scientific journals of England, Germany, Italy, Switzerland, Belgium and our own country as these were established.

Mrs Howard Mumford Jones has brought her experience with university presses and with the editorial staff of the Smithsonian Astrophysical Observatory to bear on the selection of the biographies for this volume. These include Herschel, Volta, Laplace, Oersted, Faraday, Henry, Darwin, Helmholtz, Pasteur, Kelvin, Langley, Rowland and Poincaré. The selection was made "in subject to cover the widest possible range of theories advanced by 'original and ingenious promoters of modern science,' and in authorship to show 'enlarged and original views of science itself.'"

In his introductory essay on the context of 19th-century science, Everette Mendelsohn traces the professionalization of science in this age of synthesis. He outlines the development of scientific societies on the model of the Gesellschaft Deutscher Naturforscher und Ärtze (1822) and their success in advancing scientists. The growing importance of applied science in this period is traced. That Germany outstripped England as a producer of organic dyes is attributed to the fact that Germany had moved quickly to develop wide-scale training for technicians, while England lagged behind, depending upon her few great men of science. Mendelsohn presents the development of scientific institutions in America in the 19th century as a slow adaptation of developments in England and on the continent, but with the advantage that it could be selective and was no longer in the 18th-century pattern of an undernourished colony tied to a mother country.

Dominique Arago, Pierre Flourens and Henry Roscoe each contributed more than one biography to this collection. Asa Gray and Joseph Henry, whose biographies appear in this volume, also appear as biographers.

Because of the sponsorship of this book by the Smithsonian Institution, the biographies of two of its secretaries may be of special interest. Joseph Henry, as the first secretary, was conscientious and imaginative in shaping James Smithson's establishment "for the increase and diffusion of knowledge among men." Henry considered that wide distribution of the Institute's publications was important for this goal. But regarding his own important investigations he had little eagerness for publication, despite the aim he expressed in a letter, "My whole ambition is to establish for myself *and to deserve* the reputation of a man of science." Fortunately the breadth of his scientific interest and his felicity in treating scientific topics gained recognition, as implied in a remark by Sir David Brewster (written when Henry was only 35): "The mantle of Franklin has fallen upon the shoulders of Henry."

Samuel Pierpont Langley, the third secretary, is described by Cyrus Adler as a man rigidly truthful in "that extraordinary Puritan New England sense, which did not even permit him to subscribe himself as being 'very sincerely yours' if he was not." His loneliness at the Allegheny Observatory and need for intellectual companionship led Langley to welcome his appointment to the Smithsonian Institution. In 1869, at the age of 35, he wrote his first two papers that resulted in replacement of a confusion of empirical local times by a national-standard time system. Langley's later investigations of solar radiation, aerodynamics and aerial navigation were carried out with the conviction that "science is not for the professional student alone, but everyone will take an interest in its results if they are only put before the world in the right way."

These biographies, some written in a style that appears ornate today, are a good supplement for the depersonalized outline of science presented in most textbooks.

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R. L. Weber has tried to interest physics students in biography by including in College Physics, *of which he is coauthor, biographical notes and portraits of the winners of the Nobel Prize in physics.*

Dust everywhere

PARTICLES IN THE ATMOSPHERE AND SPACE. By Richard D. Cadle. 226 pp. Reinhold New York, 1966. $10.00

by Ernst J. Opik

Atoms make dust; dust builds the planets; it rules their surfaces and per-

meates all space. We are here presented with a mini-monograph on the ever present particulate matter, a synopsis of the kind that, to the reviewer's knowledge, has not been published before. It deals with distribution of sizes, number densities, origin, reactions with surroundings, cosmic and human roles of diverse particle populations: natural and man-made aerosols in the terrestrial atmosphere; air pollution and rain formation; radioactive fallout, its formation in nuclear explosions and further transport; interplanetary and interstellar dust; dust on the surfaces of the moon, on the planets and in their atmospheres.

To squeeze this enormous subject into so small a volume, a noncommittal method of presentation has been followed by the author—something intermediate between a popular and a technical style. Searchlight pictures of the various directions of research are given, sometimes with very elementary text, sometimes with formulas and symbols only being mentioned, often without adequate explanation and definitions. It is more like a catalog of what has been going on in this sector of research, rather than a systematic presentation of the topics. For the initiated researcher it is a useful guide; he will mostly be able to complete or reconstruct whatever is unfinished. The beginner may find it more difficult and will have to check on the literature, which, though profusely cited, is deliberately incomplete, the references being "selected as examples." This is not much of a setback since each of the sources cited is able to provide, if needed, new references and fill in the gaps. More objectionable is the inclusion of some less reliable sources, apt only to mislead the reader, such as A. Dauvillier's *Cosmic Dust* (which I reviewed in PHYSICS TODAY, Jan. 1963, p. 70) in which astronomical facts and physical laws are badly misrepresented. As a rule, Cadle's monograph usually abstains from critical judgment and presents the often contradictory data and opinions as they are published by the various authors.

With the somewhat loose style and casual approach, shortcomings are inevitable, some examples of which are given in the following.

In the theoretical introduction, monotonous distribution functions of sizes, without frequency maxima, and the concept of cumulative frequencies appropriate to such functions, are not mentioned; they are later introduced, without further explanation, in the astrophysical applications (meteors, etc.). The monograph by G. Herdan, *Small Particle Statistics,* (which I also reviewed, PHYSICS TODAY, Jan. 1962, p. 66), is specially dedicated to size distribution functions, but is not mentioned—an omission that cannot be justified even by the deliberately casual method of selecting the literature.

On page 19, submicron-size extraterrestrial particles are said to be vaporized, while "larger objects may only partially melt, casting off droplets"; the actual situation is exactly the reverse, small particles dissipating kinetic energy through radiation without vaporization.

In the Langmuir-Stokes equation (number 2.37), ρ, the density of the droplet, is not defined. The terms "exosphere," "ozonosphere," "chemisphere" are mentioned only once on page 75 without any explanation of their meaning.

On pages 135 and 136, an outdated view of the zodiacal light as part of the solar corona, and of a considerable role of light scattering in it by free electrons is maintained; Mariner II data have dispelled this concept.

On page 140, the author omitted mentioning that N is the cumulative meteor flux, and reference 20 for Whipple's data is not from *Vistas in Astronomy.* On page 143 and equation 5.8, N is not the "cumulative mass flux" but the cumulative number flux down to limiting mass m. Equation 5.9 on page 144, exactly copied from Hawkins with the original error repeated, would require impact penetration to increase with the density of the target; a negative power of the density, $-2/3$ is the correct expression. *Ibidem,* "Brunell" for Brinell hardness is also copied from Hawkins.

On page 164, the much publicized yet widely misinterpreted Alphonsus "eruption" observed by Kozyrev is again ascribed to "gas emission" although actually it was fluorescence of a solid that did not move from the place.

On page 173, equation 6.6 pretends to represent the general illumination law on the lunar surface, although actually it is only valid at the lunar equator.

On page 188, the nonmelting limit for the Martian polar caps is, of course, 32°F, not 32°C, as stated. Promiscuous use of British and metric units in the book may have led to other similar misstatements.

On page 198, the contention of synchronous rotation for Mercury no longer holds.

On page 208, the suggestion that the sun-grazing Comet 1882 II "vaporized and later recondensed" is physically absurd; there is no process that could lead to recondensation of the vapors.

Despite these and similar shortcomings, the book is of considerable value for the researcher; it illuminates the field of study in all directions. It is up to the student to watch his step and to check the data and opinions critically.

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The reviewer shares the post of astronomer at Armagh Observatory, Northern Ireland, with that of professor of astrophysics at the University of Maryland, College Park, Md.

Emphasis on use

QUANTUM MECHANICS. By A. S. Davydov. Trans. from Russian by I. V. Schensted. 671 pp. NEO Press, Ann Arbor, Mich., 1966. Paper $6.00

by Henry S. Valk

With the appearance of the NEO Press edition of A. S. Davydov's *Quantum Mechanics,* we now have available two English translations of this work.

The book is the outgrowth of a course of lectures given for several years to students in the physics department of Moscow University. As such, it presents a reasonably complete and clear exposition of the standard material to be expected in any introductory graduate course in quantum mechanics. Such topics as wave functions and the Schrödinger wave equation, exact and approximate solutions, perturbation theory, representation and transformation theory, and scattering theory are fully covered. The