action. It teaches an awareness of the many details imprinted all over the countryside, and helps us read the stories they can tell.

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Chronicles of Marine Research

Danske Ekspeditioner pa Verdenshavene. Danish Expeditions on the Seven Seas. TORBEN WOLFF. Rhodos, Copenhagen, 1967. 336 pp., illus. $21.

The Danes have contributed to our knowledge of life in the seas of the world out of all proportion to their population and material resources. The politicians, the navy, the nobility, and the industrial tycoons have all contributed both interest and funds to the support of expeditions to all the seas of the world over a period of 200 years. Such names as Forskål (a Swede who did not return from the first Danish scientific expedition) and Steenstrup (who studied the alternation of generations) are memorialized in the names of animals; C. G. J. Petersen and Johannes Schmidt are names synonymous with marine biology; and the oceanographer relies upon Copenhagen sea water as his ultimate standard for determining salinity. As for our own times, everyone concerned with the study of the sea has heard of Anton Bruun and Gunnar Thorson, as well as of the author of the volume under review, who is well known as a member of the *Galathea* expedition and present representative of the long and distinguished line of Danish crustacean specialists. The Danes have just reason to be proud of this long and excellent record of marine research, which began with the times of Linnaeus and continues to this day.

Now this story, from the first expedition to Arabia in the naval ship *Grønland* to the recent expeditions in the Indian and Atlantic oceans, is told by Wolff in a volume as imposing as one of the older expedition reports.

It is part of the tradition of Danish science that its work should be made accessible to the world in languages other than Danish. This seems to have been started with the publication of the *Ingolf Reports* in the 1890's, although Wolff does not make any further comment on the matter. I have always understood that H. J. Hansen, who was probably the most irascible of all carcinologists, had a great deal to do with this. This book, of course, follows the tradition: the upper half of the page is Danish, the lower English. The book is obviously a labor of love on the part of the author as well as the printers, and there is much valuable information about the organization and conduct of the numerous Danish expeditions to the seas of the world. Now and then one would wish for a bit more information about the personalities of the people involved, and certainly more about the Danish studies in their own seas; Petersen is sadly slighted in this regard. Another oversight, perhaps natural, is that it is seldom mentioned that success in this field is the result of willingness to undertake long, hard hours of drudgery studying the material and preparing the results.

There are several sorts of illustrations in the book: photographs of ships, people, and places, reproductions of original black-and-white drawings of organisms, diagrams of gear and field procedures and track charts, and color plates. Most of the color plates are reproductions originally made for old reports in the glorious days of lithography, and several have been made directly from paintings in museum collections. It is heartening to see that faithful reproduction of this kind of illustration is still possible, even with a screen separation process.

This book is not only a picture book for the library table; it is a significant contribution to the history of marine biology, and will be consulted as a primary reference. Perhaps the review copy at hand was roughly handled in transit, but it does appear that for such an expensive book with such heavy paper the binding was perhaps not adequately reinforced.

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Great Waters. A Voyage of Natural History to Study Whales, Plankton and the Waters of the Southern Ocean. ALISTER HARDY. Harper and Row, New York, 1967. 542 pp., illus. $10.95.

This is a book full of pleasure for practicing oceanographers and for others concerned with the matter of oceanography. It recounts the 1925-to-1927 voyage of the British Royal Research Ship *Discovery* "to study the Antarctic seas and all within them that might have a bearing on the lives of the great whales which there formed the object of so rich a fishery." The investigations begun on this voyage were part of the British contribution to the great international flowering of oceanography that took place in the two decades before World War II. The author was chief zoologist on *Discovery*, and the backbone of this account is the journal he kept during the voyage. The book also includes much material from other sources to round out the story of the Antarctic ecosystem which supports the whales that have been so heavily hunted. Hardy, who is renowned as a specialist in plankton, is exceptionally well qualified to explain its great importance, and he does so clearly. He puts into perspective the studies based on this and later voyages, giving a good general résumé of most of the contents of the first 34 volumes of the *Discovery Reports*, and, more important, makes them coherent for even the nonspecialist. For the younger oceanographers, accustomed to electronic and acoustic aids in their fieldwork, the book gives the feeling of the days when, for example, the diurnal vertical migration of plankton was being confirmed by the new closing tow nets. The large picture of productivity in this immensely fertile ocean is clearly drawn, and shows the complexity and also the simplicity, as in the very short food-chain leading to the great whales. The small planktonic animals are not merely numbers in tables and charts but are also described as animals with their own, various ways of life.

Sir Alister communicates his appreciation of the impressive beauty of the sea and the rugged coasts both in words and in his watercolors. It is too bad that expense prevented the inclusion of more of these sensitive paintings in this abundantly illustrated book. The publishers have produced a good-looking volume, but have served the author and his readers ill in the plethora of distracting and careless misprints, not only in scientific names but also in names of people and places and in common English words.

Among the pleasures of *Great Waters* are the occasional personal glimpses of scientists known to many of us by their work, and to some of us personally. The author himself is revealed from

time to time in a characteristic English aspect. For example, lamenting the lack of exercise space on *Discovery* (a square-rigger!) he says, "When not working a station, I went down to the stokehold every evening to stoke and trim coal in the bunkers for an hour," which, even allowing for the reward of a bucket of hot, fresh bath water, impresses a somewhat sedentary seafarer like me.

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How To Depict

Scientific Illustration. Theory and Practice. CHARLES S. PAPP. Brown, Dubuque, Iowa, 1968. xiv + 318 pp., illus. $11.75.

Graphic Communication. WILLIAM J. BOWMAN. Wiley, New York, 1968. xii + 210 pp., illus. $9.95. Wiley Series on Human Communication.

Practical Geometry for Technical Drawing. S. J. WOOLVEN. Cambridge University Press, New York, 1967. viii + 256 pp., illus. $3.95.

All three of these books are well worth the attention of any scientific illustrator or potential illustrator, whether he is an artist or a scientist who wishes to illustrate his own papers. Each of the three deals with a different aspect of illustrating, and they complement each other remarkably well.

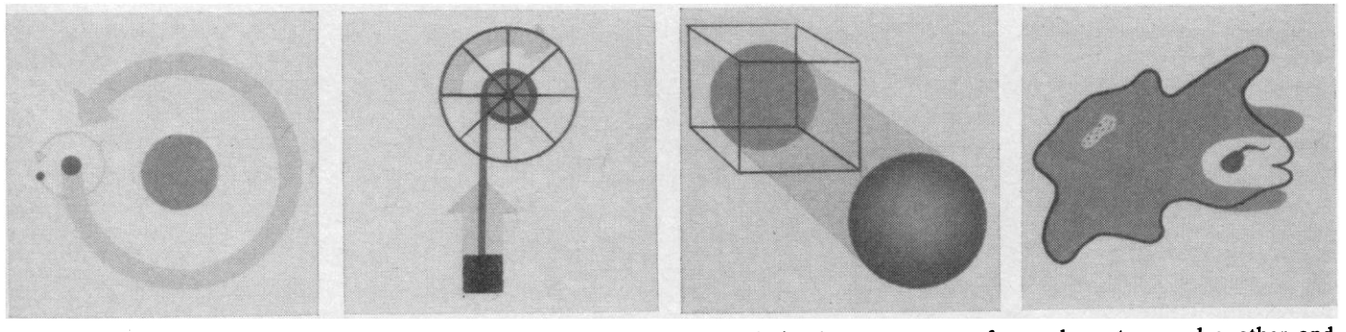
Charles Papp's book deals specifically with the problems and techniques of scientific illustration. The author, a highly talented scientific illustrator, is as detailed and precise in his writing as in his drawing. The major portion of the book is devoted to analyses of and instructions regarding the drawing techniques applicable to different subjects. Among the matters treated are the degree of accuracy and detail required in different types of publications, be they scientific, semipopular, or popular, and the best ways of achieving the desired results. Happily for the beginner, each major technique is described step by step and common pitfalls are considered, along with the amount of reduction that is desirable and the most appropriate printing method.

The special problems associated with each subject field are discussed. Archeological and paleontological rendering are included as well as the more familiar subjects of zoological and botanical illustration. Papp's illustrations are all outstanding, and a number of them are exquisite.

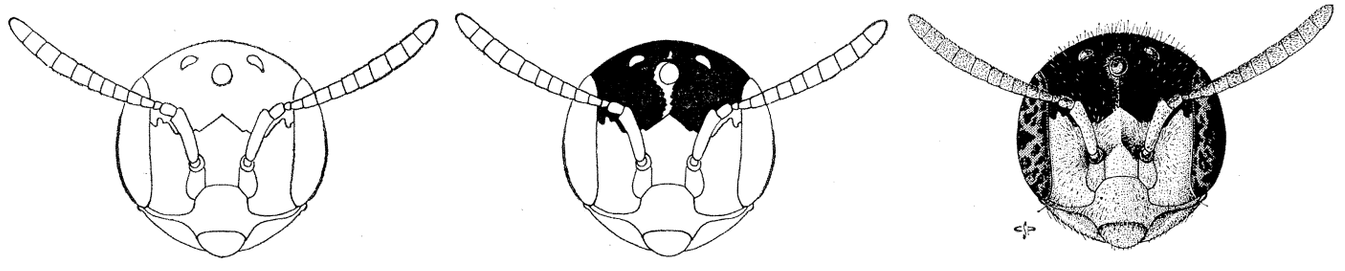
Descriptions of proper drawing instruments and their uses and of suitable papers and drawing surfaces are helpfully included. So is an informative section that introduces the reader to the kinds of drawing equipment and aids that are available, helpful, or necessary to the scientific illustrator. An extra bonus comes in the form of numerous and helpful hints drawn from Papp's experience with scientists and editors of scientific journals on how to satisfy both. The planning of formats, the reduction of artwork, composition, and proportions are all explained clearly.

The author rather forcefully brings out one point which is too infrequently made and with which this reviewer agrees wholeheartedly. This is the need of a good background in science for anyone making a career of scientific illustration. Training in a scientific subject gives the illustrator not only a knowledge of subject material but also familiarity with the scientist's point of view and needs.

Graphic Communication by William J. Bowman may be of more interest and use to the commercial artist than to the scientific illustrator, but it contains much valuable information that can readily be used by the latter. Many different types of subject matter and many



Examples of the illustration of motion. *From left to right*: The compound circular movements of one element around another and a third, subordinate element around the first; a pulley motion in which both circular and direct movements are indicated; a kind of exit movement, depicted without the use of an arrow; an amoeba changing the position of its right side forms to absorb a small organism (here again the movement pattern is made evident without the use of arrow forms). [From *Graphic Communication*]



Steps in the drawing of a bee. *Left*, a pencil outline is inked in; *center*, dark areas are covered with India ink, leaving highlights around the ocelli and the middle of the frons; *right*, the finished drawing. "Incidental patterns in the eyes are added. . . . Shading . . . brings out the 3-D effect. Highlighting the ocelli gives life. Details at the base of the antennae give a moderately concave appearance. . . . Hair lines on the black areas are scraped with a scapel. . . . Pubescence on the antennae is illustrated by scraping very fine lines close together. . . . To finish the eyes a prefabricated tone [is used]." [From *Scientific Illustration*]