gether. The unity of concept and theoretical technique in atomic, nuclear, and subnuclear physics is emphasized. This is brought out very clearly by comparisons of atomic and nuclear excitation spectra and by the uncanny resemblance of the curves for inelastic scattering of electrons by helium atoms at 120 ev, by lead nuclei at 600 Mev, and by protons at 16 Gev. This is the sort of thing that Weisskopf understands and teaches us perfectly.

The part played by "pictures" in the exposition of scientific ideas is also recognized—especially in the more recent essays. Weisskopf describes his type of explanation as *anschaulich*, meaning "plainly visible for the mental eye." An actual drawing, however metaphorical, may convey more of this abstract image than any amount of talking. The algebra of the review of "The compound nucleus" suddenly comes alive in the graphic representation of the course of a nuclear reaction in the later article "Problems of nuclear structure."

To be intelligible, you must know whom you are addressing. These essays originally appeared in various journals, ranging from *Reviews of Modern Physics* to *Scientific American*, and are more or less specialized in proportion. Most of them were written for such an audience as the readers of *Science*, presumably professional scientists but not necessarily knowledgeable about physics. As a physicist, I find it difficult to judge whether they could all be understood by, say, an associate professor of botany, but they are ideal for the student at the first stage of a course on atomic and nuclear physics. The article "Quality and quantity in quantum physics" tells him (qualitatively!) exactly what he will have learned in all the drudgery that will follow.

The supreme factor in clear writing cannot be communicated, and is not always learned in a lifetime of experience: it is wisdom. A science exists as a vast depository of facts and theories, from which must be chosen a few significant and central themes. To shape a subject in the mind requires more than technical knowledge: it demands that "desire and pursuit of the whole" called natural philosophy. The style is the man. The ultimate reason why many physicists will want to read these essays—whose subject matter, after all, is not unfamiliar—is that they are written by one of the most admired and loved scientists of our times, a man who has lived in obedience to the highest ideals of the scientific community: modesty, internationalism, high critical standards, recognition of the priorities of others, and service to humanity.

In the essay "My life as a physicist," the author tells us how he got that way. How jealous we must be of that Golden Age: the new physics, the Open Sesame to every hidden treasure of nature; Heisenberg, Bohr, Pauli; Göttingen, Copenhagen, Zürich. But remember also the poverty, the temporary jobs, the sinister political backdrop of Germany in the '30's. It was by no means all cakes and ale—or, indeed, all IBM cards and Xeroxed reprints. Follow this by teaching in an upstate American university, and the pressure and drama of Los Alamos. In what high-powered graduate school, through what munificent fellowships, at the feet of what sage, can the modern young scholar acquire the same combination of intellectual and spiritual strength, without arrogance or pretense? In the '50's, Weisskopf withdrew from all the national defense activities of the scientific community, and devoted himself to international causes. CERN, the model institution of international science, is a reflection of his personality. We do not, perhaps, recognize how far we are still governed, in our scientific and moral standards, by the example of that small group of "elders" of which Weisskopf is so distinguished a member. Who will replace them?

In his final essay, "The significance of science," Weisskopf discusses all those issues of the "relevance" of science that are so widely debated. As one might expect, he states clearly and concisely the characteristic arguments on every side, notes inconsistencies, and pricks follies. He emphasizes the social obligations of the scientist and the dangers of overspecialization and technical arrogance. But fundamentally he is a rational humanist with a decent bias toward optimism. As Hans Bethe says of him in his foreword, "All his life he has sought and contributed to knowledge, and all his life he has shown compassion." This mixture, like the book here reviewed, is much to be recommended.

JOHN ZIMAN

H. H. Wills Physics Laboratory,
University of Bristol,
Bristol, England

Aerosol Research

Aerosols and Atmospheric Chemistry. Proceedings of a symposium, Los Angeles, March 1971. G. M. HIDY, Ed. Academic Press, New York, 1972. xviii, 348 pp., illus. $14.50.

This volume contains 30 papers presented at the 1971 American Chemical Society Kendall Award Symposium honoring Milton Kerker. The contributors are all well known in the field, and the reader receives an excellent status report on a few selected topics in aerosol physics and chemistry, such as aerosol formation and growth, optical properties of aerosols, and specific techniques for determining aerosol mass, size, and chemical composition. Furthermore, the editor has devoted almost half the book to a detailed presentation of the "classical" 1969 Pasadena Smog Aerosol Study.

In a series of 12 articles, the reader is made familiar with the history, the approach, the techniques used, and the major results of this first attempt to investigate urban atmospheric aerosols involved in photochemical reactions. This section not only is of interest to specialists concerned with similar problems, but it more importantly reveals to the general chemist, physicist, and atmospheric scientist the extreme complexity of an aerosol system, as well as the sophistication in instruments required to obtain information on the physical and chemical properties of particles suspended in and interacting with a continuously changing gaseous environment.

The book has already found its way to the library of almost every researcher working with atmospheric aerosols. However, what might benefit this rather small group of specialists does not necessarily meet the needs of general scientific readers. The reader should not on the strength of the title expect a comprehensive, critical, and uniform presentation of "aerosols and atmospheric chemistry." He should not expect to find a ranking or classification of specific topics discussed in the book in terms of overall importance or relevance to atmospheric processes. And least of all should he expect a textbook-style overview of the field wherein each topic is given a lengthy general introduction. Those scientists who are interested in the present state of the art in aerosol physics and chemistry, or who wish to acquaint themselves with the methodology and the research tools

used in this field, will find this book highly rewarding, however. Graduate students in physics and chemistry searching for experimental or theoretical research problems most certainly will not be disappointed after studying in detail the authoritative articles in this book.

VOLKER A. MOHNEN
Atmospheric Sciences Research Center, State University of New York, Albany

Ancient Building Material

Stone. Properties, Durability in Man's Environment. E. M. WINKLER. Springer-Verlag, New York, 1973. xiv, 230 pp., illus. $33.70. Applied Mineralogy, vol. 4.

Early cave man has been identified as such from that domicile of his which was fabricated from the rocks by nature's processes. Modern man quarries and artificially constructs his stone "caves" on top of the surface of the earth. Geologists are thoroughly familiar with rocks on the outcrop and at depth, but many of us know comparatively little about stone, the primary building material obtained from the earth's crust. Winkler's book fills a long-existing gap between classical petrography of native rocks and documentation on those constituents and properties of rocks which make them useful, durable, and pleasing as building materials. The book is easily readable and will be informative to geologists, stone producers, engineers, architects, ecologists, and stone conservators.

Winkler's viewpoint (and book) is distinctive in another way—he writes of stone in man's environment, rather than solely in the geologic environment. From this enlarged and interprofessional perspective the essential features common to rock and stone are given with reference to igneous rocks, clastic and chemical sedimentaries, and metamorphic rocks. The broad view is maintained as properties of stone arising from their solid phases, interstices, cements, and thermal and optical (light transmissivity) behavior are discussed. Natural deformation of stone by unloading, plastic deformation, pressure release (rock bursts), and shock waves due to blasting during quarrying and in buildings after incendiary and nuclear bombing are surveyed.

Colors of stone are considered with regard to genesis, nomenclature, and esthetics. For example, warmer tones in sedimentary rocks typically are converted to colder tones in metamorphic rocks. Reflectivity and polish may enhance the beauty and utility of one stone whereas another is most pleasing in fractured, sawn, or native surface.

From an approach unconventional to geology the decay, weathering, and durability of stone are extensively treated. Instead of focusing on the altered daughter product, Winkler treats of what alteration does to the original stone. He includes such agents and processes as dissolution, bacterial activity, chelation, microplants, interstitial expansion by ice and dissolved salts, osmotic pressure, organic physical effects, fire resistance, and urban versus rural versus desert climates. Ecology and humanity are not neglected. Silicosis, its symptoms, physiology, and prevention, is considered much more fully than with the cursory dismissal usual in geologic literature. Stone conservation is the subject of the 13th and final chapter, but some 12 pages of useful information on mineral properties and American Society for Testing Materials specifications and a glossary are appended.

Each chapter is closed with a helpful summary. The book is well illustrated, including several full-color plates and a beautiful full-page picture of the harmonizing stone front of the Notre Dame Memorial Library. A caliper measures the thickness of the printed pages as 13/32 inch—at a list price of $33.70, the shelf index is approximately $83 per inch. Winkler has produced an excellent book on stone; the publisher's price impels one to think of gold.

W. D. KELLER
Department of Geology, University of Missouri, Columbia

Japanese Protein Chemistry

Proteins. Structure and Function. M. FUNATSU, K. HIROMI, K. IMAHORI, and K. NARITA, Eds. Kodansha, Tokyo, and Halsted (Wiley), New York, 1973. Two volumes. Vol. 1, x, 382 pp., illus. $19. Vol. 2, x, 270 pp., illus. $14.50.

The last decade has seen impressive developments in the analysis of protein structure and function. With the information that has become accessible through x-ray diffraction, high resolution magnetic resonance spectrometry, rapid kinetics, and genetic analysis and through the continuous refinement and improvement of the more classical physical and chemical methods, it has become possible to construct sophisticated structure-function models of a number of proteins. Although these models are still not yielding any complete answers concerning the dynamic action of proteins in living cells, they have made it possible to formulate the questions at a high level of mechanistic detail.

The scientific community has been kept up to date about the conceptual, theoretical, and experimental achievements in this field through a flood of accounts, first in the journals and then in digested form in textbooks, lectures, and an awesome quantity of treatises and reviews.

The review literature has become rather repetitive and stereotyped, and a new two-volume work entitled *Proteins: Structure and Function* was consequently received by this reviewer with only lukewarm enthusiasm. A glance at the table of contents suggested that this one might be a little different, however. In addition to well-established "stars" such as trypsin (dealt with by T. Inagami) and lysozyme (K. Hamaguchi and K. Hayashi), there are chapters on phage lysozyme and endolysin (A. Tsugita and Y. Ikeya-Ocada), ribonuclease T (K. Takahashi) and its substrate analog complexes (T. Oshima and K. Imahori), all in volume 1, and, in volume 2, on amylases (K. Hiromi), stem bromelain (T. Murachi), ricin (M. Funatsu), threonine deaminase (M. Tokushige), ribulose diphosphate carboxylases (T. Akazawa), and amino-terminal acetyl groups in proteins (K. Narita).

The objectives of the editors in putting together this rather unusual collection of subjects were to present aspects of research on protein structure and function ranging from detailed analysis of the most studied and best understood proteins to physical, chemical, and biological probing of less completely characterized ones; to illustrate, by encouraging each author to deal primarily with his own work, the variety of approaches taken to problems within the field; and to make the contributions of Japanese protein chemists more widely known. Although I don't think that separate books are required to achieve this last objective (especially after noting the well-known accom-