on the surface, where they may cause sufficient irritation to produce a many-layered scab in which they may be present in large numbers.

We have found that the application of a 5-per cent solution of DDT by an ordinary nebulizer to the inner surface of the ear of the rabbit affords a simple, nontoxic method of curing this condition. When the scabs are many layered, it may be necessary to make several applications of DDT at three-day intervals in order to reach the more deeply situated parasites. The destruction of the parasites is followed rapidly by the healing of the affected surface. A single application is useful in the prophylaxis of exposed animals.

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Book Reviews

Photosynthesis and related processes. Vol. I: ***Chemistry of photosynthesis, chemosynthesis and related processes in vitro and in vivo.*** Eugene I. Rabinowitch. New York: Interscience Publishers, 1945. Pp. xiv + 599. (Illustrated.) $8.50.

In the last 25 years our knowledge about photosynthesis has undergone a luxuriant growth. At the beginning of this period Stiles and Spoehr each summed up the available data in monographic form. Since then information has merely accumulated; and while there have been efforts to weed and cultivate small sections, the field as a whole has not had the intensive examination and harvesting it has needed and deserved.

The task is formidable; its extent is indicated by the fact that the present book is only the first of a pair planned to cover the subject. This volume deals with the chemical phases of photosynthesis, while its promised successor is to treat the physical aspects.

The book contains 20 chapters. The first two are introductory and place the subject in its scientific and historical setting. The next eleven chapters take up the photosynthesis reaction as a whole, its products, related reactions outside the cell, chemosynthesis by bacteria, the photochemical reactions, the nonphotochemical reactions, and the effects of outside chemical agents. The seven chapters that follow describe the pigments involved in photosynthesis, their structure, chemistry, and photochemistry. A final chapter covers the relations between photosynthesis and respiration.

There is a large number of original diagrams, tables, and figures. Also, there are excellent author and subject indexes. Each chapter ends with a bibliography arranged historically. A rough count adds up to about 2,000 titles.

The treatment of this extensive material is fresh and tough-minded. Every contribution to photosynthesis and the related subjects has been read and evaluated, and is given a presentation which is just and rigorous.

The book, however, is no pedestrian account of work accomplished. The first chapter is beautifully written; it has a magnificence of conception that carries one along breathlessly. Similarly, Chapter II, which describes the discovery of the basic phenomena of photosynthesis, maintains a fine balance between large issues and detailed data and gives one a sense of participating in the high adventure of scientific discovery. Even Chapter III, which has no historical structure, is fascinating reading because of the sheer intellectual power of its analytical procedure.

Naturally, such an exciting level of writing cannot be maintained, and the price which has to be paid for the patient, inclusive, and critical presentation of so large a collection of material is an absence of the dramatic power of an historical narrative. Since one does not ordinarily find this in a scientific monograph, we may gratefully accept these first three chapters as the *hors d'oeuvre* of a nourishing meal furnished by the rest of the book. The chapters which follow are not just to be read; they need to be studied. And for this too we are grateful. We need the careful and detailed discussion of all this wealth of data for the edification of scholars in this field and for the instruction of those just entering it. Dr. Rabinowitch is to be congratulated on the high level which he has maintained in working over this staggering mass of information.

With so much excellence already received, it may seem ungracious to ask for something else. Yet one wishes that Rabinowitch had not divided the subject into the obvious chemical and physical volumes. Photosynthesis is all of a piece; its division into physics and chemistry is artificial and produces difficulties which are apparent even to the author. Perhaps the situation will be improved when the physical companion volume appears, so that one can easily refer from one volume to the other.

Also, one misses a chapter or two in which the larger outlines of the subject are delineated. The same boldness, which in Chapter II omitted details in order to bring out the essential features of photosynthesis as recognized in the early days, could have been used to paint a broadly conceived picture of the essentials of today. One would like to see in sharp relief such concepts as the light and dark reactions, quantum efficiency, limiting factors, the effect of light intensity and of intermittent illumination, so that the reader might have clearly before him the large masses of the composition before he stops to examine the details which enrich and enliven the separate parts.

Nevertheless, even the elaborate and detailed presen-

tation has its virtues. For example, we cannot but become impressed with the relation of photosynthesis to other biological activities which build organic compounds by reducing carbon dioxide. Some plants require light but use H_2S as a reductant instead of H_2O. Others do not even require radiation, but rely on the energy they get from simple organic substances. The pattern is the same, but the specific means vary. This hierarchy of CO_2 reduction processes may help us imagine the origin and development of photosynthesis. It shows us simpler systems which could have furnished energy for life before the invention of chlorophyll, a substance which is high in the structural scale and needs living tissue for its manufacture.

This is a great book, which will serve for many years as *the* source book of critically digested information about photosynthesis. It is to be hoped that Rabinowitch will not keep us waiting too long for the second volume and that, having acquired all this erudition about photosynthesis, he will take his learning lightly and write a small book for the uninitiated so that the general scientific public may profit from his prodigious labors.

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Sampling statistics and applications: fundamentals of the theory of statistics. **James G. Smith and Acheson J. Duncan. New York and London: McGraw-Hill, 1945. Pp. xii + 498. (Illustrated.) $4.00.**

This volume is a very well-presented combination of advanced statistical method and both elementary and advanced sampling theory. It is intended for advanced students and research workers and is gauged at a level which makes a thorough knowledge of elementary statistics a prerequisite to its enjoyment and comprehension. However, granted a thorough training in the elements of statistics, basic concepts and definitions in advanced theory are clearly presented. Symbols are well defined, and the scope of mathematical treatment is chosen in a manner which makes the volume very valuable as a text and as a reference book.

After the general theory of frequency curves has been discussed, the theory of random sampling is presented in Part II, proceeding to an advanced exposition in Part III. Parts II and III deal with important sampling considerations not usually found in statistical texts. The advantages and necessities of random sampling are discussed, and a very careful treatment of the practical difficulties encountered in the use of random sampling is included. In this connection the authors explain why it must be admitted "that confidence in an inference based on a random sample is dependent on the 'thought' or firm belief that it is a truly random sample. Whether thought with respect to randomness is any sounder, as a basis for inferences, than thought with respect to representativeness of a sample obtained by some other method is a debatable question." Recent conflict of theory among experts indicates the vital significance of this consideration.

A portion of the section devoted to elementary sampling theory discusses the value of stratified or representative random sampling. The authors point out the value of stratification when it is based on correlates with the survey objective. They recognize a reduction in error when proper representation is achieved: "The significance of stratified or representative random samples is that it reduces sampling errors."

Sampling is discussed in relation to the assembly of evidence and also in relation to the estimation of population parameters. This allows an extension of the theory to our ordinary statistical conceptions of reliability and confidence. The boundaries of statistical inference are defined, and examples of their application are given.

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The bacterial cell. **René J. Dubos (with an addendum by C. F. Robinow). Cambridge, Mass.: Harvard Univ. Press, 1945. Pp. xix + 460. (Illustrated.) $5.00.**

This thought-provoking discussion integrates our knowledge of the biological and chemical architecture of bacteria with the classical techniques of cytology and interprets some of the phenomena of the infectious process in terms of the biochemical architecture of the bacterial cell. The author makes the point in his Preface that "in addition to physicochemical properties shared by all living forms, each bacterial type possesses a structural and biochemical individuality which could serve as a basis for an orderly statement of the problems of cellular organization, and for a rational system of classification based on phylogeny." Known facts, however, are too few for convincing integration and generalization—thus a plea for more fundamental investigations in the field of bacterial physiology.

The volume is the outgrowth of a course of eight lectures delivered under the auspices of the Lowell Institute in Boston. The chapter titles are important enough to note: "Materials, Problems and Methods," "Cytology of Bacteria," "Physicochemical and Staining Properties of Bacteria," "Analysis of Cellular Structure by Biochemical and Biological Methods," "The Variability of Bacteria," "The Nature of Virulence," "Immunization Against Bacterial Infection," "Bacteriostatic and Bactericidal Agents," and "Trends and Perspectives." The addendum is entitled "Nuclear Apparatus and Cell Structure of Rod-shaped Bacteria."

The author discusses the many controversial questions impartially and with credit to the protagonists of both sides. Where final conclusions are unwise, they are not made by the author.

The author's statement, "Even among the Eubacteriales—the so-called true bacteria—one finds strange bedfellows, such as small Gram-negative autotrophic organisms, the Gram-positive proteolytic spore formers, acid-fast bacilli, which differ so profoundly from each other in metabolism, structure and even mode of division as to have little in common except microscopic