tal expenditure that would be repaid in fuel cost savings in two years. Much of the reduction would be achieved through the now familiar steps of winterization—improved insulation, temperature setbacks related to use, reduced and often improved lighting. It is less expensive to improve the energy efficiency of the existing buildings than to build a power plant of equivalent capacity.

These issues will increasingly be brought into the economic and political realm. We are able to see to the end of our existing fossil-fuel base, so the heating and cooling plant of an existing building fueled by gas or oil will probably have to be replaced, with the attendant conversion costs, well within the useful life of the building. Beyond this, energy use is an ethical and social issue: "Buildings designed to overuse energy penalize everyone who needs energy for survival," Stein writes in showing the connection between energy use in the United States—35 percent of all energy use globally—and subsistence living conditions in much of the developing world.

The basis for optimism that Stein offers is rooted in his conviction that design is the act of intelligence applied to the allocation of existing resources and that there is an esthetic based on the "virtue of necessity," a phrase from the painter Paul Klee. "We could well expect a marked improvement in the quality of the built environment in the United States if there were a drastic reduction of energy use per square foot and a more intelligent use of the energy that remained," Stein writes. Whether one is already converted to this point of view or has yet to be convinced, the reader will find that in Stein's book the argument for it is carefully researched and modestly proposed.

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Pollution Processes

Marine Pollutant Transfer. H. L. WINDOM and R. A DUCE. Lexington (Heath), Lexington, Mass., 1976. viii, 392 pp., illus. $21.95.

Reiterating the truism that the oceans constitute the final repository for increasing levels of anthropogenic wastes, the editors of this book note the need for a comprehensive understanding of the transfer of pollutants such as heavy metals, petroleum, and chlorinated hydrocarbons in the marine environment. The book, an extension of a workshop sponsored by the National Science Foundation's Office for the International Decade of Ocean Exploration, presents the findings of the NSF/IDOE Pollutant Transfer Program in an admittedly incomplete attempt to summarize present knowledge concerning the movement of certain pollutants across major interfaces (air-sea, river-sea, biosphere-sea, particle-sea, sediment-sea).

The opening chapter, which summarizes the workshop, contains generally thoughtful interpretations of various research alternatives by the panel chairmen. The generalizations about global mechanisms prove to have certain weaknesses when applied in specific studies. This is almost unavoidable given the complexity of the subject and the piecemeal way in which data have been collected. The remaining 14 chapters are filled with useful information, some old and some new, concerning the movement of heavy metals, petroleum compounds, organochlorines (DDT, PCB's), and certain less well known organic contaminants (phthalic acid esters, halocarbons) across various interfaces. Heavy metal bioaccumulation and transfer are described by C. Patterson *et al.* and R. A. Duce *et al.*, and H. L. Windom and his associates, in a summary of their studies concerning cadmium and mercury transfer in southeastern Atlantic coastal areas, lucidly describe some attempts to construct simple models of metal movement through specific marine systems. Some attention is paid by other authors to the fate and distribution of pelagic tars. R. W. Risebrough *et al.* give a thorough though somewhat overlong account of DDT and PCB movement through marine food webs, with an emphasis on the higher trophic levels (birds and mammals). In short, the book is a combination of literature reviews and accounts of individual research efforts that conforms fairly well to its stated goals.

The scope of the subject and the paucity of information about it have led to some omissions and overgeneralizations. For instance, there is little discussion of marine microbial activity even though consideration of such activity, together with trophodynamic response, is basic to any understanding of pollutant transformation and movement. Other factors, such as widespread physical alteration (due to channelization, dredging, damming, diking, and the like) in coastal drainages, are likewise ignored even though there is increasing evidence that they can be important to the movement of pollutants through various aquatic systems. The literature reviews and much of the original research described in the volume are sound. The book is most noteworthy, however, for the attempt it makes to bring some organization to what has been a relatively chaotic branch of marine research. For this reason it should prove useful to specialists in marine research and pollution ecology.

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Structural Carbohydrate

Chitin. RICCARDO A. A. MUZZARELLI. Pergamon, New York, 1977. xvi, 310 pp., illus. $38.50.

In spite of its bulk in the world's biomass and its importance as the main component of the integument of arthropods, the most abundant living organisms, chitin has received relatively little attention from researchers. Chitin is important in biology as the most widely used structural carbohydrate in the animal kingdom, being absent only in vertebrates and echinoderms. It is useful in analytical chemistry for ion exchange, chelation, and affinity chromatography and in an assortment of medical applications, but more important is its increasing use in industry for metal chelation, membranes, and photographic processes.

Muzzarelli's book shows the importance of chitin, and it is the first book to set forth the chitin chemistry needed in industrial and academic research. The first four chapters deal with the chemistry and properties of chitin, the last three with its uses and applications.

Muzzarelli begins with an outline of chitin occurrence and synthesis. It seems most likely that the chitin fibers, in fungi at least, are spun from chitin synthetase granules or chitosomes in much the same way cellulose fibers arise in other plants. It will be interesting to see if similar chitosomes are responsible for the chitin of animal cuticles and what role they may play in fiber orientation. Chitin associations with carotenoids, glucans, and proteins are dealt with sketchily because of the inadequacy of our knowledge of the chemical linkages concerned. Inhibitors of chitin synthetase, such as polyoxin in fungi and benzoyl phenylureas in insects, promise to be useful for experimental studies as well as to have practical application as fungicides and insecticides.