Book Reviews

Marine Pollution: Biology, Technology, and Laws

International Conference on Oil Pollution of the Sea. Report of proceedings, Rome, Oct. 1968. Available from the Secretary, British Advisory Committee on Oil Pollution of the Sea, Natural History Museum, London. 416 pp., illus. Paper, 40s.

Informal international conferences on oil pollution of the sea were held in 1953 (London) and 1959 (Copenhagen), and each of these informal conferences led to an intergovernmental conference at which significant advances were made in controlling the discharge of "persistent oils" (mainly fuel residues and crude petroleum) at sea. The Rome conference in 1968 was a similar informal affair; whether it, too, will stimulate further international legislation remains to be seen. An immediate result was the decision to create an organization of Mediterranean countries to deal with marine disasters in their area. Further recommendations reinforce the efforts of the Intergovernmental Maritime Consultative Organization (IMCO) and other bodies to obtain the universal adoption of the "Clean Seas Code" which is already observed by most responsible tanker operators, to institute traffic-separation schemes wherever the density of shipping warrants it, and to intensify the search for methods of removing spilled oil without damage to marine life. To a professional biologist, the drafting of resolutions is, however, less immediately interesting than the more than 30 papers that were presented and discussed by a large assembly of experts from many nations. The report of these proceedings is nearly five times as long as its predecessors and contains contributions on many aspects of the problem.

Among the biological papers, the most concise and best documented is an account by R. B. Clark of the inroads made by oil pollution on seabird populations. Many ornithologists consider Clark's warnings to be exaggerated; it is hoped that they are nevertheless thought-provoking. The decline of a puffin colony in the Scilly Isles from 100,000 to 100 breeding birds since the beginning of this century is disturbing, whatever the cause. The contention that it merely reflects a natural decline in auk numbers adds little comfort to Clark's well-supported calculations that a colony of guillemots (another auk, "murres" in North America), depleted to half its numbers by an oil spill, would require more than 50 years to regain its original size. J. J. C. Tanis and Mörzer Bruijns contribute up-to-date figures on seabird mortality in continental Europe, and Mrs. M. K. Rowan of South Africa calls attention to the perilous situation of the jackass penguin, whose numbers have been small for some time. Penguins occupy in the southern hemisphere a niche similar to that of auks in the north; they have been suffering a similar decline since "mammoth" tankers (over 100,000 tons) reopened the old Cape route.

On the technical side, W. M. Kluss provides an informative view of the operational procedures of a safety-conscious tanker company and discusses what can be done, particularly in the way of advance planning, to minimize pollution after an accident; three subsequent papers outline the problems of administering a traffic-separation system to avoid such accidents and "load-on-top" techniques which reduce routine pollution from tankers. Sir Solly Zuckerman, the chief scientific adviser to the British government, eloquently defends its handling of the *Torrey Canyon* disaster, looking ahead realistically and authoritatively to the work that remains to be done on methods for the control and removal of oil spilled on the open sea or stranded on exposed coasts. French contributors vigorously though less eloquently blame the British for many of their *Torrey Canyon* troubles, providing a glimpse of the perennial "disperse or sink" controversy. A number of the intriguing ideas offered in lesser papers, such as spraying a slick with hot paraffin-wax and scooping up the solidified raft, or sucking oil from the surface through a gimbel-mounted floating funnel, would scarcely work in bad weather around a tanker stranded on an offshore reef, where some alternative to "detergents" is badly needed. Biologists (who are usually landlubbers) are at their least thoughtful when offering suggestions for coping with this problem—witness the Swedish delegate who proposed that tankers carry inflatable plastic spillbooms, when it is known that these fail to contain oil even in the most moderate sea conditions. Technical experts make equally astonishing biological assumptions, as when Wardley Smith (who, as the British Ministry of Technology head man in oil-pollution research, has greatly improved the efficiency of shore-cleansing methods) cites the magnitude of the 1967 commercial catch of adult sea fish or of lobsters and crabs taken in fairly deep water offshore as evidence that the three-quarters of a million gallons of "detergent" used on *Torrey Canyon* oil was not really damaging to marine life.

Problems in international and maritime law arising from oil pollution form another technical aspect rarely considered by biologists although important to its control; they are discussed in papers by Max Edwards (U.S. Department of the Interior) and Colin Goad (IMCO) which clarify the present situation and point the way to very necessary improvements. Unlike the previous two, this conference also discussed other forms of marine pollution; persistent biocides are dealt with in a paper from the Netherlands, and four Italian contributions include sewage, detergents, and industrial effluents to give a clear if rather patchy picture of the general situation in that part of the Mediterranean. Marine pollution of all kinds everywhere is a growing problem; as the minister of the Italian Merchant Marine said in closing the conference, "Technical progress threatens to upset the normal balance of nature; the adoption of legal, technical and administrative measures to prevent and check pollution is a matter of urgency." Those who are interested in the conservation or

exploitation of marine resources are all too aware of this urgency; they, and indeed all who use the sea, will find in these proceedings both a helpful guide to the current situation and a challenging list of problems which demand prompt solution.

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A Science in the East

A History of Japanese Astronomy. Chinese Background and Western Impact. SHIGERU NAKAYAMA. Harvard University Press, Cambridge, Mass., 1969. xvi + 334 pp., illus. $10. Harvard-Yenching Institute Monograph Series, vol. 18.

The history of astronomy in the cultures of East Asia, developing as that great science did in those regions wholly independently of the West, has always been one of the most fascinating chapters of the history of astronomy in general; but in Western languages there has been much less on Japan than on China. This has partly been because Japanese astronomy, though showing much originality, was fundamentally derivative from the older science of China, and partly also because the Japanese language and sources have been even less well known to sinological historians of science than those of the Chinese. Now, however, Japan has produced a scholar whose supremely competent book, here reviewed, is worthy to be placed on the same shelf as the basic contributions of Gustav Schlegel, Léopold de Saussure, and Henri Maspero. If it was not printed in Japan (and there is no evidence that it was), the Harvard University Press deserves warm congratulations for the masterly intercalation of the numerous Chinese characters in the text, abundant footnotes, and bibliography. This last follows the system of the *Science and Civilisation in China* series, but with the useful modification of keeping italics for the titles of published books, and putting the names of manuscripts within quotation marks—a point worth mentioning because it illustrates another great merit of the work, the author's copious use of manuscript material preserved in the Japanese libraries.

Nakayama's general approach is that of a study in the transmission of ideas. First he follows the absorption and adaptation of Chinese astronomy in Japan during the millennium from A.D. 600 to 1600, then he divides the period of the Tokugawa Shogunate into two. From 1600 to 1720 European astronomy was challenging the older ideas and methods in Japan, but the Chinese influence still remained overwhelming. From 1720 to 1880 the supremacy of "Western" (that is, modern) astronomy was gradually recognized. At this point the author terminates his study, which is illustrated by numerous graphs and geometrical diagrams. Particularly valuable for medievalists are a chapter on astrology and another on Chinese calendrical science. It is true, as Nakayama says, that the latter has been inadequately treated by previous historians, who have not always realized that each "calendar" was really an ephemeris, a treatise in itself and a new set of tables—and there were more than a hundred of them during the past two millennia—but this neglect was not only "because of technical complexity and the lack of a Western counterpart," it came about also because the only really adequate study of the calendars, due to Yabuuchi Kiyoshi, was (and to this day remains) in the Japanese language. Much of the most interesting material in Nakayama's book is contained in ten appendices, from which may be cited such appetizing items as "the derivation of Asada Gōryū's formula for the variation of tropical-year length" and "Takahashi Yoshitoki's epicyclic theory of trepidation."

The admiration of this reviewer for Nakayama's book will have already become evident, but there are two criticisms I cannot forbear voicing. First, it may be a little disappointing to some not to learn more about the observatories of late medieval and early modern Japan—where they were established, who supported them, and how they were equipped. Our author must certainly know, and perhaps could be persuaded to write a further monograph on this interesting subject. Second, one feels throughout a characteristic somewhat grudging tone toward Chinese civilization, mother of all East Asian science (see, for example, pp. 12ff., 15, 63, 74); modification of this would have given an even higher quality of objectivity to the whole. It is probably partly just because the author himself, trained, after all, as a modern scientist, feels he owes more to Western than to Chinese civilization; but possibly also partly because an admiration for traditional Chinese culture has been closely connected at times in Japanese history with the regrettably nationalist and insular outlook of Neo-Shintoism (p. 8), to say nothing of the absurdities of the Buddhist monk Entsū (1754 to 1834), who spent his life fighting against Copernican astronomy in the interests of the traditional Indian-Buddhist Mount Meru cosmology (p. 211ff.). However, there are places where the author speaks in reasonably generous terms of the scientific achievements of the parent civilization of East Asia.

All in all, the present volume must be saluted as one of the most valuable additions of our time to the growth of knowledge about the development of the exact sciences in the civilizations of East Asia.

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Zoological Engineering

Animal Mechanics. R. MCNEILL ALEXANDER. University of Washington Press, Seattle, 1969. xiv + 348 pp., illus. $9.50. Biology Series.

This unusual and interesting book describes the application of some of the principles of mechanics to a wide range of zoological investigations. Although Alexander comments that his book was written for zoologists with a long-forgotten knowledge of physics and no knowledge of engineering, this reviewer, an engineer with a limited background in biology, found the book very worthwhile.

The book is divided into seven chapters, each dealing with a different area of mechanics: force and energy; joints and mechanisms; elasticity and viscosity; strength; pressure, density, and surface tension; motion in fluids; and vibrations and sound. Within each chapter, sections describing the physical theory alternate with sections on zoological applications. The topics covered include such diverse matters as an elasticity theory interpretation of the shape changes of a flatworm, a study of fluid pressures in a burrowing bivalve mollusk, wind tunnel tests of the yaw stability of a gliding shark, and discussions of acoustic impedance matching in the human ear. The numerous comparisons between biological and engineering mechanisms are quite instructive. For example, the author shows that the alula feathers of a pigeon's wings increase the lift coefficient in a manner analogous to that of slots in the wings of a modern airplane. Often a single