cluded here concerns the free oscillations of the earth, which rings rather like a bell, with its characteristic line spectrum, when struck hard (for example, by an earthquake).

Phenomena of the solar photosphere and chromosphere are summarized by G. Righini "for the benefit of nonspecialists." This article is based mainly on A. Unsöld's textbook and an article by C. de Jager, published in *Handbuch der Physik*. R. Lüst's brief article on the corona and solar wind appears to be essentially an expanded abstract of his fine review in *Space Science Reviews* [**1**, No. 3 (1963)]; I suspect this contribution appears here only to provide so-called "completeness."

T. Gold's discussion of interplanetary particles and fields deals with heuristic models. He suggests a variety of physical ideas, along with a number of illustrative sketches, which may be a source of inspiration to theorists more inclined to develop mathematical models. A detailed analysis of a long series of observations of solar cosmic rays, made with the Explorer VII satellite, forms the main substance of a paper by J. A. Van Allen and W. C. Lin. In addition, they discuss some modifications to Störmer theory (which applies to a steady dipole field) that are imposed by the real geomagnetic field.

A long article by R. Jastrow, on planetary atmospheres, will be useful to students entering the field. Its general utility is unhappily marred by the absence of any references to the literature. In the final article, S. Hayakawa treats x-rays and high-energy particles from the moon and planets, detectable (perhaps) by instruments on spacecraft.

As far as the book as a whole is concerned, Rossi is to be congratulated for assembling such outstanding contributors. Still, I am unfavorably impressed by the unevenness of treatment among different articles and by the absence of an index: Almost any of these articles might just as well have been published in a review journal. The main excuse for publishing this particular set of papers together is evidently a traditional or commemorative one, which is fine. But I take the view that, when I pay this kind of price (more than 4 cents per page) for a book, I can reasonably expect something special besides a hard cover.

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Elementary Science Education

Elementary Teacher's Classroom Science Demonstrations and Activities. David E. Hennessy. Prentice-Hall, Englewood Cliffs, N.J., 1964. xii + 308 pp. Illus. $7.95.

Hennessy frankly claims that the purpose of this book is demonstration. The pages are filled with ingenious, practical, and clearly described assemblages of materials. Sources for the latter indicate their ready availability. A Foucault pendulum on a piano stool and a tack oscillating between tin cans charged with rubbed plastic are examples of interesting set-ups. The suggestion that a collecting net can be obtained from the butcher who wraps hind quarters of beef in conveniently shaped cheese cloth is useful. David Moon's illustrations are excellent. Hence, the avowed purpose is admirably achieved.

How much of a contribution the work is to today's ferment in elementary science education is another matter. On this question I feel that the score is negative.

The philosophy underlying the selection of activities is outmoded because the content does not move much beyond Newton. Even space science is related to inertia, action and reaction, and forces. More-modern science thinks of interaction of limited systems as models to describe physical and celestial phenomena. A rocket is pushed, not by Newtonian laws, but by unequal pressure of gases within it.

Living things are introduced by collecting and killing insects, instead of having the children explore the interactions with various environments. The universe is approached by concentrating on the static relation of size and distance in the solar system. Geology is presented with no thought for the tremendous sweep of time and the slow but continuous change inherent in this study.

Not one of the conceptual schemes suggested by Paul Brandwein and other modern science educators is present even implicitly in the book: ideas of energy transformation, the influences of environment and heredity on living organisms, the immensity of change in the universe.

The pedagogy advocated is not the sort that promotes learning by children. The teacher shows and tells. The explanations offered in the sections labeled "Discussion" are often unacceptable as modern scientific thinking: atmospheric pressure tries to fill a partial vacuum (p. 94); bodies attract or repel each other; the suggestion that the Sphinx moth has a long tongue so that it can reach the nectar and help pollinate the flower at the same time (p. 36).

The author does not seem to recognize that children learn best through free exploratory manipulation of materials followed by articulation of their discoveries. Children parallel the procedures of scientists in that they ask questions raised by their own experiences and find answers in many ways.

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History of Technology

Rudolf Diesel: Pioneeer of the Age of Power. W. Robert Nitske and Charles Morrow Wilson. University of Oklahoma Press, Norman, 1965. x + 318 pp. Ilus. $5.95.

The story of Rudolf Diesel and his engine should make a good book if a sympathetic writer who understood the engine would explain its development carefully. The engine has been responsible for the transformation of sectors of our economy, and it is historically interesting as a rare example of the way science is supposed to be applied to engineering—the Diesel engine began as a pure idea. The man Diesel is also an interesting figure, a proud, over-rational neurotic, with chronic headaches and occasional breakdowns, a driven man with a mission to do for the 20th century what James Watt had done for the 19th. In 1893 he published a book in which he set forth the abstract principles of his rational heat engine, as he called it, before he had any hardware at all. He got into deep trouble because the engine did not turn out to be what he said it was, but he was nevertheless able to sell his pure idea to manufacturers for a handsome fortune, which mysteriously disappeared before he had a commercially viable engine. He also undertook to reconstruct society on rational principles, or at least he wrote down the principles in his book *Solidarismus*, but he could find no one to implement these ideas.

That story could stand on its own feet without being glamorized, but the

authors of this recent biography are bent on making the story glamorous and the language colorful, with the result that the important ideas are not clearly presented. Diesel's original conception is not made clear, nor is the reason why the engine diverged from this conception. The book has much scattered information about varieties of engines and the comings and goings of men, some of it wrong, and a good deal of it unintelligible. It provides background scenery but no explanation of the technical and economic forces at work in the Diesel engine's recent conquest of the fields of marine and railway propulsion.

The book is a reworking of biographical materials already published, mostly by Eugen Diesel, the inventor's son, with irritating artificial coloring added. It has a good index and a full bibliography, but no footnotes. It is an excellent piece of book design and manufacture. I wish it made more of a contribution to our understanding of Diesel and his engine.

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On Form and Style

Style Manual for Biological Journals. Prepared by the Committee on Form and Style of the Conference of Biological Editors. Published for the Conference by the American Institute of Biological Sciences, Washington, D.C., ed. 2, 1964. x + 117 pp. Illus. $3.

The first edition of this manual was published in 1960. The second, appearing only 4 years later, attests to its general acceptance. It is the most useful book of its kind for the biological author, editor, and referee. Nearly half of the volume is devoted to "Writing." Here one finds suggestions, accompanied by examples of good and bad style, for making one's writing a better vehicle for transmitting scientific information. Simple rules for word usage, punctuation, and spelling all have the goal of brief and clear expression. But it does give one a surrealistic feeling to read the first sentence: "Learn to write effectively." Does any author truly believe that he writes ineffectively? I would wager that he has little trouble communicating with himself even in the first rough draft. It would be equally useful to have said: "Learn to be wise."

One also finds in this same section the statement, "Describe your materials and methods in sufficient detail so that another worker can repeat the procedures exactly." Would many editors accept without modification a paper so prepared?

I should like to enter a mild protest with the philosophy that permeates this and similar style manuals. There is too much concern with little things. Considering the problems of scientific writing and publishing today, does it really matter if we write "anesthesia" and not "anaesthesia," "base line" and not "baseline," "eyeball" and not "eye ball," "Florence" and not "Firenze?" Does the gain of a little space warrant a great effort to standardize abbreviations? Abbreviations save space but, when unfamiliar, they waste the reader's time. How many of these standard abbreviations are familiar to *you*: A, a, bl, cor, d, f, f., n, p, p., and T? "Agr" is the accepted abbreviation for Agraire, Agralia, Agrar-, Agrarnyi, Agricol-, and Agrikult- when used in the titles of journals. But conceivably it would assist one in finding the journal if the whole word were given. The finest scientific editor known to me has a simple rule for abbreviations: avoid them.

Style manuals promote uniformity. When the result is improved (and less expensive) communication, fine. But far too often the goal seems to be uniformity for the sake of uniformity. In preference to concern with the latter, I would prefer to have a committee of editors dealing with the bigger problems. Having been an editor myself, I believe that our breed tends to be pica wise and manuscript foolish. Should we not devote our major efforts to more pressing questions? How are we to reduce the number of publications? Cannot we prevent the repeated publication of essentially the same information, and frequently by the same individuals, on the topics of the moment? How should we regard the rapid succession of brief and preliminary notes that form the running diaries of some of our busier biologists? Neither the libraries nor the biologists of today can cope with the deluge of scientific publication—and for this situation we bear a major responsibility.

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Theoretical Physics

Elements of Quantum Electrodynamics. A. I. Akhiezer and V. B. Berestetskii. Translated from the Russian edition (Moscow, ed. 2, 1959) by A. Sen and R. N. Sen. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1964. viii + 301 pp. Illus. $15.25.

Quantum electrodynamics is the theory of the interaction of photons, the quanta of the electromagnetic field, with electrons and positrons. It is without question the most successful of the theories yet formulated to describe the domain of elementary particles. Consequentially the theory plays a central role as a guide to the development of future theories and as a stepping-stone in the education of future theorists.

Akhiezer and Berestetskii's book is not a new offering in this field. The first edition appeared in Russia in 1953, just four years after the theory took a giant step forward in the work of Schwinger, Feynman, and others. The book was therefore one of the first comprehensive treatments of the subject, and in the late 1950's many graduate students cut their field-theoretic teeth on the English translation provided by the U.S. Atomic Energy Commission. The AEC translation of the complete 1953 edition is still available in practically all physics libraries across the country.

The book under review is a translation of roughly half of the second Russian edition (1959). The translators claim that major portions of the second edition were "virtually rewritten." However, it appears that it would be more correct to say that the material was rearranged; most of the topics treated in this volume are also considered in the AEC translation. More importantly, because in the volume published by the Israel Program for Scientific Translations only half of the second edition was translated, a large number of illuminating applications of the formalism are omitted. It is by no means obvious that this is a pedagogical advantage.

Although *Elements of Quantum Electrodynamics* is a venerable text, it is unlikely to assume a prominent position in the classroom. The treatment of the subject matter is extremely concise and little motivation is provided in its development. Furthermore, a number of excellent textbooks on quantum electrodynamics have been pub-