1001 Questions Answered About the Weather. Frank H. Forrester. Dodd, Mead, New York, 1957. 419 pp. Illus. + plates. $6.

This is an unusual book written in question-and-answer form. The 1235 items are organized in 12 chapters, which deal with the sun, the air-conditioned earth, thunderstorms, color in the sky, climates, applications, medical meteorology, weather lore, the weather services, history of weather studies, and how to be weather-wise.

The author appears to have engaged in an orgy of questions and answers and to have come out with a peculiar mixture of good and bad. For example, one is surprised to read, "What is humiture?" and relieved to find that it is "a nonscientific term" which indicates "the mean between temperature and humidity." There are many other questions and answers on this level.

The style is admirably calculated to catch the eye of the reader, but the reader, if he has any background at all, will catch the author in a number of inaccuracies, oversimplifications, and sweeping statements.

Certain sections, particularly those which deal with instruments and observations, everyday weather, and climate, contain much information of interest to laymen. The most pleasing part of the book is the chapter on the history of weather studies. Here the reader is taken from antiquity to the International Geophysical Year and reminded of many historical dates which are often lost in the rushed tempo of modern teaching.

It has been difficult to determine what audience the author had in mind. The book is dedicated to "Michael, who is too young to ask questions." In the foreword, written by Ernest J. Christie, it says that the book will be valuable in libraries, schools, and places of business and will be a useful reference for amateurs and professionals alike. Perhaps one may assume that the author knows best. Few will wish to read the whole book, but many will like to browse through parts of it.

SVERRE PETTERSSEN
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Edward Williams Morley. His influence on science in America. Howard R. Williams. Chemical Education Publishing Company, Easton, Pa., 1957. xi + 282 pp. Plates.

To the many who refer glibly to the Michelson-Morley experiment, the second name in the couplet has almost no association with a human being. Howard R. Williams has not only brought the man, Edward Williams Morley (1838–1923), out from behind the tag, but he has also discovered and thereby undoubtedly preserved a large body of manuscripts concerning him. One need not go all the way with Williams in considering Morley "the greatest chemist and pure scientist of his time" to see in this account a progression which has wide implications concerning the state of science in America in the last half of the 19th century.

From ministerial student to secondary-school teacher, to college preacher and professor of all scientific work at Western Reserve University, to self-educated chemist and industrial consultant, Morley, by the 1880's, steadily moved toward basic research. His determination of the atomic weight of oxygen was his *magnum opus*. If Williams is less enthusiastic about the obstacles and missed opportunities in Morley's career, he nevertheless shows them clearly. Morley's years of work on the analysis of air missed the inert gases. His collaboration with Michelson ended abruptly and left a sense of strain. The university thoughtlessly allowed his oxygen apparatus to be broken up while he was in Europe.

Because of the importance of the experiment, a more detailed assessment of Morley's contribution to the work with Michelson would be welcome. But Williams has well performed the rescue from oblivion of Edward W. Morley.

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Schedules of Reinforcement. C. B. Ferster and B. F. Skinner. Appleton-Century-Crofts, New York, 1957. vii + 741 pp. $6.50.

A "schedule of reinforcement" might be described as an experimenter's strategy, prescribing exactly how the administration of reinforcing stimuli, usually food or water, to an animal depends upon the animal's behavior over a period of time. Combining extraordinary ingenuity with apparently limitless resources in the way of electrical programming devices, Ferster and Skinner have devised means of duplicating in the laboratory virtually any kind of response-reinforcement contingency that one might expect to find in an animal's natural environment, and probably some that unautomatized nature has yet to try.

The microcosm upon which these investigators have imposed their schedules is a modified picnic icebox containing a pigeon and a food-dispensing machine. Whenever it pecks a lighted key on the wall of the box, the pigeon operates an automatic recorder and, upon occasion, the food-dispenser. Five years of intensive research have been devoted to obtaining a detailed description of the process whereby the pigeon adjusts its rate of key-pecking to prevailing schedules of reinforcement.

This description is transmitted to the reader, just as it comes from the pigeon, in the form of graphs representing cumulative responses versus time for individual animals. Even to the untrained eye these graphs will spell out some striking facts. An abundance of direct and unequivocal evidence establishes the fact that the pigeon can learn discriminations based on "clocks" (that is, stimuli that vary systematically with time) and on "counters" (stimuli that vary systematically with cumulative frequency of the pigeon's own responses over any designated interval). From these facts it is but a short inferential step to the conclusion that variations in rate of responding under various schedules are attributable to discriminative control of the response by temporal patterns of response-produced stimulation.

To psychologists this monograph will represent not simply a research report but also a tour de force in Skinner's long-standing campaign against some of the most deeply entrenched canons of experimental method and theory construction. It presents, in some 900-odd figures, perhaps 5 percent of the staggering quantity of raw data collected during the project; it reports scores of experiments, and it reveals the delicate and precise control that one may obtain over an animal's behavior, given sufficiently complete command of the animal's environment. But it includes no mention whatever of systematic criteria for sampling, no formal experimental designs, no measurement of error, no logical deductions from hypotheses, no statistical tests, no summarization of the fruits of experiment in the form of abstract laws or conceptual models.

By comparing the present volume with, say, C. L. Hull's *Essentials of Behavior,* one can see clearly the consequences of following either the extreme "intuitionist" or the extreme "formalist" in his approach to a science of behavior.

W. K. ESTES
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Light Scattering by Small Particles. H. C. Van de Hulst. Wiley, New York; Chapman & Hall, London, 1957. xiii + 470 pp. Illus. $12.

The book is divided into three main parts. Part I is devoted to "Basic Scattering Theory," part II to "Special Cases of Particles," and part III to "Applications." The first two parts are very com-

plete and occupy 380 pages of a total of 453 pages. The last part is relatively short and, in the words of the author, "is meant to give only typical examples of practical problems in which the preceding theories have proved important." The three domains from which such examples are chosen are chemistry, meteorology, and astronomy. References to important literature are distributed lavishly throughout the book; it closes with a 5-page index of names and an 11-page subject index.

Characteristic of the book is the fact that the subject of light-scattering is treated exclusively from the "particle" point of view. This means that the discussion is deliberately limited to cases in which the scattering can be considered as a superposition of radiations emerging without interdependence from separate particles, whereas cases like the scattering by an inhomogeneous medium with local fluctuations of its optical properties are omitted from the discussion.

Within the range defined by these restrictions the treatment is excellent. In part I everything is said which is necessary to characterize the scattered light in the most general way. This will be evident from the titles of the two last chapters in this part: "Wave propagation in a medium containing scatterers" and "Polarized light and symmetry relations." Specifically, it is shown in this part how any scattering problem can be solved if the four components of a four-component matrix are known for each individual particle with a particular orientation in space. Part II, which occupies the main portion of the book, shows, for special types of particles, how to find these components and the simplifications which are possible in many cases. Here special attention is devoted to particles that are either very small or very large by comparison with the wavelength of the light. The classical case of spherical particles, in which a rigorous calculation (G. Mie) is possible for any ratio of the diameter to the wavelength and for any optical constants of the material of the sphere, is treated extensively. As a special case, a whole chapter is devoted to the "optics of a raindrop" and the theory of the rainbow. Part II closes with two chapters treating "Particles of other forms" and "Edge phenomena and surface waves."

In summary, this is a book which can be highly recommended to anyone who wishes to be informed about all the details and the sometimes surprising implications of the disturbing effects which particles have on the propagation of light. It is a book which is not always easy to read, but the effort involved in doing so is highly rewarded.

PETER P. DEBYE
Raytheon Manufacturing Company

The Terpenes. The triterpenes and their derivatives. vol. IV, *Hydrocarbons, Alcohols, Hydroxy-aldehydes, Ketones and Hydroxy-ketones.* The late Sir John Simonsen and W. C. J. Ross. Cambridge University Press, New York, 1957. ix + 524 pp. Illus. $13.50.

Progress in the elucidation of the structures of the triterpenoids has occurred mainly in the last 20 years and culminated recently in the establishment of the biosynthetic link between the triterpenes and the steroids. This volume by Simonsen and Ross represents a collection and critical survey of an already large and rapidly expanding literature. It would be welcome in any event but is the more so since the authors have been able to include the most recent advances in the understanding of the biosynthesis and stereochemistry of the triterpenes and closely related sterols.

The organization of the new volume follows that of its predecessors in the series, commencing with a brief description of the broad structural features of the triterpenes and progressing from the hydrocarbons to alcohols and polyfunctional triterpenes. Each compound is discussed within the classical framework of source, proof of structure, and chemical reactivity. Extensive use is made of infrared and ultraviolet absorption spectral data in support of the structure assignment, so that the work contains a wealth of valuable, general information of this sort.

Large as is the catalogue of triterpenes of established structure, the authors' listing of an almost equal number of compounds of unknown constitution gives promise of continuing activity in meeting the challenges presented by structure variations within the triterpenoid framework.

The large size of triterpene molecules has forced the extensive use of outline formulas in this most recent volume of the series. Most organic chemists will welcome this departure from earlier practice. However, some will take offense, and others may even be confused somewhat by the apparent disregard shown by the authors in this case for the beautiful geometric regularities of hexagons and pentagons.

The acknowledged interest and contributions of outstanding English chemists in the preparation of the volume gives assurance that the consistent effort to organize the literature on the terpenes which has been so successful in the hands of Sir John Simonsen will not cease with his death.

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New Books

Thrombelastography. Pietro de Nicola, Chauncey Leake, Ed. Thomas, Springfield, Ill., 1957. 120 pp. $5.50.

Elements of Modern Abstract Algebra. Kenneth S. Miller. Harper, New York, 1958. 196 pp. $5.

Economic Analysis and Policy in Underdeveloped Countries. P. T. Bauer. Commonwealth-Studies Center, Duke University Press, Durham, N.C. Cambridge University Press, London, 1957. 158 pp. $3.

The Spectrum of Atomic Hydrogen. G. W. Series. Oxford University Press, New York, 1957. 87 pp. Paper, $2.

Ordinary Difference-Differential Equations. Edmund Pinney. University of California Press, Berkeley, 1958. 274 pp. $5.

Archeological Investigations at the Mouth of the Amazon. Bulletin 167, Bureau of American Ethnology. Betty J. Meggers and Clifford Evans. Smithsonian Institution, Washington, 1957. 692 pp.

Finding Fossil Man. Robin Place. Philosophical Library, New York, 1957. 126 pp. $7.50.

An Introduction to Scale Coordinate Physics. An introduction to the formalization of the macro operational point of view. William Bender. Burgess, Minneapolis 15, 1958. 349 pp.

Louis Pasteur. A great life in brief. Pasteur Vallery-Radot. Knopf, New York, 1958. 212 pp. $3.

The Beetles of the Pacific Northwest. pt. II, *Staphyliniformia.* Publ. in Biology No. 16. Melville H. Harch in collaboration with Milton W. Sanderson and Gordon A. Marsh. University of Washington Press, Seattle, 1957. 393 pp. $7.

The Pharmacologic Principles of Medical Practice. A textbook on pharmacology and therapeutics for medical students, physicians, and the members of the professions allied to medicine. John C. Krantz, Jr. and C. Jelleff Carr. Williams & Wilkins, Baltimore, ed. 4, 1958. 1324 pp. $14.

Resources for the Future, Annual Report. For the year ending 30 Sept. 1957. Resources for the Future, Washington 6, 1957. 89 pp.

Trephine Technique of Bone Marrow Infusions and Tissue Biopsies. Henry Turkel. The author, 8000 W. Seven Mile Road, Detroit 21, ed. 8, 1957. 84 pp.

Rapport Annuel sur le Fonctionnement Technique. Année 1956. Institut Pasteur du Viet-Nam. Saigon, Sud-Viêtnam, 1957. 138 pp.

A Practical Guide to Plant Sociology. For foresters and agriculturists. F. R. Bharucha and W. C. DeLeeuw. Orient Longmans, Bombay, India, 1957. 46 pp.

Expert Committee on Malaria, Sixth Report. WHO Tech. Rept. Ser. No. 123. 84 pp. $0.60. *Joint FAO/WHO Expert Committee on Milk Hygiene, First Report.* WHO Tech. Rept. Ser. No. 124. 54 pp. $0.60. *Juvenile Epilepsy, Report of a Study Group.* WHO Tech. Rept. Ser. No. 130. 44 pp. $0.30. *Treatment and Care of Drug Addicts.* WHO Tech. Rept. Ser. No. 131. 19 pp. $0.30. World Health Organization, Geneva, 1957.