through the ideas of imprinting, celestial navigation, chemical gradients, Coriolis force, and continental drift without finding a solution he is comfortable with. He is sure only that random wandering is "the most preposterous theory of all."

As in *The Windward Road*, Carr's climax is a lament for the disappearing species of sea turtles. His title in this latest book derives from a statement of dismay expressed by the Bermuda Assembly in 1620 at the decay even then of "so excellent a fishe." He is very pessimistic now about the prospects for sea turtles unless much more is done. He hopes that a technology of sea-turtle husbandry may be worked out, and he has begun an Operation Green Turtle for this very purpose.

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Ore-Forming Fluids

Geochemistry of Hydrothermal Ore Deposits. HUBERT LLOYD BARNES, Ed. Holt, Rinehart and Winston, New York, 1967. xvi + 670 pp., illus. $19.50.

A very large proportion of the world's metallic wealth has been extracted from mineral deposits precipitated from hot aqueous solutions that rose through the earth's crust in a variety of geologic environments. The depths and petrological nature of the sources of the solutions generally are not known. Many hydrothermal mineral deposits are associated in time and space with igneous activity and crustal disturbances, and a genetic relationship logically can be inferred. However, a wide variety of apparently hydrothermal deposits show no obvious relationship to igneous processes, and their origins have been a subject of extensive and prolonged dispute.

The 19 contributors to this carefully edited book have attempted with moderate to considerable success to inform their readers of some of the problems posed by hydrothermal ore deposits, the current status of methods and results of investigations, and the kinds of conclusions that may be reached concerning the origins and natural histories of these deposits. The problems faced and enumerated by the contributors, all well-known specialists, range from the simple to the very complex, and suggest to the reviewer the kinds of problems that might be encountered by a team of modern scientific investigators attempting to unravel the secrets and duplicate the experiments of an ancient, somewhat deranged alchemist who left behind some of the chemicals and solutions that he used and created, a few fragmentary scribbled notations on faded parchment, and an assortment of battered, corroded pieces of laboratory ware.

As might be expected, the presentations vary in depth and skill of approach, and portions of some treatments are elaborations of the ordinary or belaborings of the abstruse.

The starting point of all investigations of ore deposits must be the deposits themselves. In spite of their worldwide distribution, their very diverse geologic environments, and times of origin extending through much of geologic history, it has long been known that hydrothermal deposits, wherever they are found, have many characteristics in common. There is a general order in which ore and gangue minerals are deposited from the cooling solutions, and chemical interactions between the solutions and the rock they invade leave a relatively small number of distinctive types of alteration mineral assemblages and consistent, repetitive patterns of alterations.

By drawing on studies of actual ore deposits and laboratory investigations of many kinds and of various degrees of elegance, and by bringing together fragmentary data relating to the chemistry of aqueous solutions at high temperatures and pressures, the contributors have attempted, as far as is possible, to make a quantitative evaluation of the composition, density, temperature, and pressure of the ore-forming fluids and the kinds and rates of changes of these variables during a typical epoch of ore-deposition; but admittedly, and like the ancient alchemist, they can report only that considerable and spectacular progress has been made and that much more investigation will be required before a detailed, incontrovertible characterization of ore-forming fluids becomes possible.

The book probably was not intended to be nor will it serve well as a textbook for classroom instruction. Rather it will and should be considered as an important, authoritative reference for students of the genesis of hydrothermal mineral deposits.

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Plant Pathology

The Biochemistry and Physiology of Infectious Plant Disease. ROBERT N. GOODMAN, ZOLTÁN KIRÁLY, and MILTON ZAITLIN. Van Nostrand, Princeton, N.J., 1967. x + 354 pp., illus. $12.50.

In a discussion of plant diseases today, the student of pathology is immediately aware of the need for an understanding of the biochemical and physiological mechanisms of pathogenesis. Such information is effectively presented for the student in this book by Goodman, Király, and Zaitlin. The authors' stated purpose is to familiarize advanced undergraduate and graduate students with current research on and concepts of biochemical and physiological changes in the host as induced by the plant pathogen.

The subject matter is presented in a reasonable manner, beginning with the infection process and covering photosynthesis, respiration, cell wall composition and metabolism, nitrogen, phenol and growth-regulator metabolism, vascular transport, and toxins. All but two chapters ("The infection process" and "Toxins") present the biochemistry and physiology of the healthy plant in a condensed form, followed by individual consideration of host-induced alterations initiated by viral, bacterial, and fungal pathogens. About equal attention is given to each of the pathogens. The collating of material from three authors has been very well executed, so that transition from sections dealing with metabolism in the healthy plant to those concerned with the altered condition in the diseased plant is smooth.

The authors have succeeded in preparing a text that will fill the need of the graduate student and, for that matter, one that may also serve the established researcher. Certain important aspects of host-parasite relations have been ignored; for example, wound barrier formation and the effects of chilling on the biochemistry and susceptibility of tissues. Some discussions of cited material are handled by the authors in a conventional manner, with editorial comments; in others, references are given and the subject is terminated without any additional comment. Perhaps the most serious fault of the text is created by the general approach of the authors in including the sections on general biochemistry at the beginning of each chapter. It is unlikely that this elementary biochemical treatment of the healthy plant will be

of value to one unfamiliar with biochemistry. The 50 pages or so devoted to general biochemistry might have been better used to extend discussions of the biochemistry and physiology of the diseased plant.

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Two Natural Historians

A Naturalist in Russia. Letters from PETER SIMON PALLAS to Thomas Pennant. CAROL URNESS, Ed. University of Minnesota Press, Minneapolis, 1967. vi + 189 pp., illus. $7.50.

Unpublished correspondence between fellow naturalists is not, in itself, particularly noteworthy. But when the protagonists are of international repute and concerned with all phases of natural history, interest is aroused. And when the region under consideration was, and continues to be, somewhat inaccessible, the editing of such manuscript material becomes mandatory.

Pennant (1726–1798) and Pallas (1741–1811) represent the best in 18th-century natural history: well-read and indefatigable field collectors, alert to all details yet possessing the ability to select the relevant data, candid and open-minded but critical and discerning in matters pertaining to science. Moreover, as the editor points out in the introduction, each was opposed to Linnaean taxonomy.

The present collection, then, records Pallas's (and, by implication, Pennant's) efforts to substantiate his criticism of Linnaeus' system of classification. Although he never addresses himself explicitly to the logical foundations of Linnaean taxonomy, it is clear that by his knowledge of Russian and subarctic fauna and flora Pallas was able to justify his dissatisfaction with the system. As a result of better information he obtained on geographical distribution and ecology, Pallas was able to add much new material to the zoological record. A knowledge of the seasonal changes of the behavior and coloration of animals in their native habitat enabled him to amplify many observations made by earlier naturalists.

Yet even this knowledge gained by some 40 years in the field did not satisfy Pallas. Over and again, he requests from Pennant information on some matter of detail, news of new publications, and, above all, specimens. The exchange of specimens was a two-way affair, however, and many pages are taken up with Pallas's lists of desiderata and what he is willing to exchange. In addition to zoology, Pallas and Pennant shared an interest in mineralogy, botany, and geography. Information from Russia was particularly welcome to Pennant, and he owed much to Pallas's almost unique knowledge of northern taxa.

Following the 17 letters, there are a biographical sketch of Pennant and Pallas, a selected bibliography, a key to illustrations (derived from Pallas's writings), and a complete index.

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Chemical Reactions

Photochemistry and Reaction Kinetics. P. G. ASHMORE, F. S. DAINTON, and T. M. SUGDEN, Eds. Cambridge University Press, New York, 1967. xvi + 378 pp., illus. $13.50.

This book commemorates the contributions of R. G. W. Norrish to photochemistry and reaction kinetics. It comprises a series of essays in which a number of Norrish's former students and scientific colleagues describe specific areas of research in which he has been active. While the immediate occasion of this volume was Norrish's retirement from the Chair of Physical Chemistry in the University of Cambridge in September 1965, its appearance is happily coincident with the accolade of the Nobel Prize in which he shared.

The first two contributions, by W. A. Noyes, Jr., and B. Lewis, respectively, specifically survey the contributions of Norrish to photochemistry and to the study of combustion. That by Noyes admirably summarizes both the historical context of the photochemical work and the sweep of its development.

Chapers 3 to 7 are concerned with photochemistry in several of its aspects. Chapter 3, "Photochemistry in the liquid phase" by C. H. Bamford and R. P. Wayne, presents a useful review of a number of photochemical systems, subdivided into inorganic and organic. The review does not uniformly carry each system to its latest state of development, but all of the material presented is helpful as survey and commentary. Chapter 4, by F. S. Dainton and D. B. Ayscough, deals with gaseous photochlorination—principally of hydrogen, chlorocarbons, and hydrocarbons. Both mechanistic and rate considerations are discussed, and useful digests or relevant Arrhenius parameters are provided.

Chapters 5 and 6 describe some aspects of flash photolysis. The former is by George Porter, co-discoverer of the technique and Nobel co-laureate with Norrish. Porter presents a personal and brief account of the experimental characteristics of the method and surveys various subfields and applications of the technique to date. Chapter 6, by B. A. Thrush, reviews in considerable detail some of the intensely interesting work—much of it done at Cambridge—on the gas-phase kinetic spectroscopy of small radical and molecule intermediates in various states of electronic and internal excitation.

Chapter 7, "Energy transfer in molecular collisions" by A. B. Callear, is the highlight of the volume. In 65 pages Callear gives a succinct and effective account of various aspects of the study of transfer of energy between translational, rotational, vibrational, and electronic degrees of freedom of small molecules. The author's interest in the field obviously owes its origin to his location at the center of experimental work in kinetic spectroscopy.

In Chapter 8, J. C. Bevington summarizes Norrish's work in polymer chemistry. The remainder of the volume deals primarily with the kinetics of oxidation. Chapter 9, by N. N. Semenov, leads off with a somewhat general account of "Modern concepts." Chapters 10 and 11, by J. H. Knox and P. G. Ashmore, respectively, deal with low-temperature oxidation and the sensitization and inhibition of ignition. A chapter by J. H. Purnell and C. P. Quinn on pyrolysis of paraffins concludes the volume. These last four chapters provide a useful digest of the status of areas which, in some ways, rank among the most frustrating and recalcitrant in gas-phase chemical kinetics.

This tribute to Norrish is intended for use by students. It should be of value to all such who desire a very readable, introductory exposition of the areas treated, as well as to many scientists who wish to refurbish their backgrounds in these subjects.

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