collection evidently think that the answer to these questions is an emphatic 'yes'.

On the surface at least, this is a remarkably counter-intuitive claim. Of all the human projects devoted to laying aside prejudices, and to putting in place mechanisms to guarantee objectivity, has science not been the most assiduous in executing its ideals?

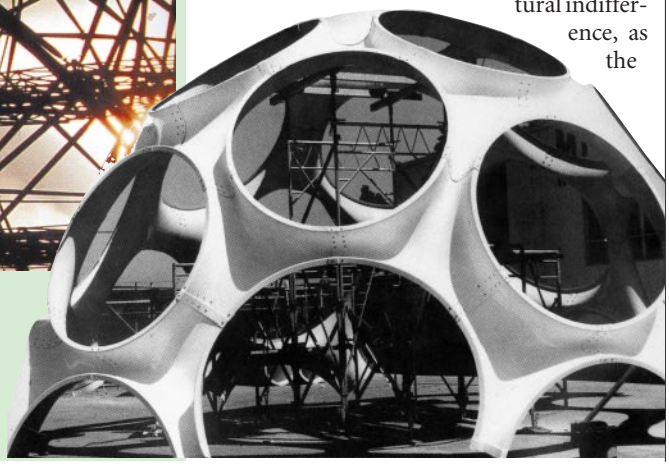
And yet science has been practised at a vast array of sites, each with different physical, acoustic and olfactory qualities: the alchemist's workshop with its roaring furnace and smelly, noisy stills; the wide-open, airy spaces of the field; the fusty alcoves of the museum; the antiseptic hospital. Even to express things in this way, of course, is to run the risk of caricature. Laboratories, gardens, observatories, hospitals and so on all come in a wide variety of sizes and configurations. But these stereotypes can convey something of the remarkable array of knowledge-producing scientific arenas.

Any attempt to come to terms with the spaces of scientific endeavour is plainly a multi-faceted project. And the essays in this collection focus on one key aspect of the task: the connections between science and architecture. The entire volume is concerned with elucidating the relationships between the buildings of science and the building of scientific knowledge.

Temporally, these essays, by academics and practitioners, take us from early modern European museums and chemical houses to twentieth-century molecular biology laboratories and the post-modern hospital. Conceptually the range is just as great, dealing with the ways in which the arrangement of scientific space has managed the tricky relationships between secrecy and openness, concealment and display; with the role architecture plays in shaping individual and group identity; and with the prevalence of physiological and mechanical metaphors (such as circulation and compression) in architectural thought. More specifically, the links between scientists and architects in the construction of the Lewis Thomas Laboratory for Molecular Biology at Princeton is the subject of several chapters.

Like most multi-authored works, this book lacks a single, coherent line of argument. Some of the essays consist of the autobiographical reflections of individuals directly involved in particular building projects; others are normative arguments about the kind of relations that should obtain between science and architecture; others are historical interrogations of how the shape of buildings influences the shape of science.

But the crucial issue, in my view, is whether (and if so, how) the cognitive content of science is influenced by its setting. Building arrangements have a bearing on the social relations that can take place among the scientists inhabiting these spaces. But can the architectural spaces themselves condition the knowledge that is produced? Whether this question can be answered without succumbing to either architectural determinism or architectural indifference, as the



Architectural adventures

A model of the Autonomous House (above) and Richard Buckminster Fuller's 'Fly's eye dome', from *Norman Foster: A Global Architecture* by Martin Pawley (Thames & Hudson /Universe Publishing, £14.95/$25).