

States Coast Survey, investigating astronomical and geodetic questions. In that sense he was a precursor of the distinguished school established in Britain by the late Sir Gerald Lenox-Conyngham at Cambridge. To read these papers, written in the early 'eighties, on the reasons for, and limitation of, pendulum experiments is to gain a substantial insight into the physics of the Earth. Peirce must have possessed something of a flair for discerning the essentials of his subject.

However, it is as a philosopher that Peirce will be remembered: his views on what to do and how to do it (or how not to do it) tend to be devastating when applied to research in general. He provides discriminants for the worth-whileness of tackling any given set of propositions experimentally. These criteria concern priorities, time, cost, and so on, and seem close to the considerations which any responsible director of research would apply to-day. In his time, naturally, the play was not for the high stakes of the mid-twentieth century, but the theory is all there, and of great interest. Another example of his rapier-like mind is his approach to the old game of 'twenty questions'. On his showing, a score of interrogations is far too generous an allowance; something like half that number should reveal almost anything, if every shot carries the maximum possible epistemological weight. All this points inevitably towards the growth of a new science, that of cybernetics and information theory, utterly unknown during Peirce's life-time, but destined to become of major importance thereafter. If alive now, he would be a master of electronic computers. Another example of his power of foresight, as Prof. A. D. Ritchie has noticed, is his grasp of the influence of order of magnitude upon the laws applicable to single particles on one hand, and to assemblies on the other. Taken for granted to-day, Peirce perceived this more than sixty years ago.

The collection of reviews and correspondence (strengthened by a detailed bibliography) portrays Peirce as a distinguished reviewer, kindly but ruthless in pressing an author's meaning to the limits of both philological and semantic significance. He seems to extract from a book considerably more than the writer probably intended to put into it. This applies more particularly to minor works, but when dealing with a major theme like Lobachevski's "Geometrische Untersuchungen", his comments are masterly.

It may be useful to indicate the plan and contents of the bibliography, more particularly since much of the material had its origin in rather unlikely places. The general scheme is: (1) Science of Discovery, (2) Science of Review, (3) Practical Science and Miscellaneous, (4) Book Reviews, (5) Life and Letters. This is, in fact, the author's own pattern of taxonomy, and depicts once again the unique quality of his mind. It should perhaps be added that a number of unpublished manuscripts still remain, which are of value for an assessment of his place in the development of philosophy in America. The general bibliography covers the period 1860-1911, with the addition of a few undated entries. Another section follows, containing items from *The Nation*, including Peirce's review of the two volumes of J. Willard Gibbs (1907). Lastly, comes a list of miscellaneous entries and indexes (cross-references, proper names and subjects).

If ever a work deserved the time-honoured title of the "Theory of Knowledge" these volumes certainly do. The editor and the Harvard University Press are to be congratulated upon their efforts.

F. I. G. RAWLINS

THE KILLING OF MICRO-ORGANISMS

Disinfection and Sterilization.

By G. Sykes. (Spon's General and Industrial Chemistry Series.) Pp. xviii+396+7 plates. (London: E. and F. N. Spon, Ltd., 1958.) 75s. net.

THIS book is a survey of the physical and chemical methods of killing micro-organisms. The scope is wide and the author, who has purposely avoided the subjects of chemotherapy and antibiotics, has condensed the material into 370 pages. Although this has prevented any detailed discussion it has permitted some cases of repetition in different sections of the book.

The subject-matter can be divided into two main sections, the physical and the chemical methods (sterilization and disinfection). Parts 1 and 5 of the book deal with the chemical methods and Part 2 with the physical ones. The disinfection and sterilization of air (Part 3), the disinfection of viruses (Part 4) and preservatives (Part 6) are treated separately.

Part 1 deals with the theory of disinfection and methods of testing. In the brief section on bacterial enzymes the difficulty of differentiating between disinfectant action and chemotherapeutic action has forced reference to some chemotherapeutic agents.

The treatment of the dynamics of disinfection is brief and no mention is made of the probit percentage survivor/time curves used by many modern workers, including Jordan and Jacobs, who are so often quoted in this section.

Details of many of the methods of testing are stated although little is given on the comparison between the methods, or with other methods of biological assay.

The chapters in Part 2 deal with sterilization by heat, radiations, filtration, gases and vapours, and the effects of cold, desiccation, and cellular disintegration. Each chapter is complete in itself, but the reader will have difficulty in finding which is the most efficient method for sterilizing a specific material.

Part 3 is a concise and well-balanced account of the disinfection and sterilization of air.

Most of the short section on disinfection of viruses could be incorporated in other sections of the book since all the virus-inactivating agents mentioned in this section have more detailed treatment in other sections.

In Part 5 the commonly used disinfectants are discussed under the headings: phenols and related compounds, dyes, quaternary ammonium compounds, halogens, and heavy metals. The sections are comprehensive but, although the coal tar disinfectants constitute the most widely used group, the problems associated with their formulation receive but little consideration. The testing of 'quats' would be more appropriately discussed in Chapter 3.

It is essential that any book on disinfection should discuss the problems of microbial spoilage, and Part 6 deals adequately with this, and quite correctly other causes of spoilage are not mentioned.

The book is well indexed and the bibliography is extensive, although the practice of referring to a 'private communication', which has not been made or is not going to be made freely available, is very frustrating.

It will be a valuable reference volume in all microbiological libraries.

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