earthquake was not predicted and resulted in major damage and casualties; the Sungpan earthquake was predicted and resulted in slight damage, partly because it occurred in a sparsely populated area.

The delegation arrived in China four months after the convening of the National Science Conference of China, where the importance of science and technology were reaffirmed after ten years of unrest during which politics was placed ahead of everything else. In describing the organization of earthquake engineering research in China (chapter 2), the report depicts a state of change, with the laboratories that were destroyed and the university programs that were discontinued during the Cultural Revolution being restored or reorganized and institutes being assigned to new administrative units in answer to new demands or political realities. The chief agency of earthquake engineering research, the Institute of Engineering Mechanics in Harbin, for example, was moved out of the Academy of Sciences and placed under the State Seismological Bureau; its laboratories were subdivided and expanded. Recent visitors to China have found that changes are still going on; politics in science is being further de-emphasized, and some laboratories are now in operation with both Chinese and foreign instruments and apparatus.

Earthquake engineers in China have had to deal with the realities of earthquakes more than perhaps any of their colleagues elsewhere in the world. Beginning with the Xingtai (southwest of Beijing) earthquake, there were more than ten potentially or actually very damaging earthquakes in China during the period 1966–1976. In the seismically active and densely populated regions of China, many of the buildings either were constructed in a time when little was known about the seismicity of the area or were not constructed suitably to reduce the hazards of an earthquake, owing to a lack of funds, building materials, or building technology. Adequate construction was further hampered during 1966–1976 by the refusal of construction workers to accept the criticism of an engineering supervisor. In view of what is known about the past seismicity of many regions in China and the performance of old buildings in earthquakes, the questions facing engineers concern how the new building codes should be formulated and how some of the older buildings in seismically active areas could be shored up. The answers of course have to take into account the severe limitation of funds and the urgent demand for new construction. The report illustrates these points well and provides details of current building practices, some of which would certainly cause consternation to engineers in other parts of the world.

The report on the Tangshan earthquake is the most comprehensive one available in English. This earthquake, according to recently available official figures, resulted in casualties of about 200,000 (at the time the report was written the figure was rumored to be anywhere from 650,000 to 800,000). A devastating 85 percent of the multistory buildings in the region were either severely damaged or destroyed. Historically the region has not been particularly seismic, and it had been assigned a maximum intensity of VI. In fact, because of the presence of thick sediments in the region, the existence of faults was questioned even after the earthquake; although the faults had been mapped in coal mines, they were not linked to neotectonics. Tangshan is now open to foreigners, although much of the evidence of the earthquake has of course been erased during construction. The report contains some clear photos, provided by the Chinese hosts, of the aftereffects of the event. However, together with the writers of the report, this reviewer hopes that Chinese engineers and scientists will compile and publish a complete account of the Tangshan event, for such a report would assist us in alleviating such disasters in the future.

A 12-story apartment building under construction in Beijing (Peking). "Buildings in Peking are designed by the Peking Institute of Architectural Design for an earthquake of intensity VIII on the Chinese scale." This and a similar project visited "seemed to typify new apartment construction in Peking." It "has precast exterior walls, precast floors with topping, cast-in-place concrete shear walls, and brick partitions." With the construction procedures used, "it takes approximately 2 months to finish the concrete construction and about six months for total building completion." [From *Earthquake Engineering and Hazards Reduction in China*]

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Glaciology

Symposium on Glacier Beds. The Ice-Rock Interface. Ottawa, Aug. 1978. International Glaciological Society, Cambridge, England, 1979. 446 pp., illus. Paper, £25. Journal of Glaciology, Vol. 23, No. 89.

The symposium of which this book is the proceedings brought together glaciologists, who study the mechanisms of ice flow, and glacial geologists and geomorphologists, who observe the effects of past ice movements on the landscape. Discussions covered the nature of the ice-rock interface, physical and chemical processes at the interface, erosion and deposition, subglacial hydrology, glacier sliding, properties of basal ice, and conditions at the base of ice-age ice sheets.

The volume contains 26 complete papers plus 29 abstracts. Three are review papers; one deals with erosion processes (Boulton), and the other two present the views of the two main protagonists in the long-standing debate about glacier-sliding mechanisms (Lliboutry and Weertman). Other reviews, of observations of the glacier bed and sliding in tunnels (Vivian) and boreholes (Kamb *et al.*) unfortunately appear only as abstracts. Discussions of each presentation plus a 20-page general discussion are particularly valuable features of the book.

Questioning of accepted ideas is a feature of the book. Boulton, for example, presents the striking observation that 90 percent of the basal movement of an Icelandic glacier occurred not at the ice-bed interface but by deformation in subglacial till, and Kamb and his colleagues found a layer of "active subsole drift" between ice and bedrock. These observations show that the basic assumption in all present theories of glacier sliding, namely that there is a sharp interface between clear ice and an undeformable bed, is unrealistic.

The discussions reveal wide dif-

ferences of opinion on such fundamental matters as the relative importance of abrasion and plucking in erosion and the role of subglacial streams. Thus, although Boulton and Hallet have made theoretical analyses of abrasion, a comprehensive theory of erosion seems unlikely to emerge in the near future.

On the practical side, the symposium showed the variety of methods available for tackling the many unsolved problems. Though mathematical analyses and laboratory simulations will continue to be useful, the main need is for more detailed observations in tunnels and boreholes and also on surfaces exposed by retreating glaciers. For example, much can be learned about subglacial processes by mapping features and examining carbonate deposits on such surfaces (Walder and Hallet).

Many textbooks present a tidy picture of their subject by glossing over those awkward observations that do not fit current theories. A symposium volume such as this, on the other hand, emphasizes the areas of ignorance and disagreement. This is the first step to progress, however, and the book should guide the direction of research in the years ahead.

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Biological Membranes

Liposomes in Biological Systems. GREGORY GREGORIADIS and ANTHONY C. ALLISON, Eds. Wiley-Interscience, New York, 1980. xii, 412 pp., illus. $57.

Artificial lipid membrane vesicles, commonly known as liposomes, have been widely used both as experimental models in membrane research and as carrier systems for cellular delivery of drugs and other macromolecules in vitro and in vivo. The use of liposomes as model membranes has resulted in a significant increase in our understanding of molecular dynamics at the cellular level. Though the possible medical application that first attracted attention, enzyme replacement therapy, is still underdeveloped, there are promising new leads with respect to the use of liposomes in the treatment of parasitic diseases, metal poisoning, metal storage diseases, tumors, and rheumatoid arthritis. Genetic manipulation of cells in vitro and in vivo and targeting of liposomes to specific tissues are possibilities now under active development.

It is tempting to say that liposomes started as a cure in search of a disease. With the benefit of hindsight, and in spite of present successes, it seems to me that the problems associated with their eventual utilization in biology and medicine have only recently come into proper focus. It is quite possible that the early enthusiasm may have tempted researchers to downplay the complexities of the biological milieu in which such a simple carrier system was expected to operate. At this stage there is an increasing prospect for numerous useful applications of liposomes, although it has become clear that liposome properties have to be modified significantly to produce optimal results of practical significance. In view of the versatility of the liposome system and the number of investigators now involved in this field, the future looks promising.

This book is devoted exclusively to various biological applications of liposomes. Although the subject is timely, the book itself seems to be about two years out of date. Most of the chapters cover the literature only up to 1977, with some including a few references from 1978 and others missing most references from 1977. The last chapter (by G. Gregoriadis), however, is a brief but reasonably well organized summary of recent progress in various avenues of research.

The book begins with a chapter by A. D. Bangham, who gives a personal account of the early days of the liposome field, followed by a dense compendium of references on liposomes as model membranes, circa 1975–76. In the chapter by Gregoriadis, an account of the author's earlier work on various aspects of liposomes, such as their disposition in tissue, their role as carriers of lysosomal enzymes and drugs, and their adjuvant effects and oral delivery, is followed by a generous sprinkling of recent unpublished results. J. H. Fendler analyzes drug entrapment in liposomes and its possible enhancement by the formation of various complexes. G. Poste reviews the interaction of liposomes with cells in vitro, with an analysis of possible mechanisms of interaction and a discussion of the difficulties of interpreting the data. G. Weissmann and M. Finkelstein review their work with liposomes as enzyme carriers. G. Scherphof *et al.* discuss the interaction of liposomes with plasma components and liver cells. There are papers on liposomes as carriers of methotrexate (H. K. Kimelberg), chelating agents (Y. E. Rahman), and steroids (I. H. Shaw and J. T. Dingle). G. M. K. Humphries discusses the use of liposomes in immunological studies, with a review of the work from the groups of Kinsky and McConnell. Other chapters are authored by T. DeBarsy and F. Van Hoof, W. E. Magee, and I. R. McDougall.

Because of the delay in publication, the book is not likely to enhance the reader's appreciation of the current state of the art. However, by providing an overview of the earlier work of several leading groups, it is likely to be helpful to people just starting in the field. In this respect, it is a useful addition to several other books and reviews on the subject that have appeared during the last few years.

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Advances in Lipid Research. Vol. 17. Rodolfo Paoletti and David Kritchevsky, Eds. Academic Press, New York, 1980. xii, 308 pp., illus. $31.

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