to reinforce the traditional belief that yellow fever was a disease associated peculiarly with poverty and immigration. Municipal efforts at medical care and prophylaxis, the city's attempts to care for the orphaned, the unemployed, and the convalescent—all proved totally inadequate; a voluntary society, the Howard Association, composed of earnest young merchants and professional men, stepped in to undertake these medical and philanthropic tasks. (Relief funds collected in other American cities were, for example, sent in many cases not to New Orleans' municipal government but directly to the Howard Association). The medical profession was in a peculiarly difficult position, its members unable to cure and incapable of agreeing upon either a cause or preventive of the disease—yet exhausted by the burden of work thrust upon them. Therapeutics were heroic, preventive measures pathetically traditional: streets were cleaned, cannon fired twice daily, and barrels of tar burnt to purify the presumably infected atmosphere.

The 20th-century reader of Duffy's study will be particularly shocked at the supine and formless behavior of New Orleans' municipal government. The city had no real board of health, and even when the epidemic was clearly gaining headway legislators resisted efforts to appropriate funds for fighting the epidemic and aiding its victims. Once the disease had established itself, moreover, the city's government largely evaporated; two-thirds of the board of aldermen and assistant aldermen slunk away from the infected city—despite the traditional assumption that such officials should remain and help personally during such periods of crisis. No northern city of comparable size was, in this period, quite so bereft of formal leadership and administrative mechanisms.

Duffy has told his story clearly and with an eye for interesting detail. He is somewhat handicapped, however, by a comparative paucity of personal documents describing the epidemic and a consequent dependence upon printed sources almost exclusively. These often lack the immediacy of less formal and self-conscious diaries and letters. And during epidemics, of course, journalists and physicians tended to be particularly tendentious or evasive.

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Papers in Archeology

New Roads to Yesterday: Essays in Archaeology (Joseph R. Caldwell, Ed. Basic Books, New York, 1966. 556 pp., illus. $12.50) consists of 20 articles on archeology that have appeared in *Science*. They are grouped under the headings of Old World Beginnings, The New World, Cities and Civilization, and one under Science in Archaeology, and are followed by a comprehensive index. The lengthy introduction weaves together the diverse pieces and supplies some necessary background, so that the nonprofessional reader will emerge with considerable understanding of some of the goals of archeological research and some comprehension of the discipline. In addition to the last paper, several others could come under the heading of science in archeology to distinguish them from the more strictly archeological and culture-history items.

The range of the contributions is impressive, for, as the editor states,

> The excitement and ferment over the past decade, when archaeology's horizons were so rapidly expanding, found a ready-made historian in *Science*. . . . Many of these [essays] are landmarks that should excite the general reader as well as the professional archaeologist, for they are written by the innovators themselves [p. 1].

The editor's selections are of high quality, and it is good to have them easily available in this attractive and coherent form.

The book suffers from only one serious flaw; with a few exceptions, I could find no indication as to when the individual articles were published. Although some of the articles have been modified or revised, there is a continuing flood of new material in archeology and it is important to know exactly when a particular piece originally appeared and to what extent, if at all, it may have been revised. Here one can only estimate how up-to-date each article is by referring to the latest item in the accompanying bibliography. It is to be hoped that in a second printing this omission will be remedied.

In general this is a highly successful experiment which should justify the production of similar volumes made up of *Science* articles in other fields.

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Chemistry of Seawater

Chemical Oceanography, volume 1 (Academic Press, New York, 1965. 732 pp., illus. $25), edited by J. P. Riley and G. Skirrow, aims to be a "comprehensive textbook on chemical oceanography to cover the chemistry of the sea, the interaction between the components of seawater and marine life, and the geochemistry of marine sediments." Volume 2 (reviewed in *Science*, 27 May 1966) covers marine sediments; volume 1 concerns itself with the chemistry of seawater. The subject is developed in 13 chapters by 11 authors, all experts in their fields. The problem with the work under discussion as a textbook results from the dilemma of chemical oceanography as a branch of science. There really is no science of chemical oceanography. Rather, the subjects usually covered under that heading form parts of a number of scientific specialties. We can study the physical chemistry of the complex, relatively concentrated solution of electrolytes that is seawater. We can study the physical processes that take place in the ocean and at the ocean-atmosphere interface by studying chemical data. We can consider seawater as the environment for marine life and so study the interchange of chemical constituents between the marine biosphere and hydrosphere. As geochemists, we can trace the pathways of elements from the weathering of rocks, down the rivers, into the sea, and back into sediments. Looking at this problem on a grander time scale, as paleoecologists, we can consider how the seawater, by interacting with the lithosphere-biosphere and atmosphere, has stabilized the chemical environment on the surface of our planet as a suitable stage for the evolution and persistence of life. We must orient our science to a specific problem and a point of view, rather than gather together all the bits and pieces of study that a chemist can do at sea.

In chapter 1, J. P. Riley reviews the history of chemical oceanography from the Greeks to the future prospects for exploiting the mineral resources in and under the sea. Next, K. F. Bowen briefly reviews the currents and mixing processes in the sea. This is followed by a discussion of the physical properties of seawater by R. A. Cox. These properties are summarized in 14 tables, and some of the techniques of measurement are presented. A review of the major constit-

uents of seawater by F. Culking is followed by a discussion of the minor elements by E. D. Goldberg. The dissolved gases are treated by F. A. Richards, with a separate chapter on carbon dioxide by G. Skirrow. The nutrients, phosphorous, nitrogen, and silicon, are discussed in separate chapters by F. A. J. Armstrong and R. F. Vaccaro. The dissolved organic constituents are discussed by E. K. Duursma, and the production of organic matter in the primary stages of the marine food chain is described by J. D. H. Strickland. The final chapter presents a more integrated approach to the problem of anoxic basins and fjords by F. A. Richards.

Although the organization of the book makes it satisfactory as a reference work, it is inadequate as a textbook. It fails to show the relationships among the various chemical-physical and biological factors. To train earth scientists to cope with the problems presented by nature, a textbook must be better integrated, for the oceans are ignorant of the narrow specialties suggested by the chapter headings. The book is useful as a series of review articles by experts with an extensive, relatively up-to-date bibliography and a good index.

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Thinkers Incorporated

Bruce L. R. Smith's **The RAND Corporation** (Harvard University Press, Cambridge, 1966. 348 pp. $7.95) is based on a thesis written at Harvard and suffers to some extent from the normal problems of thesis style. But it affords us a welcome, comprehensive study covering the history of RAND up to about 1962. It describes RAND's fortunate beginnings, the roles of important individuals, and the internal organization of the company, and details the effect that one spectacularly successful study (R-266, on deployment and dispersal of air bases) had on Air Force policy. In addition, it deals with significant issues that have been raised about nonprofit advisory corporations: the relationships to the sponsor and to the public, and the problems of competition (real or imagined) with industry and the universities.

But perhaps the most interesting part of the book deals with the problems and prospects of the corporation. There are discussions of optimum size, of the mechanisms of getting individuals of great ability to work on interdisciplinary issues, and, perhaps most surprising, the importance of "selling" the results of its work, in depth and detail, to the group that is paying for them.

Smith obviously believes in the corporation's future (he now works at RAND), but the problems he defines and the future he paints make it appear that to some extent the good old days are over and that RAND is a victim of its own success. And what a success it was! The revolution of strategic thinking in the United States in the 1950's is clearly one of the important RAND accomplishments. The early thinking on missiles and space, the use of quantitative social science, and the development of program budgeting deserve additional laurels. One of the consequences of recognition has been that universities which once scorned strategic thinking as a discipline hired away RAND people, and the Defense Department took others—Charles Hitch, Alain Enthoven, Henry Rowen—to put the new brand of thinking into effect within its own walls. Because RAND was set up initially in the interests of the Air Force, it was affected by the later decline in relative importance and affluence of the Air Force. RAND took on other jobs, and new companies similar to it began attracting some of the spotlight.

One of the issues in government agencies that are trying to develop new programs is whether or not a RAND-type corporation should be set up to do independent advisory work for them. Surely, the argument goes, we need analytical help, and the alternatives of short-term contracts with industry or universities, or in-house operation, seem to have great drawbacks. Therefore, the history of RAND, the most successful corporation of its kind, has many lessons. But whether or not such an organization would be useful in studying transportation, pollution, crime, urban development, or science policy, is not clear. Revolutions of the RAND type do not occur often. The main lesson of this book seems to be that RAND was a happy accident, very dependent on the quality of its staff.

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New Books

Mathematics, Physical Sciences, and Engineering

Actualités de Phytochimie Fondamentale. C. Mentzer, Ed. Masson, Paris, 1966. 324 pp. Illus. Paper, F. 119. Contributors are: D. Billet, J. Chopin, C. Deschamps-Vallet, O. Fatianoff, and H. Pacheco.

Advanced Concepts in Physical Chemistry. Ernest D. Kaufman. McGraw-Hill, New York, 1966. 283 pp. Illus. $9.95.

Advances in Catalysis and Related Subjects. vol. 16. D. D. Eley, Herman Pines, and Paul B. Weisz, Eds. Academic Press, New York, 1966. 301 pp. Illus. $13. Five papers: "The homogeneous catalytic isomerization of olefins by transition metal complexes" by Milton Orchin; "The mechanism of dehydration of alcohols over alumina catalysts" by Herman Pines and Joost Manassen; "Complex adsorption in hydrogen exchange on Group VIII transition metal catalysts" by J. L. Garnett and W. A. Sollich-Baumgartner; "Stereochemistry and the mechanism of hydrogenation of unsaturated hydrocarbons" by Samuel Siegel; and "Chemical identification of surface groups" by H. P. Boehm.

Advances in Free-Radical Chemistry. vol. 1. G. H. Williams, Ed. Logos Press, London; Academic Press, New York, 1966. 303 pp. Illus. $12. Six papers: "The abstraction of hydrogen atoms by free radicals" by A. F. Trotman-Dickenson; "Inorganic hydrogen- and alkyl-containing free radicals, part I, Groups II, III and IV" by N. J. Friswell and B. G. Gowenlock; "Solvent effects in free radical reactions" by Earl S. Huyser; "Vapour phase halogenation of aromatic compounds" by Eduard C. Kooyman; "Free-radical reactions of bridged cyclic compounds" by David I. Davies and Stanley J. Cristol; and "Rearrangement of radicals in solution" by R. Kh. Freidlina.

Advances in Heat Transfer. vol. 3. Thomas F. Irvine, Jr. and James P. Hartnett, Eds. Academic Press, New York, 1966. 325 pp. Illus. $12. Five papers: "The effect of free-stream turbulence on heat transfer rates" by J. Kestin; "Heat and mass transfer in turbulent boundary layers" by A. I. Leont'ev; "Liquid metal heat transfer" by Ralph P. Stein; "Radiation transfer and interaction of convection with radiation heat transfer" by R. Viskanta; and "A critical survey of the major methods for measuring and calculating dilute gas transport properties" by A. A. Westenberg.

Advances in Organometallic Chemistry. vol. 3. F. G. A. Stone and Robert West, Ed. Academic Press, New York, 1965. 488 pp. Illus. $17.50. Five papers: "Applications of nuclear magnetic resonance to the study of organometallic compounds" by M. L. Maddox, S. L. Stafford, and H. D. Kaesz; "Lewis base-metal carbonyl complexes" by T. A. Manuel; "Carboranes and organo-substituted boron hydrides" by Thomas Onak; "The structures of organolithium compounds" by Theodore L. Brown; and "Organometallic nitrogen compounds of germanium, tin, and lead" by J. G. A.