

has focused interest on the common problems of development and emergence of insects produced in a linear series of cells. Indeed, even the correct orientation in their cells of the pupae of both solitary wasps and honeybees seems to depend upon similar sensory cues. Solitary bees are renowned for their specific foraging preferences and most solitary wasps also specialize in a particular kind of prey, but, in general, social wasps, like social bees, have lost their host specificity, no doubt because they are not limited to one brood generation and a brief foraging period.

The direct transfer of food between the members of a social insect colony was first demonstrated for wasps, and the realization of its extensiveness and importance in ants, bees and termites as well as wasps has allowed many important advances in our understanding of insect societies to be made. When a wasp larva receives an appropriate signal from an adult it exudes a drop of fluid from its mouth which the adult imbibes. Although this behaviour (trophallaxis) has long been known, the value, if any, of the fluid to the adult is still a matter of controversy. Indeed, as the authors point out, despite the large amount of current research on wasps and other social insect colonies we still do not know precisely how the colonies are organized.

There is a suggested reading list of 10 publications. Although 40 authors are mentioned in the text the sources of their work are not given, but nevertheless the authors are to be congratulated on bringing together such a large amount of fascinating information and presenting it in an eminently readable manner.

JOHN B. FREE

Sounds Submerged

Underwater Acoustics. By Leon Camp. Pp. xi+308. (Wiley-Interscience: New York and London, November 1970.) £8.25.

THE origin of this book was an intensive sixty hour lecture course at the University of California given to practising engineers with various academic backgrounds. Because the underwater acoustics field is very broad, the authors admit they had difficulty selecting material so as to keep the book to a manageable size. On this point, the authors are to be congratulated. Their coverage is quite adequate for either final year undergraduates or graduate engineers just entering the field, for whom the book is presumably intended.

Introductory chapters deal with the mechanics of vibration, and introduce

the ideas of complex number notation, phase, resonance and selectivity. Wave and ray acoustics are described in detail, together with various types of transducers and array radiation patterns. The analysis of some simple sonar situations and the use of matched filter and signal processing techniques conclude the text.

Unfortunately there are many errors in the book, and while many of these are easily spotted (equations dimensionally incorrect), readers may find the mistakes irritating and so lose confidence in the authors' integrity. It is sad that most of the errors are due to poor editing and careless proof reading.

For a book meant for students new to the underwater acoustics field it fails to present the material in a readable manner. Emphasis is given to mathematical dexterity, without explaining the meaning of many equations. For example, when the circular locus of a particular ray path is derived, the radius of curvature is given as $-Co/g$, where Co is a velocity and g a velocity gradient. There is no explanation of why the radius of curvature appears to be negative and inconsistencies in an associated diagram make the situation even more confusing.

Underwater acoustics involves the disciplines of acoustics, mechanics, and electricity, and notation conventionally used in one of these disciplines often has a completely different meaning in the others. The authors have used the notation applicable to the discipline being discussed at a particular point, and this can be very confusing, especially as no list of symbols is available except for those pertaining to one chapter. Thus it is impossible to use the text as a reference book, for time has to be spent searching for the meaning of symbols.

The last two chapters on sonar systems and signal processing include material fresh to most texts on the subject. Apart from these chapters, the book adds nothing to the range of similar books currently available.

D. J. CREASEY

Luminescent Molecules

Fluorescence Analysis: a Practical Approach. By Charles E. White and Robert J. Argauer. Pp. x+389. (Dekker: New York, September 1970.) \$18.75; £8.90.

MOST molecules absorb light somewhere in the ultraviolet/visible/infrared region of the electromagnetic spectrum and therefore absorption spectrophotometry in solution is probably the most used analytical technique for the determination of a great number

of substances. Absorption bands are broad, however, and chemically similar substances have overlapping spectra, which makes the determination of one substance in the presence of others extremely difficult. Nevertheless, very small differences in molecules which scarcely affect the absorption spectrum can cause quite profound changes in the stability of the electronic state to which the absorbing molecule is promoted by absorption radiation. These molecules which have stable excited states are usually capable of some form of luminescence. Because only a few molecules fluoresce, the selectivity of fluorescence analysis is usually much superior to absorption analysis. In addition, fluorescence analysis is almost invariably more sensitive for reasons which need not be discussed here.

Fluorescence analysis has, however, for inexplicable reasons never achieved much popularity in the Western world, though other countries, particularly the USSR, seem to have used it to good effect much more extensively. More recently the twin problems of "source scatter" and "quenching", which quite unrealistically seem to have turned so many potential users against the fluorescence technique, have been more fully appreciated as relatively minor in importance, and increasing use is now being made of this method of analysis.

This book by White and Argauer gives a fairly full and detailed account of the practice of fluorescence analysis in a modern laboratory. The authors point out that there are many theoretical treatments of fluorescence phenomena, and after citing some of these they get down to their subject with commendable vigour. Instrumentation is reviewed in a chapter which may unfortunately become dated rather quickly if the topic continues to grow at its present speed, and this is followed by a very fine exposition of the correction of excitation and emission spectra—one of the best accounts of this topic that I have seen. Subsequent monographic chapters deal with fluorescent metal chelates, quantitative methods, fluorescent indicators and the application of spectrofluorimetry to separation techniques such as chromatography and to agricultural problems. Special contributions are then made on the applications of fluorescence to the study of proteins and amino-acids, polynuclear aromatic hydrocarbons and other organics and, in particular, vitamins and steroids. The phenomena of chemiluminescence, X-ray fluorescence and atomic fluorescence (wrongly labelled as "resonance" in the latter instance) are discussed usefully, and finally there is a good account of clinical fluorimetric procedure.

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