the various buffer systems that permitted accurate *p*H measurements. His great work on the physical chemistry of proteins was of central importance in establishing the fact that proteins were definite large molecules, subject to the general laws of chemistry. The emphasis of the laboratory on protein and enzyme research has continued under his successors, K. U. Linderstrøm-Lang and M. Ottesen. In the years after 1945 under Linderstrøm-Lang, a man of brilliant and many-sided gifts, the laboratory became a mecca for protein chemists from around the world.

The physiological department, in its early days under E. C. Hansen, made important contributions to the biology of yeasts and later of higher fungi; the work on yeasts not only was important for science but was of great practical significance for the brewery. Hansen's successor, Johannes Schmidt, also a botanical researcher, became famous as an oceanographer; his studies on the life history and breeding places of the Atlantic eels, and later his circumnavigation of the globe (1928–30) in the *Dana II*, were particularly notable for contributions to biological and physical oceanography. Øjvind Winge, who succeeded Schmidt, became one of the world's leading yeast geneticists; his successor, Heinz Holter, one of the editors of the present book, is eminent in histochemistry and cytochemistry.

The major part of the book is devoted to biographies of these men and others who have played an important role. Several of the biographies appeared earlier in the *Comptes Rendus* of the Carlsberg Laboratory. Here they are sometimes shortened from the original versions, but it is of great value to have them all together. One chapter is devoted to personal recollections of the laboratory by visitors who have worked there; some of these recapture the atmosphere of the place and the people in it very well indeed. I liked particularly the recollections of R. D. Hotchkiss, but all are well worth reading. The final chapters recount the recent reorganization of the laboratory, under financial and other pressures, and its transfer from the Carlsberg Foundation to the United Breweries—a change that greatly enhances the scope of applied research in the expanded laboratories, but leaves an active center of basic research that maintains its continuity with the past.

The book is well printed, with numerous interesting photographs of people and activities, and with a number of well-reproduced color plates. The text is written for the informed public, for readers with some basic background in science. Except in a very few places it requires no specialized technical knowledge for its understanding. The book is a worthy record of a great laboratory.

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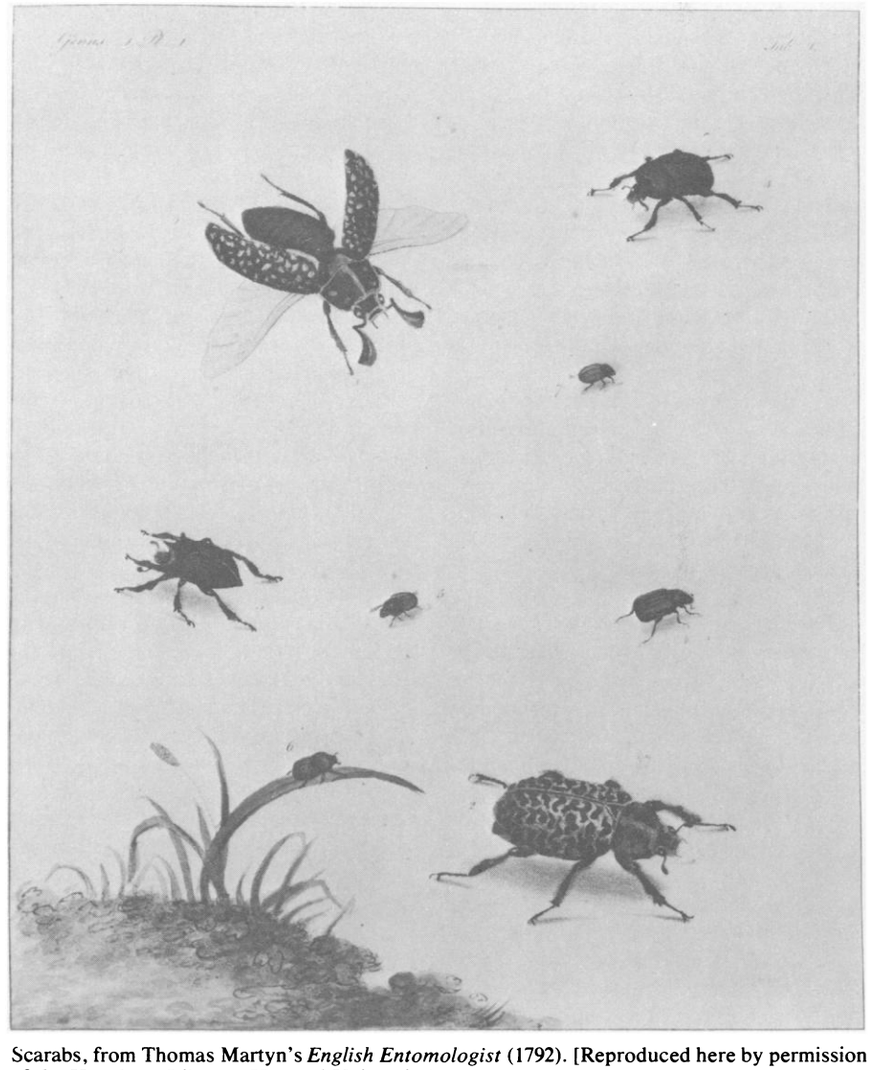
Pictorial Works

Zoological Illustration. An Essay towards a History of Printed Zoological Pictures. DAVID KNIGHT. Dawson, Folkstone, Kent, and Archon (Shoe String Press), Hamden, Conn., 1977. xii, 204 pp., illus. $17.50.

Fine illustrated zoological works fetch astonishingly high prices on the rare book market; even in facsimile editions they cost far more than most honest scientists, historians, and animal lovers can pay. Our only consolation—as David Knight points out in this book—is that when these books were first published we could not have afforded them either.

Anyone who covets or is lucky enough to own some of these handsome works will find much of interest in this book. As one would hope, Knight gives plenty of samples of zoological illustrations, taken from several genres of books on animals published between the late 15th century and the early 20th century (that is, between the invention of printing in the West and the introduction of photographic methods for printing illustrations) and notes the advantages and difficulties associated with the various processes used to reproduce zoological drawings. He describes a good number of zoological works and supplements his text with long lists of other illustrated books and journals and secondary sources. The emphasis is decidedly on English books and on treatises on vertebrates (especially birds); it is not clear whether



Scarabs, from Thomas Martyn's *English Entomologist* (1792). [Reproduced here by permission of the Houghton Library, Harvard University]

this reflects the author's special interests, a historiographic tradition, a judgment about the book's readers, or the actual history of zoological publishing.

Knight's special concern is not with bibliophilic matters, however; rather, he wants to investigate the place of these books within the history of the science of zoology. How do the texts and pictures of these books fit together? What scientific attitudes and theories do the pictures embody? What can these sumptuous publications tell us about the social organization of zoology in a given period? How have their scientific functions changed over the past 500 years? These are certainly the kind of questions "an essay towards a history of printed zoological pictures" ought to take up. And Knight makes many astute observations about the ways pictorial works exemplified the zoology of their times: how, for instance, the high cost of plates in books was subsidized by their prior publication in journals, how the grouping of animals in a single illustration displayed the author's ideas about classification, how Darwinian theory encouraged artists to show animals against the background of their natural habitat and to record individual variations within a species. It is unfortunate but excusable in "an essay towards a history" that the author has not drawn together these observations into a more general argument about the scientific functions of zoological illustrations.

What is harder to forgive, though, is his neglect of the artistic content and context of zoological illustrations. The point here is not the beauty or ugliness of these pictures—Knight disclaims any intention of assessing them "by purely aesthetic criteria," although in fact he often does rate them on their attractiveness—but rather the decisions that determined the final composition and rendering of the image. In the introductory chapters, he raises some pertinent questions about the constraints imposed on the artist by prevailing artistic conventions, by the zoologist and publisher, and by the printing process; but he does not go on to consider how the artist dealt with these constraints in practice and solved the tricky problems of presenting complex scientific information visually.

As a rule, we realize how much these matters determine our response to a picture only when the artist's solution has been especially incongruous or especially apt. Consider, for example, the romantic choice of a moonlit ruined castle as the background for the picture of bats in Buffon's *Histoire naturelle* (figure 56), or the deft use of cast shadows to create the illusion of scarabs walking across the page of Martyn's *English Entomologist* (figure 68; reproduced here), or the ingenious folding of a long, sinuous eel to tuck it into a small space in Playfair and Günther's *Fishes of Zanzibar* (figure 23). The general naïveté of non-artists about the construction of convincing visual images makes it all the more important that a book on the history of zoological illustrations pay attention to these sorts of issues. Moreover, it can be done very well: see, for example, Robert Herrlinger, *History of Medical Illustration to 1600*; David Woodward, Ed., *Five Centuries of Map Printing*; and Ann Blum and Sarah Landry, "In loving detail," *Harvard Magazine*, May–June 1977, pp. 39–51.

Finally, an illustrated book about illustrated books invites comment on its own appearance and production. This book comes off very badly in comparison to the works it describes. The index is wholly inadequate, the bibliographic entries idiosyncratic in form, the text marred by a great many typographical errors. Knight's disregard for the visual aspects of illustration seems to have carried over into the handling of the figures. The pictures are not keyed to the text. The captions are uninformative: even in the chapter on techniques of zoological illustration, the captions do not specify how the drawings were reproduced. A still more striking sin of omission is the failure to name the artists of the pictures in the captions. Worst of all, the pictures themselves are printed here in muddy grays and exaggerated blacks and show through the thin paper. What should have been a delight to see and read is, as a result, a sad disappointment.

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French and British Studies

Essays and Papers in the History of Modern Science. HENRY GUERLAC. Johns Hopkins University Press, Baltimore, 1977. xx, 540 pp. $20.

Historians of science will be happy to have these papers conveniently collected in a single volume, though few if any of the essays will be new to them. Word of the publication of a paper by Guerlac has regularly sent historians to seek it out, even in the most recondite of places. Urbane, literate without ostentation, occasionally enlivened with wit barely concealing a sharp needle, Guerlac's work was a school in which many of us learned the art of marshaling evidence to bring to bear on carefully defined historical problems.

Here there are brought together 33 of the more than 50 articles Guerlac has written, one as early as 1943 and the remainder dating from 1950 through 1976, ranging in subject from general aspects of the history of science through Newtonian science and Lavoisier and the chemical revolution to science in French culture. Whatever their subject, the majority of the papers illustrate the author's inclination to work "in small form," as a kind of historical detective piecing clues together to solve some persistent interpretative puzzle. There is inevitably some repetition, and, as is exemplified by the difference between the biographical sketch of Stephen Hales (of 1972) and the earlier (1951) "The Continental reputation of Stephen Hales," there are some minor corrections of fact as other investigators added their meed of information to Guerlac's own studies.

Each reader will have his or her own favorite selections. Among mine are "Francis Hauksbee: Expérimentateur au profit de Newton" combined with "Newton's optical aether: His draft of a proposed addition to his *Opticks*," where one goes from a reasoned inference, in the first, to demonstration by documentation, in the second, of the influence of Hauksbee's work in returning Newton to aetherial hypotheses. Another set is "The origin of Lavoisier's work on combustion" combined with "A curious Lavoisier episode," showing the influence of Guyton de Morveau's experiments on Lavoisier's and on the original phrasing of his famous "sealed note," changed in publication to conceal competition with his French contemporaries. And, in a different and more reflective mood, there is the discussion of Montesquieu and natural laws of society in "Humanism in science" combined with "Three eighteenth-century social philosophers: Scientific influences on their thought," which deals with Montesquieu, Voltaire, and the Baron d'Holbach.

Rereading "Lavoisier and his biographers" makes one wish that Guerlac would just once transcend his preference for articles over books to write the biography of Lavoisier that only he could write. And of course one does not always agree with his interpretations. Although Guerlac admits that the French "mathematical positivists" probably understood Newton less than the British experimentalists, he is himself too much