

earlier "Washington Study", Richard Foster Jones's "Ancients and Moderns", is likewise robbed of its full value by lack of an index. It is remarkable, in view of their specifically expressed opinion concerning Birch, that the editors should not have provided Sprat with an index. It is to be hoped that, should a re-issue of the book be called for, which is not unlikely, an adequate index will be furnished.

E. N. DA C. ANDRADE

MICROBIAL VARIATION AND RUSSIAN EXPERIMENTS

Microbial Variation

Edited by V. D. Timakov. Translated from the Russian by G. H. Beale. Pp. x+202. (London and New York: Pergamon Press, 1959.) 40s. net.

THE book contains twenty-two papers by workers at the Gamaleia Institute of Epidemiology and Microbiology on the subject of 'directed variation'. The investigations described fall into two main groups: studies of the consequences of growing one bacterial species on killed cultures of a different species in an attempt to explain the formation of new species in bacteria; and examination of the changes brought about in organisms as a result of submitting cultures to the effects of antibiotics, bacteriophages, immune sera, etc., with the object of obtaining avirulent organisms capable of immunizing against pathogenic bacteria. The thesis put forward by Prof. Timakov in the introductory article is that organisms undergo variation under such conditions and that the nature of the variation can be directed by the environmental conditions imposed.

The more controversial material is contained in the first nine papers, concerned with the variation of an organism 'directed' by growth in the presence of dead cells of another species. Sufficient experimental detail is provided to allow some assessment of the significance of the results or to provide the recipes for attempts at reproduction of the experiments. In essence the experiments involve the growth of a large inoculum (10^{10} cells) of, say, *Escherichia coli* in a medium containing a suspension of killed cells (density 10^8 - 10^9 cells/ml.) of, say, *Salmonella breslau*. Transfers are then made at intervals of seven days (details of times and temperatures are not stated in all papers) and variants appear after 6-15 transfers. Variants isolated after 6-7 transfers are unstable and lose their 'new' properties on cultivation in normal media; variants isolated after the fifteenth transfer are stable and possess new, stable characteristics. Examination of the properties of these stable variants shows that they have acquired some of the characteristics of the killed cells on which they were grown. In the example cited, cells are obtained which are agglutinated by anti-*breslau* but not by anti-*coli* serum, and have become virulent. Other variants are found to have characteristics intermediate between those of *E. coli* and *S. breslau*. In his introduction, Prof. Timakov suggests that this is not the change of one species into another, since the *breslau*-like variant differs from *S. breslau* in being less able to produce infection when given orally; consequently, the experiments are said to demonstrate the production of a new species. It all depends on how you define a species, and there is considerable specious argument on this topic.

Such 'directed variations' are accomplished using various typhoid, paratyphoid, dysentery and coliform organisms. The editor remarks that "Certain objections which are not without foundation have been raised in connexion with this work . . . some workers believe that the bacteria . . . with characters of *S. breslau* were nothing more than germinated heat-resistant forms of *S. breslau*". One wishes that more details were provided to refute this belief; we are simply told that the suspensions were tested for sterility over a period of from fourteen days to six months. No practical details of bacteriological technique or quantitative data for controls are given. It is possible that something akin to transformation might be taking place in these experiments, and one paper deals with the directed variation of *E. coli* grown in the presence of nucleoproteins from pathogenic bacteria, but the work of Griffiths, Avery, Macleod and McCarty is dismissed in three lines as "inconclusive as proof of the occurrence of inter-specific variation". There is little attempt to explain what might be happening in these experiments, other than to emphasize that the formation of new species can be directed in these various ways.

The book provides an interesting account of the work and views of certain Soviet biologists. Readers' reactions will be largely conditioned by their training and beliefs, but, at least, they now have sufficient data provided for them to attempt to direct variation for themselves.

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NON-METALLIC BRITTLE MATERIALS

Mechanical Properties of Non-Metallic Brittle Materials

Edited by W. H. Walton. (Proceedings of a Conference on Non-Metallic Brittle Materials organized by the Mining Research Establishment of the National Coal Board in consultation with the Building Research Station (D.S.I.R.), and held in London, April 1958.) Pp. xi+492. (London: Butterworths Scientific Publications; New York: Interscience Publishers, Inc., 1958.) 90s.

THE variety of brittle materials is immense; some of them are heterogeneous even on a macroscopic scale, and some are anisotropic. Both features make their study difficult. Yet a knowledge of the properties of these materials is of great importance to a variety of industrial processes and it was with this idea in mind that the Mining Research Establishment of the National Coal Board and the Building Research Station organized a conference in April 1958. The Proceedings of this Conference present, probably for the first time, a series of papers which demonstrate the immense amount of work which is going on in this field and also emphasize the difficulties of elucidating the properties of brittle materials because of the presence of a large number of varying parameters. The format of the Proceedings in general follows the course of the conference.

At Session 1, "Strength in Compression, Tension, Bending and Shear" was considered and papers were presented giving experimental results on the strength of cubes of coal under uniaxial compression and under triaxial compression, the strength of bricks and a review of the micro- and macro-strength of glass. Other subjects considered were the strain-