

among others. The second describes some simple computer procedures such as subtraction of pairs of images (one highly defocused), and histogram modification. In a final chapter, the author discusses the interpretation of images of various kinds and their reliability.

Misell has gone to great lengths to present all this material simply, with the result that most of the qualitative description will not be found difficult to follow even by readers unfamiliar with the jargon of the subject. The usefulness of the more mathematical parts of the text is much more questionable, however: on p41, for example, it is assumed that the reader will need to be told that "The  $i$  which precedes  $\eta$  in Eq. (3.12) is used mathematically to denote a phase shift in the exponential" and that  $i = \sqrt{-1}$  (though this is not the first appearance of  $i$ ). A few pages later, however, he is expected to be able to cope with two-dimensional Fourier transforms in vector notation, convolutions, delta functions and the like. The section on image analysis contains much helpful guidance on indexing diffraction patterns but not really enough to learn the subject: too little for the newcomer, too elementary for the instructed. This criticism is true of much of Misell's book: as a qualitative account of electron microscopy, biased towards periodic biological specimens, it is very clear and contains an immense amount of information; but as soon as an attempt is made to become more exact, it is unsuitable for those with little mathematical background and too elementary for those who may wish to implement the various techniques. Nonetheless, it was certainly well worth making the effort to write a text at this level and much of it will be found extremely helpful.

Saxton's book covers very different ground. An opening chapter is again devoted to generalities about electron image formation, and a short chapter sets out the properties of the discrete Fourier transform. The next five chapters, the heart of the book, are concerned with the question of determining the wave function of which the recorded image indicates only the modulus, the phase being lost. This problem is still being actively explored, though less energetically than during the first few years after the publication of the Gerchberg-Saxton algorithm, the first solution proposed, in 1972. The final three chapters are concerned with the hardware and programming of image processing, and include a description of the high-level language devised by Saxton to simplify the task of image processing on a large IBM computer. However, in view of the numerous subsequent developments and the introduction of a much-improved mini-computer version of the language (SEMPER) by Horner and similar languages in other image processing centres, this material has already drifted somewhat out-of-date. It is surprising that

Misell does not deal with this topic at all, for potential users of digital techniques with no time or desire to learn much computing would surely be delighted to learn that simple languages are being devised to enable them to perform advanced processing almost effortlessly.

Saxton's book thus deals very fully with two branches of digital electron image processing: phase determination and picture handling. It is essential reading for anyone studying electron image interpretation, the phase problem in particular, and indeed, the analogous problem that arises in many other fields, optical coherence theory for example. It has the merit that not only is the theoretical support set out fully but numerical methods and computational trials are also described at length. Complicated though the subject is, Saxton has succeeded in writing a clear and highly readable account and it is unfortunate that much of the intricate work from the Groningen group led by Professor H.A. Ferwerda appeared too late to be fully integrated into the text.

Both books are well-produced, and Misell's is particularly well illustrated, many of the images having been taken specially for this volume. One minor criticism of the latter is the use of "rad" as a radiation unit as well as "radian" — as SI is adopted everywhere else, why is radiation dose not given in grays? The severest criticism that can be levelled at Misell's volume is no fault of the author, however, for the only glaring inaccuracy occurs in the preface. There, Dr A.M. Glauret, the series editor, writes "each book . . . will also be available in an *inexpensive* edition for individual use . . ." (my italics); to describe a 300 page paperback in a successful series costing \$60 as inexpensive, while a cloth-bound advanced text of much more limited appeal is priced at (only) £15.15, the series editor must somewhere have lost touch with reality.

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## Quantitative study of phytoplankton

*Phytoplankton Manual*. Edited by A. Sournia. Pp.337. (UNESCO: Paris, 1978.)

THIS book is the latest in a series of monographs on oceanographic technology initiated by the Scientific Committee on Oceanic Research of UNESCO. Although entitled *Phytoplankton Manual* the book is almost entirely devoted to marine phytoplankton, and only four pages are specifically devoted to freshwater phytoplankton.

A group of phytoplankton workers were called together, drew up the general arrangement and content of the volume and then handed over to the editor. In his introductory chapter the editor records the problems involved in drawing together such a work and he also indicates how difficult it is to get contributors to comply with deadlines. Also in the introduction the editor expresses a hope "that the present manual will provide a description and evaluation of all current methods". This is, of course, a fine objective but an impossible one as almost every worker has some refinement or variation which is considered to be an improvement for the conditions found in a particular area. This book does, however, cover another aim of the editor in that "an attempt has been made here to cover the quantitative study of phytoplankton at all stages of research, starting even before the act of collecting a sample (i.e., planning the study) and ending somewhat after the act of

enumerating the organisms (i.e. interpreting the results)".

Consisting of a large number of short sections written by people with experience in working with phytoplankton, the methods are described in considerable detail and often compared with related methods, the book is a veritable mine of information. On the other hand because it does contain detailed descriptions of so many methods a young worker just starting in this field might be overwhelmed and find it impossible to decide which is the most suitable method to adopt. It should, however, prevent many of the initial errors which tend to detract from the value of the early results of inexperienced workers.

This, no doubt, will prove to be a valuable manual for all workers in marine phytoplankton, but I imagine a comparable one for the freshwater phytoplankton will also be required. If this book leads to a more uniform approach to the sampling, counting, statistical treatment and calculation of biomass of marine phytoplankton samples, it will have served a useful purpose.

The volume is clearly printed with few errors; it is strongly bound, although a more water-resistant cover may have been an advantage for a laboratory manual. There is an adequate list of references, a list of manufacturers of apparatus and a rather sparse index, but as the editor points out, with a chapter on "How to Use the Manual" the index does not need to be comprehensive. The price for a book of this size and containing so much practical information is extremely reasonable.

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