

of the plates are laterally restrained which leads to the so-called equation of three shears or stresses. This equation is then expressed in differential form to enable the deformations at the junctions to be taken into account where warranted. These analyses are then applied to continuous structures, to study the effect of transverse diaphragms and edge beams and, in fact, to the practical problems arising in hipped-plate structures.

The second part of the book discusses the various flexural theories that have been put forward and shows how these may be applied to practical designs to determine both the 'membrane' and the bending stresses.

Both these parts are illustrated by numerous examples which emphasize the essential features of each method of analysis considered and, further, show how the calculations should be performed in the design office in the most rational and economical manner.

The final part of the book deals with pyramidal hipped-plate structures of various types; the fundamental structural action of the various types is broken down into the relevant slab components and analyses developed appropriate to a wide range of structures. Also in this part of the book, some interesting structural problems are discussed in the light of hipped-plate theory; among these are plate girder bridges, spiral staircases and various torsion problems.

The presentation of the material in the book is in the form of a large number of short chapters, each dealing with a specific aspect; this makes for easy reference. In general, the figures are clear, but on some the reduction in size has been such as to make reading of numerical data and some of the symbols difficult.

The book is written from the point of view of a structural designer rather than that of the mathematical analyst; the examples chosen are admirably suited to emphasize the design aspects of each problem and the most suitable method of dealing with these. The author is a consulting engineer and his book can certainly be recommended to others in this profession and to students seeking a fundamental appreciation of hipped-plate structures.

The book by Gol'denveizer is a mathematical treatise on the elastic theory of thin shells which, to a certain extent, is complementary to those already published by Vlasov and Novozhilov. The first part of the book presents in detail the derivation of the complete fundamental equations for shells using vector notation. This section is based on the assumption that plane sections remain plane, which Gol'denveizer states as "the preservation of the normal element"; this assumption is discussed in some detail and the implications of it are illustrated with reference to the equations derived earlier.

Part 2 of the book considers the membrane theory for shells as an approximation to the equations derived in Part 1 resulting from the assumption that the transverse shear forces and the twisting moments are zero. Thus, the membrane theory is treated as an approximation to the more general bending theory and its range of applicability as such is considered.

Part 3 deals with the problem of circular cylindrical shells using Fourier series; the main purpose of this study is to emphasize those aspects of approximate analytical methods of interest in more complex shell structures and to enable the implications of the various assumptions in the analyses to be considered.

Part 4 is largely a mathematical justification of the various approximate methods using what is called asymptotic integration. In this section the higher derivatives of a parameter representing the half thickness of the shell are retained and attempts made to carry out the integration with complete mathematical rigour. The final part of the book deals with the derivation of suitable approximate methods for various types of shell structure.

This book is reproduced by a photolithographic process which is quite acceptable to the reader despite its lack of uniformity. It is to be regarded as a treatise on shell theory and its usefulness will be primarily to the research worker in this specific field.

R. E. ROWE

MAGNETIC RESONANCE SPECTROSCOPY

NMR and EPR Spectroscopy

Papers presented at Varian's Third Annual Workshop on Nuclear Magnetic Resonance and Electron Paramagnetic Resonance, held at Palo Alto, California. By the NMR-EPR Staff of Varian Associates. Pp. viii + 288. (London and New York: Pergamon Press, 1960.) 80s. net.

IT has become an annual practice of Varian Associates to hold a 'workshop' at Palo Alto, California, and a similar meeting is to be held at Zurich later this year. The 'workshop' is designed to introduce new workers to the characteristics of nuclear magnetic resonance and electron paramagnetic resonance phenomena, and to keep experienced ones abreast of developments in both fields. The 1959 meeting was divided into three parts: an introductory session, two days of lectures and laboratory sessions devoted to high-resolution nuclear magnetic resonance spectroscopy, and similarly, two days to electron paramagnetic resonance spectroscopy.

The book is essentially a record of these lectures and some of the laboratory sessions; its aim and general arrangement follow the pattern set by the 'workshop'. Part 1 contains five chapters which provide an initial survey, outlines of the basis and range of application of nuclear magnetic resonance and electron paramagnetic resonance spectrometers respectively, and then descriptions of their operating fundamentals. Part 2 describes the theory and instrumentation involved in high-resolution nuclear magnetic resonance spectroscopy, and some structural and chemical applications, followed by brief accounts of more specialized topics including the determination of relaxation times, the measurement of the radio-frequency field, and the use of magnetic field modulation in integrating systems. Part 3 similarly gives a more detailed account of electron resonance spectroscopy, its chemical and biological applications, and its use for photochemical studies, together with short discussions of colour centres and double resonance phenomena.

The book, therefore, gives a survey of many aspects of nuclear and electron resonance spectroscopy, although there are some important omissions; for example, there is no discussion of the use of nuclear magnetic resonance for the structural analysis of solid samples. Considerable space is devoted to the influence of various instrumental parameters on the output signal, and while this is largely described around Varian instruments, most of it will be relevant

to other spectrometers. The main defect is an apparent lack of editing and co-ordination in producing the book from the material presented at the 'workshop'; the repetition which is acceptable and desirable in a lecture series is less welcome in a book. Basic topics are described with increasing detail but with considerable overlap on passing through the various chapters of Part 1 to Parts 2 and 3, and, for example, the same photograph of a high-resolution nuclear magnetic resonance spectrometer appears three times in Part 1, and similar drawings of the spectral shape produced by 'dished' and 'domed' magnetic fields occur on pp. 60 and 95.

In short, the book contains good material but is badly edited. It can be recommended to all who need a general introduction to the field, and should be particularly valuable to those who want some insight into the experimental problems involved in the operation of spectrometers. R. K. WEBSTER

DEEP-SEA MICROBIOLOGY

Meeres-Mikrobiologie

Tiefseeforschungen. Von Prof. Dr. A. E. Kriss. Pp. ix + 570. (Jena: Gustav Fischer Verlag, 1961.) 98.10 D.M.

IT has long been recognized that Russian investigators have played an important part in the development of the science of marine microbiology. It is unfortunate, however, that owing to language difficulties and the relative inaccessibility of many of their journals and monographs, their results have remained comparatively unknown to most workers outside the U.S.S.R. The appearance of another book on marine, and in particular on deep-sea, microbiology where so few already exist would in itself be an event, but where it also summarizes the tremendous volume of recent Russian work in this field it is doubly welcome. The present volume is a revised German edition of the 1959 Russian one which gained for its author a Stalin prize. A more thoroughly revised English version is due to appear shortly.

In 1947 the Institute of Microbiology of the Academy of Sciences of the U.S.S.R. organized a series of investigations into the microbiology of the deep layers of the various seas and oceans. This was in contradistinction to most of the previous work, both inside and outside the U.S.S.R., which dealt mainly with surface waters and the continental shelf, and which was so ably summarized by ZoBell in his *Marine Microbiology* (1947). Commencing with the Black Sea, these Russian investigations have virtually covered every major sea and ocean from the Arctic to the Antarctic, allowing comparison to be made between various types of marine basins—the Black Sea, an intra-continental deep-sea basin; the Caspian, the largest sea-lake; the Pacific, in regions containing the deepest trenches in the world; the Arctic, with its perennial covering of pack ice: and the results to date have now been ably summarized by Prof. Kriss.

Descriptions are given of the methods, both quantitative and qualitative, used for investigating water masses in depth including two pioneered in this sphere by Kriss and his colleagues, namely, the submerged-slide and membrane-filter techniques. As a result, we have for once a composite picture of the vertical and horizontal distribution of bacterial populations throughout the world's seas and oceans,

including the effects thereon of various seasonal, geographical and other factors. Two long chapters are devoted to descriptions of the various species of bacteria, yeasts and actinomycetes encountered and their morphological variations, both vertical and horizontal. Some of these organisms are new to science, for example, the class of *Krassilnikoviae*, of which some excellent microphotographs are provided.

Having described both qualitatively and quantitatively the microflora, and also their general biochemical propensities in transforming a great variety of substances in sea and oceans, Kriss then attempts to give some idea of the microbial biomass in these water basins, utilizing to the full the direct-count and membrane-filter techniques, although some may doubt the reliance placed on these by Russian workers. Data indicate that the greatest microbial concentrations occur in certain layers in the Caspian Sea (approximately 250,000/ml. or a biomass of 45 mgm./m.³) followed by the Black Sea and the Pacific in the area of the Kuril Islands. In the North Polar Sea, even at the season of maximal activity the counts and biomass are approximately only 1/10–1/20 of those of the Caspian.

To many readers, the final chapters on micro-organisms in relation to the biological productivity of the ocean, and as indicators of hydrological phenomena, will be of most interest. Kriss maintains that insufficient account has been taken of the importance of micro-organisms for investigating problems of biological activity in aquatic environments, as, for example, in their role in providing, in themselves, food for young fish and in producing vitamins and other biologically active substances. With regard to the use of micro-organisms as hydrological indicators, Kriss obviously believes that they can be of immense value for the study of the dynamics and origin of water masses and for indicating deep currents at present poorly defined by other methods. By the use of micro-organisms, Kriss has been able to substantiate and extend the more widely accepted views concerning the general hydrography of world oceans as expounded by Sverdrup, Johnson and Fleming (*The Oceans; Their Physics, Chemistry and General Biology*: New York, 1942), although on occasions he has seemed to differ considerably from these experts.

In a volume such as this, full of interesting and often arresting facts and information in almost every page, it is difficult to be critical. The major fault appears to be the almost superabundance of data, so that one cannot see the wood for the trees. There appears to be a reiteration of material in different chapters. The long, detailed Chapter 3, describing the biochemical, morphological and other properties of the various species isolated, seems out of place in this type of book, and could well have been combined with Chapter 6, also dealing with the morphological characteristics of micro-organisms. Moreover, it is unfortunate that Krassilnikov's *Determinative Key for Bacteria and Actinomycetes* (Moscow, 1949), known to few outside the U.S.S.R., should have been used for purposes of classification.

Despite these criticisms, the book should be read by all interested in marine science, because none by previous authors contains anything approaching the amount of data collected here. It is well produced and fully documented, and lavishly illustrated with figures, diagrams and photographs, and deserves to become widely known. J. M. SHEWAN