Book Reviews

Essay in Physics. Herbert L. Samuel. New York: Harcourt, Brace, 1952. 178 pp. $3.00.

This book was first printed in England in February 1951, with a preface dated November 1950. The American edition includes an additional section on the theory of the expanding universe with an author's note dated August 1951.

The author is president of the Royal Institute of Philosophy, and throughout the book he makes a sharp distinction between the point of view of the philosopher and that of the physicist. The latter appears to him superficial in the sense that the physicist is not interested in "reality" or "fundamental causes" or "explanations" and is satisfied with descriptions of experience and with theories formulated in purely mathematical terms. The philosophers, on the other hand,

> . . . try to keep their eye on the processes of nature themselves and will not be content with their inter-measurements . . . they persist in seeking the "real essence" through a search for causes . . . it is in this realm (*i.e.*, the realm beyond the range of scientific observation and calculation), if at all, that the solutions to the fundamental problems that are still outstanding are most likely to be found (p. 39).

The book consists of two parts—in the first Lord Samuel expounds the arguments that make him dissatisfied with the achievements of present-day physics. The second part aims to be constructive by presenting a theory or picture of the universe that the author hopes may perhaps eventually be made to satisfy the demands of the philosopher. It is by this second part that the merit of the whole point of view must be judged, and it seems to me that if ever a point of view offered its own refutation, this is it. The fundamental reality is postulated to be energy, which is capable of existing in two forms, one quiescent, the other active. Most phenomena consist in the passage of energy from one form to the other. But if the physicist cannot "explain," to what extent can it be maintained that we have here an explanation? There is no suggestion of the details by which the transfer of energy between the two forms takes place, nor of what differentiates one sort of passage from another. All sorts of *ad hoc* assumptions have to be made for which there is no correspondence with any independent physical happening, and of which the meaning is predominantly verbal. Lord Samuel seems to have no conception of the nature of the problem of explanation, particularly of explanation in a brand-new field in which the old concepts fail. How can one begin the attack on such a field except by precise description?

One of the greatest mysteries for Lord Samuel is "momentum." He asks what "force" "makes" a body continue to move in a straight line. His discussion of the details of the motion of free bodies moving either horizontally or vertically in the earth's gravitational field introduces considerations essentially mathematical in character, but his thesis allows the use of none of the formal machinery of mathematics, with the result that even such elementary distinctions as between velocity and acceleration are confused.

His repugnance to mathematics makes him deprecate the precise descriptions of nature made possible by mathematical language, forgetting that the precisions so described are properly to be called discoveries about nature rather than human inventions, and that part of the task of the philosopher becomes the understanding of the precise relationships thus disclosed. The whole point of view and method of attack seem to me essentially a reversion to the Greeks, like the attack of the Greeks almost purely verbal, and perhaps even more sterile in suggesting new experiments or in correlating old ones.

The book concludes with a letter from Einstein, to whom Lord Samuel, a friend of Einstein's of long standing, had sent a copy of the book in proof, in the hope that Einstein would express his opinion. Einstein's letter is courteous and considerate, as would be expected, but the major part of the letter is occupied with seriously setting forth some of Einstein's reasons for not agreeing with Lord Samuel's views about "reality." The letter has its interest in making a little plainer some of the fundamental differences in point of view between Einstein and the majority of contemporary physicists—a disagreement that has been extensively explored in *Albert Einstein: Philosopher-Scientist* (SCIENCE, **111**, 409 [1950]), edited by Paul Arthur Schilpp.

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Microbial Decomposition of Cellulose: With Special Reference to Cotton Textiles. R. G. H. Siu. New York: Reinhold, 1951. 531 pp. $10.00.

The fact that textiles mildew or rot is a familiar one to the housewife, the camper, the cotton grower, and, more recently, to our armed forces operating in tropical areas. The amount of textile materials rendered useless in peacetime cannot be easily determined but is undoubtedly very great. The quantity rendered useless during the war in military operations was staggering. The seriousness of this situation moved the armed forces to seek methods for providing cellulosic textiles with protection from microbial decomposition. In particular, the Quartermaster Corps of the Army, in cooperation with the chemical and textile-finishing industries, began a campaign to find preparations that could be applied to military textiles and considerably extend their field life under storage and combat conditions.

This was the quick, stopgap, empirical, and practical approach. It was partially effective, but was not quite sufficient. The materials used were toxic to the

appliers and handlers. They did not always fulfill the requirements under a wide variety of conditions. Tests for effectiveness of treatment were unreliable. It was soon felt that a basic study should be undertaken into the mechanism of microbial decomposition. Thus, the studies represented by this book and so ably reported by its author are the outcome of some seven years of concentrated work by the Quartermaster Tropical Deterioration Laboratory, as well as a thorough coverage of the technical literature.

A review of the table of contents reveals what would appear to be an ambitious coverage of the factors underlying the complete cycle from the formation of the cellulose molecule to its microbial decomposition. Dr. Siu first describes this cycle as basic to nature's balance. He next describes the structure, physical and chemical features of cotton, materials made from it, and the modification that occurs when it is subjected to various types of textile wet-processing and finishing. This chapter gives an excellent coverage of the subject.

The chapter on causal organisms contains a highly authoritative discussion of the methods of identification, assay, and determination of the nutritional and environmental factors of cellulolytic microorganisms. Materials were obtained from various tropical areas and cellulose-subsisting microorganisms isolated from them. From this extensive group, representative ones were taken for further study into the mechanism of the degradation of cellulose as well as the gross effect on textile materials. This consists of such effects as the staining and discoloration of fabrics, their loss in strength and weight, and the attack on fibers as a whole.

From a scientific point of view, the section on biochemical transformation of cellulose molecules represents the most important contribution the book makes, as it presents a coordinated and complete basic study of the chain of events leading to the breakdown of cellulose by microorganisms. This sequence is not a simple and direct one that explains the action of all microorganisms. However, the author presents a valuable diagram showing the many types of decomposition mechanisms that have been experimentally verified, are probable, or are postulated. In this manner, he has indicated the progress of research and has provided the basis for further study, as well as application of the results.

The principal application of the results, insofar as the textile manufacturer or user is concerned, is that leading to an understanding of the methods of prevention of such degradation. His studies show that this may be accomplished in several ways: killing the invading organism with toxic substances; neutralizing the cellulolytic enzymes by specific enzyme inhibitors; preventing the organism from making the necessary intimate contact with the cellulose through use of an interposed inert physical barrier, such as resin coatings and impregnations; chemically modifying cellulose fibers to give a layer of resistant derivatives on their surface and/or in the more accessible amorphous regions. He then provides a list of requirements for the ideal method, pointing out that no single method has yet been devised that meets all of them. Its inherent properties should be such that it is inhibitory to a wide variety of microorganisms in relatively low concentrations, nontoxic to higher animals and man, reasonable in cost, available in large quantities, nonleachable by rain and water, heat- and light-resistant, noncorrosive to metals, odorless, colorless, and nonvolatile. Its interaction with textile fabrics should show compatibility with dyeing, and water-resistant, flameproofing, and other finishing treatments; should not adversely alter the stiffness, resiliency, elasticity, breaking and tearing strength, air and moisture permeability, water permeability, and other physical properties; should not accelerate chemical tendering of cellulose by dyes, pigments, and other finishing compounds; and should not catalyze the photochemical degradation of cellulose. Its textile processing characteristics should be such as to require relatively simple procedures, no machinery not ordinarily used in textile-finishing plants, no excessive quantities of toxic solvents, no fire hazards during processing, safety in handling and use, and capability of thorough penetration into cotton. Depending upon the use to which the material is to be put, additional requirements may be placed on the method and certain of the above may be minimized.

Effectiveness of treatment requires both laboratory and field testing methods. Dr. Siu discusses at length the details of these methods, as well as the interpretation of their results.

Finally, in a section of primary interest to those interested in specifying the performance characteristics of textiles and in providing the desired microbial protection, he relates various methods that have been tried to effect this protection. Of the three methods (physical barriers, toxic inhibitors, and chemical modification) only the toxic inhibitor method has been extensively used to date. This method has come closest to meeting the extensive requirements for the ideal method. However, there have been many shortcomings in each of the treatments, and the author points out that, at least theoretically, chemical modification shows the greatest possibilities, and he has provided an excellent basis for further investigation along these lines. The principal difficulty associated with this method is the basic one of overcoming the formidable textile production problems.

The author has taken an ancient problem that has been approached empirically in the past and has provided a sound scientific basis for the understanding of the empirical methods as well as the development of methods that may, as applied research progresses, ultimately meet the requirements of the ideal method. This book is a distinct contribution to the science of textile technology.

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