

thoroughly and rigorously, and the reader is led on to the later chapters on atomic and nuclear physics with a good grounding in the conservation laws. There are excellently illustrated chapters on colour and spectra, introducing the important part played by the spectroscopist, particularly in the early days of modern physics. The book is a most valuable interpretation of the experimental side of physics, and manages in this way to make the subject attractive and intelligible to the non-mathematician.

Prof. J. J. G. McCue's book, which is written at the same level for the same type of student, takes a wide survey of the whole of physical science and lays more emphasis on the historical and human aspects. Why do we believe in the existence of atoms and sub-atomic particles, and how do their properties determine those of the materials in the world around us? These are the questions he asks and discusses in seventy-one chapters, each centred on a single topic. The book would probably be harder reading but for the author's foresight in concentrating attention on one thing at a time, pausing at intervals to recapitulate and consolidate the material of several chapters. The chemists' contribution to the history of atomic physics is fully described, as is also the impact of modern physics on theoretical chemistry. The closing chapters have the inevitable good account of nuclear physics, but without the usual dramatic emphasis; rather more space is, in fact, devoted a little earlier to organic chemistry. A catholic selection of suggestions for further reading ranges from original papers to biographies and popular lectures; readers interested in Anderson's first report of the positive electron, Fred Hoyle's views on the origin of the cosmos, or Sir J. J. Thomson's descriptions of baseball and American football, are directed with equal precision to the source. This is a well-written book which, in spite of its wealth of detail, holds the reader's attention to the end.

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ANTIBIOTICS IN AGRICULTURE

Proceedings First Conference on the Use of Antibiotics in Agriculture

Pp. xx + 278. Publication 397, National Academy of Sciences, National Research Council, Washington 25, D.C., 1956. 2.50 dollars.

IT was an excellent idea of the National Research Council of the U.S. National Academy of Sciences to convene an international Conference on Antibiotics in Agriculture (held during October 19–21, 1955, in Washington, D.C.), and so provide an authoritative forum for discussing the many achievements, problems and expectations in the rapidly growing field of application of antibiotics in agriculture. The publication of the full report on the proceedings of this Conference is the culmination of an enterprise which was well worth while.

The leading experts of the United States and twelve other countries touched in their papers and discussion on every aspect of this fascinating topic. The scope of application of antibiotics is continuously widening. Their usefulness as therapeutic agents and as growth-promoting supplements to feeding-stuffs has been established beyond doubt, and newer developments point of considerable benefits which may be obtained

from application in agronomy (promoting growth and combating infection in plants) and food preservation. Our knowledge and experience in these new fields are still very limited, but the potentialities appear to be enormous.

In 1954 about a quarter of the total production of antibiotics in the United States, namely, nearly half a million pounds, was used as supplements to feeds. All species of agricultural animals appear to have benefited from inclusion of antibiotics in their rations, the magnitude of the positive response depending on many factors. The latter were discussed by many of the contributors.

The mode of action of antibiotics as growth promoters was a subject of a very lively controversy, dominated by the general admission that the available scientific evidence does not allow the exponents of the many hypotheses to be too dogmatic. The exponents of the theme that antibiotics promote growth by virtue of their effect on the bacterial population of the digestive tract discussed the many biological pathways which could lead to an explanation of the phenomenon. The antibiotics could act as prophylactic agents guarding against 'sub-clinical' or obvious infections, or as therapeutic agents in combating disease. They could function by modifying the nutritional requirements of the animals, or by specific effects on some of the essential nutrients. The experimental evidence with germ-free animals was by no means conclusive, and it added an impetus to some of the hypotheses which postulate that the antibacterial properties are not sufficient by themselves to elicit the growth-promoting effect. One of the hypotheses postulated a direct effect of the antibiotic upon intermediate metabolism of the host, others implicated hormonal systems, and still others the possible changes in the metabolic properties of the flora of the digestive tract. One feels rather sympathetic to the view expressed by one of the contributors: "Certainly there is not just one mechanism of action, but several".

The last section of the report deals with the public health aspects involved. In reviewing this part of the proceedings, one cannot do better than quote a paragraph from the summarizing talk of Dr. S. C. Keefer, director of the School of Medicine, Boston University. "It is important to assess the risk of sensitization or of sensitive reactions from antibiotic residues, and also to assess the significance of altering the oral or gastro-intestinal flora, and the emergence of resistant microorganisms as it is related to public health. Certainly the evidence to date would not lead one to believe that the risks outweigh the great benefits which have flowed from the use of antibiotics in animals, to improve nutrition or to prevent or treat diseases, or for that matter from their use as crop sprays in combating plant diseases or in the preservation of food. In any event, this area of antibiotic residues needs continuing study and research, and a fixed and rigid posture should not be taken without a sound basis of evidence. One must weigh the great advantages against the slight risks or the disadvantages."

The report is very well produced and no doubt will serve as a valuable reference book on this very important subject. There are a few mistakes, which could have been avoided by more careful editing, especially of the parts which report the general discussions. The reviewer cannot help feeling that a verbatim report was not the best way of dealing adequately with the discussion.

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