cludes references up to 1967; articles published before 1945 are covered by earlier reviews and so are not emphasized. At least 300 pages are devoted to tables. For example, tables 4, 5, and 6 list the emissions induced upon mixture of active nitrogen with metallic elements, nonmetallic elements, and metallic compounds listed in the order of increasing atomic weight of the element. These three tables occupy 44 pages. A similar table involving other inorganic compounds occupies 64 pages. The bibliography is 39 pages and the author and subject indexes are 51 pages in length. Of the 602 pages 223 are devoted to exposition and discussion of active nitrogen phenomena.

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Migration and Homing

Bird Navigation. G. V. T. MATTHEWS. Second edition. Cambridge University Press, New York, 1968. x + 198 pp., illus. Cloth, $7; paper, $2.45. Cambridge Monographs in Experimental Biology, No. 3.

This is the fifth review to appear in the last few years for what is (at least at present) a very slowly moving field. It is a thorough review of literature since 1955, but instead of being rigidly critical it is primarily an argument in support of Matthews' sun arc hypothesis. The book nominally covers all aspects of navigation, but it moves swiftly from migration in wild birds to homing in pigeons. Perhaps as a result of this emphasis, Matthews defines navigation in a special way. He uses the term "navigation" for what many of us call orientation ("initiate and maintain directed movement independently of learned landmarks") and demotes "orientation" to what some of us would call a tropism.

New ideas since the first edition (1955) are: (i) nonsense orientation, the taking up of a species-consistent initial heading no matter where released (a phenomenon Matthews has studied in detail, yet is convinced was uniquely lacking in the pigeons he used in his Cambridge studies); (ii) observations that pigeons home well inside 15 miles or outside 30 miles yet poorly in between, which imply that navigation may not be effective within one degree of latitude and longitude; (iii) measurements of sensory discrimination that suggest that birds' eyes have capabilities at least as great as those necessary for the validity of the sun arc hypothesis; (iv) star pattern "navigation," orientation of migratory restlessness along a consistent azimuth relative to certain groups of stars.

In the study of orientation/navigation, it is important at this step to repeat some of the critical experiments, as Emlen has done to confirm part of Sauer's work. Among the observations that need confirmation are the magnetic orientation reported by Merkel and Fromme and the evidence for bicoordinate navigation provided by Matthews' pigeon releases. The reported ability of wild birds to compensate for wind drift and to maintain direction under overcast conflicts with other evidence reported for pigeons, but Matthews treats the conflict lightly.

If, even after rock doves have been subject to intensive selection for homing ability for 150 years, sophisticated statistics are necessary to confirm that the best 20 percent of current stocks are in fact able to "home," I would expect that the ability is of little value to an individual bird subject to natural selection. Perhaps we should run a series of experiments on people, using the same techniques and statistics. My forecast is that some of my commercial fisherman friends, if released beyond 50 miles, would rapidly find their way home, and that I would never hear from some of my academic friends again.

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Hydrogen and Oxygen

Chemistry of Dissociated Water Vapor and Related Systems. M. VENUGOPALAN and R. A. JONES. Interscience (Wiley), New York, 1968. xviii + 463 pp., illus. $19.50. Interscience Monographs on Physical Chemistry.

This work is the first in a projected series of monographs on physical chemistry edited by I. Prigogine. For a book that discusses reactions which range from hydrogen atom recombination to hydrogen superoxide formation, the title is unfortunate, since water is only one component part of the hydrogen-oxygen system. Aside from their intrinsic interest for chemists, studies of reactions in the hydrogen-oxygen system have played a central role in the development of an understanding of combustion, flames, explosions, and reactions in planetary atmospheres. Complementary investigations by thermal means, electric discharge, photolysis, photosensitization, ionizing radiation, and shock tube methods have yielded a considerable quantity of mechanistic and kinetic data. Therefore this book, which covers information from all of these experimental approaches, is very welcome, particularly since no full book on the subject has appeared since the publication of Hinshelwood and Williamson's *The Reaction between Hydrogen and Oxygen* in 1934.

For a system containing only two atomic species, it is surprising, as is pointed out by P. Harteck in the foreword, that there are over 100 basic reactions. The authors have succeeded in bringing together the important experimental and theoretical studies relative to the reactions and in summarizing the kinetic information. After an introductory chapter, they devote a section to a fine description of experimental methods; accounts of the more sophisticated techniques are accompanied by clear illustrations which are very helpful for acquiring a full understanding of the experiments. The chapters which follow discuss in detail a variety of studies of reactions in the hydrogen-oxygen system. Although there are seven chapters, the sixth chapter is logically the culmination of the work. Here the authors present pertinent quantitative data and rate constants for the reaction of all the atomic, free radical, and molecular species involved. Scientists interested in any aspect of reactions in the hydrogen-oxygen system should find this compendium useful for ready reference.

The major critical judgment exercised by the authors is not so much in their own interpretation of the literature as in their choice of material containing critical evaluation for inclusion. Indeed, the empathy of the authors with some of the selected sources is such that the reader very familiar with the field may have a sense of *déjà vu*; whole passages—in at least one instance a passage three pages long—are taken almost verbatim, without quotation marks or other acknowledgment, from the published works of other authors. This does not detract from the usefulness of the book, as the authors have made wise choices.

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