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. ■

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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?

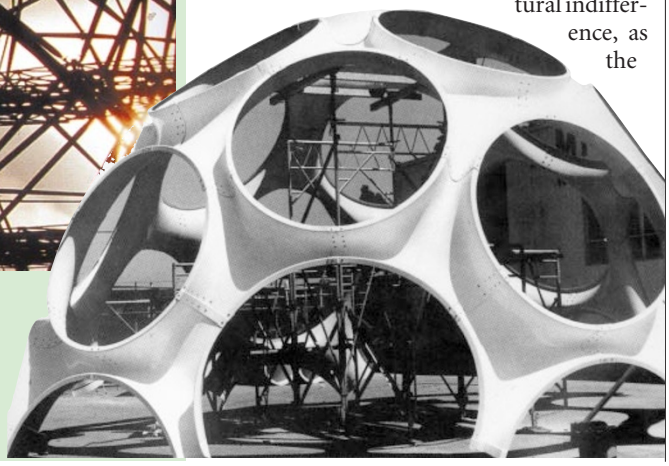
And yet science has been practised at a vast array of sites, each with different physical, acoustic and olfactory qualities: the alchemist's workshop with its roaring furnace and smelly, noisy stills; the wide-open, airy spaces of the field; the fusty alcoves of the museum; the antiseptic hospital. Even 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).

editors put it, is of paramount importance.

Several essays bear directly on this issue. Consider, first, the topic of who makes scientific knowledge. The rhetoric of 'openness', so dominant in the early days of the scientific enterprise, was actually compromised by a number of strategic exclusions that did much to shape the nature of the endeavour: women, for example, were denied access to some sites of knowledge and, when they did engage in the pursuit of natural historical knowledge, had to do so in very different spheres. Again, early laboratories very carefully managed their thresholds in order to ensure that only the 'right' visitors were allowed access. The acquisition of scientific knowledge was thus part of a social process that had its own cultural topography.

But issues of 'access' are not the only way in which place and space have influenced scientific claims. Spatial arrangement has also been important. The ways in which nineteenth-century museums displayed their artefacts, for example, expressed different views about the nature and significance of the very objects themselves. Should certain items be displayed side-by-side or far apart? Should a specimen's site of discovery take precedence over its place in some taxonomic scheme when being presented for public scrutiny? The ways in which such questions were resolved disclosed how cognitive claims and spatial arrangements were mutually reinforcing. In such circumstances, museum space became a contested map of scientific judgement. In the case of anthropological museums, the physical layout of the exhibits conjugated differences between anthropological leaders on the very nature of their projects. Just how human history was displayed articulated different ways of reading the story of the species.

Hospitals also reveal intimate links between architectural configuration and claims to knowledge. In the early nineteenth century, hospitals were built to give expression to the belief that patients were in need of moral as much as medical help; they were intended to instil virtue as well as to restore health. Accordingly, the internal structure of the hospital was designed to impose order and control on the chaos of suffering and disease. Later, the advent of the multi-storey hospital mirrored the shift from bad-air theory to the germ theory of disease; the isolation presumed necessary for the former was no longer architecturally relevant in an age of sterilization. More recently, images of the mall or hotel have been increasingly favoured as the appropriate trope for the post-modern hospital.

Whatever its drawbacks, then, *The Architecture of Science* is a most welcome volume. Readers will never again look at scientific architecture with the same eyes. ■

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Science in culture

Prints and imprints

Chris Drury's "Journeys on Paper"

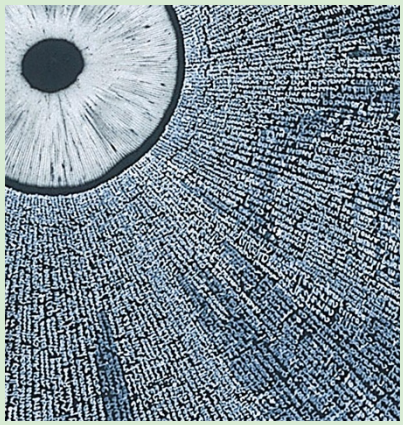
Martin Kemp

Some scientific observers of nature seem naturally drawn to complex phenomena, reaching out to grasp the elusive patterns underlying such fluctuating systems as populations of predators in relation to prey, or the beguiling chaos of fluids in turbulent motion. Others are attracted to the potential certainties of 'mathematical' engineering, in which the goal is to define the smallest functional units as components in the reconstruction of effects from causes. Temperament is clearly a powerful factor in determining who chooses which path.

Artists who aspire to reconstitute nature in their work — without necessarily imitating natural appearance — also tend to gravitate towards one of these two poles. Among the British predecessors of Chris Drury as students of landscape, Ben Nicholson's geometricizing reliefs and drawings, undertaken in St Ives between the two world wars, leant towards the mathematical pole, while Ivon Hitchen's contemporary oil paintings exploited free sweeps of overlaid paint to evoke the elusive contingencies of light, colour, atmosphere, reflection and motion in the moist English landscape.

Chris Drury's prime interest is the complexity of natural forces in action. Yet, like a number of recent artists who involve themselves in process rather than direct portrayal, he is drawn to the way in which the inherent structures in dynamic systems result in orders to which we can instinctively respond — even without benefit of the new mathematics of complexity.

Drury has worked extensively in nature itself, using natural materials to construct land sculpture and 'cloud chambers' (stone 'hives', which enclose camera obscura images of moving skies). His works on paper — or rather using paper as a surface to be manipulated — range widely across phenomena in which he senses patterns of affinity. Swirling folds in driftwood trunks of redwood are reminiscent of vortex configurations in a cross-section of tissues in the human heart. Caps of different mushrooms deposit their spore prints in a minute tracery of



STEPHEN LACEY GALLERY

radiating geometry that is at once regular and infinitely variable.

Yet there is something more at work than 'nature art'. Maps, those most conventional plottings of the surface of the Earth, are interwoven, basket-wise. A map of the Ladakh desert, for instance, is interwoven, strip by strip, with paper rubbed with desert earth to form a shallow bowl, which is in turn recessed within a rubbing from a prayer stone encountered en route. Maps are peppered with words. The nucleus of a spore print is typically surrounded by minutely inscribed names, phrases and clauses in a radial pattern that marvellously echoes the deposits from the interstices of the gills. In *Poison Pie* (pictured) the white spore print of *Amanita muscaria* (Fly Agaric) extends in an aureole of text that chants the names of poisonous fungi — *Amanita phalloides* (Death Cap), *Amanita virosa* (Destroying Angel), *Russula emetica* (The Sickener), *Coprinus atramentarius* (Ink Cap), *Hebeloma crustuliniforme* (Poison Pie itself), and so on — in concert with cool accounts of their identification and toxicity.

Drury patiently interweaves natural images and mental imprints in a constant give and take between the business of observation, acts of naming and recording, means of visual plotting, processes of classifying, evocative associations, inscribed memories, and the kinds of spiritual strivings that have accompanied so many cultures in their quest to become one with nature. As Marina Wallace says in her catalogue essay, "Drury accesses the scientific classifications and attempts to turn them into almost mythological narratives, using the element of repetition to accompany the visual marks". The result is an endlessly suggestive immersion in our visual and conceptual relationship with nature, in the orders we can discern and the contingencies in which we find such human delight. ■

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Chris Drury's "Journeys on Paper" are on view at the Stephen Lacey Gallery, One Crawford Passage, London EC1 3DP, until 7 July.