whole rather than at random, for which rigorous methods are not yet at hand. This illuminates the old and new physics and focuses attention on the relation between the sciences of the material world and those of living organisms and of human societies.

Here is an excellent volume for a scientist to give his layman friends (it includes reading lists) and—since who among us is not a layman in most of the wide stretch of science?—an excellent volume for him to read himself.

R. W. GERARD

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Life: its nature and origin. Jerome Alexander. New York: Reinhold, 1948. Pages vii + 291. (Illustrated.) $5.00.

What is life? One darned thing after another; something one relaxes from on the psychoanalyst's couch; a question of importance only to an embryo; a matter of the liver; a matter of catalysis, says Dr. Alexander.

Catalysis is defined by Dr. Alexander as the process whereby a specific particulate unit or surface (the catalyst) continuously brings about chemical union, breakdown, or structural change in other units as a result of very close contact or approach. This view of the nature of life is now of respectable antiquity, and Dr. Alexander claims no title to it. Indeed, he quotes many earlier workers who have identified themselves with this viewpoint. L. P. Troland, for example, has resumed the viewpoint very clearly in his statement that "life is fundamentally a product of catalytic laws acting in colloidal systems of matter throughout long periods of geologic time." I am, however, somewhat astonished to find that the two works in which this viewpoint has been admirably presented find no mention whatever in the pages of Dr. Alexander's book. I refer to A. I. Oparin's *The origin of life* (Macmillan, 1938) and R. Beutner's *Life's beginning on earth* (Williams & Wilkins, 1938), the latter being a particularly pleasant as well as informative book. Can it be that Dr. Alexander has never heard of them?

However that may be, Dr. Alexander's book, though by no means an original contribution to the subject, is full of the most interesting and chemically recondite facts and theories. Expert and general reader alike will find the book both readable and informative. There is a brief, simple coverage of nuclear physics, with especial reference to the smallest particles of matter and the manner in which molecules make masses. The author then considers the nature of living units (bionts), and emerges with a definition of a living unit as one which can direct chemical changes by catalysis and at the same time reproduce itself by autocatalysis, as for example, genes, bacteriophages, and ultrafiltrable viruses.

The evidence, the author suggests, indicates that the primal cause of evolution is a heritable change in existing and potential biocatalysts. The discussion of this subject in relation to genetics is most stimulating.

The final chapter, "Philosophy, the Guide of Mental Life," is rather more to the point than most such concluding chapters, in which the writer frequently reminds one of the pure mathematician, referred to by Dr. Alexander, who is never so happy as when he doesn't know what he is talking about!

Dr. Alexander's book has it faults, it sometimes wanders and the reader wonders, but I hope I have said enough to indicate that it is a book very well worth reading.

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Experimental designs in social research. F. Stuart Chapin. New York-London: Harper, 1947. Pp. x + 483. $3.00.

After a preliminary characterization of experiments by "trial and error," Chapin makes a study of three types of experimental designs which he takes to be superior: (1) the "cross-sectional" (which attempts to establish present relationships), (2) the "projected" (which involves a relationship between the present and future), and (3) the "ex post facto" (which involves a relationship between the present and past). Each method is treated both in a general way and through specific illustrative research projects. The limitations and possibilities of these approaches are considered in some detail in the last two chapters. In this last portion of the book Chapin also provides a listing and classification of available types of social measurement and discusses some of the representative testing procedures.

The experimental designs are species of a methodological approach that combines J. S. Mill's *Method of Difference* and *Method of Concomitant Variations*; that is, Chapin seeks to impose controls by keeping all variables constant save one, which he attempts to "correlate" with the phenomenon in question, and thus set up causal connections. This is a restricted view of scientific method, since it fails to take into account the new methods developed to handle a large number of variables simultaneously, a method which is perhaps more suited to social research (see R. A. Fisher's *Statistical methods for research workers*). Though Chapin acknowledges the fact that complete control is impossible, he does not provide a criterion by which we can determine which are the relevant and critical variables, thus failing to account for the traditional criticism directed against Mill's methods (see, for example, *An introduction to logic and scientific method,* by Cohen and Nagel).

Chapin takes measurement to be quantification along a scale of units and then proceeds to cite many so-called psychological and sociological scales. But in considering such "measures" as are found in attitude and status studies, he fails to recognize that, although there is quantification and ordering of some sort, there is no scale, since the units of measurement are unknown. As yet there are few sociological "feet" or "pounds."

The book is important because it points out a real possibility for advance in social experimentation and directs attention to the sorely neglected study of method in the social sciences. It is questionable, however, that real advances in research can come from an analysis of method which has not absorbed such important methodological contributions as are to be found in pragmatism

(e.g. Dewey's *Logic: the theory of inquiry* or *An introduction to reflective thinking,* by the Columbia Associates) or in experimentalism (e.g. E. A. Singer, Jr., "Philosophy of Experiment," *Symposium,* I, 2).

RUSSELL L. ACKOFF

Wayne University

Our plundered planet. Fairfield Osborn. Boston: Little, Brown, 1948. Pp. xiv + 217. $2.50.

It was Fairfield Osborn's father who, some 20 years ago, called our present era the end of the age of mammals, if my memory is not tricking me. In this book the son makes compellingly clear that, in the march toward oblivion, mankind has placed itself near the head of the procession. As the only animal that deliberately destroys the environment on which its survival depends, man has used his magnificently developed forebrain to heighten the effectiveness of that destruction. The result, as Mr. Osborn shows, is a shambles; while populations increase, the means of satisfying their needs steadily diminish.

The story is told through more or less random samples that show parallel developments of the relationship between man and his environment on the five continents and Australia. Nearly everywhere man's destruction of vegetation has disrupted the hydrologic cycle, with resultant soil erosion, floods, siltation, falling water tables, vanishing wildlife—essentially, though he does not stress the fact, falling human living standards. And, as the earth disease progresses, more and more of the organism-environment is involved, and treatment and cure become more difficult and more costly.

He has assembled so many valuable data that space limitations require omission of even reference to most of them. He does an especial service by reminding us of the role of the Mesta—the Spanish Wool-growers' Association—in wrecking their country. He points out that "nature gives no blank endorsement to the profit motive" and recommends world-wide planning. He sets forth, eloquently, that "science" is not yet ready to synthesize the adequate environment visualized by some technicians and many economists; we still need the "back forty." He recognizes, as many international do-gooders still cannot, that cultural limitations prevent the use of modern technology in countries dominated by backward, illiterate, and/or exploited populations.

The reviewer has only one serious quarrel with the book: Mr. Osborn repeatedly refers to excessive populations but does not suggest doing anything about checking their increase. He makes many a convincing plea for better use of the land. The uninformed reader might conclude that improved land-use would take care of mankind, even after we were piled three deep. Direct checks on human reproduction are at least as indispensable as forest management and contour plowing.

This is a book that should be widely read; almost anyone reading it will want to recommend it to others. It tells perhaps the most important story of our day—and tells it well.

WILLIAM VOGT

Pan American Union, Washington, D. C.

Introduction to mathematical statistics. Paul G. Hoel. New York: John Wiley, 1947. Pp. x + 258.

This book furnishes a panoramic view of the aims, ideas, and methods of mathematical statistics. It "was designed to serve as a textbook for a two-semester course in mathematical statistics for which elementary calculus is a prerequisite," and in writing it an attempt was made "to keep in mind the needs of applied statisticians for a modern reference book on the fundamental methods of mathematical statistics. The material treated was selected to give the beginner a fairly broad introduction to both classical large-sample and modern small-sample methods." The author also states that "a number of topics have been treated very briefly," since he "did not care to incorporate more material than experience indicated could be satisfactorily covered in a two-semester course." As guides to supplementary reading, annotated references are provided at the end of each chapter.

Noteworthy features of this book are: (1) Its broad coverage of the ideas and techniques of statistical inference, especially those found to be most effective in industrial experimentation, quality control, and acceptance inspection. Thus, in addition to treatment of the material found in most elementary statistics texts, the reader is introduced to such topics as discriminant functions, statistical tolerance limits, and testing for randomness by runs and serial correlations. (2) The effective use made of moment-generating functions to obtain elementary proofs of many of the basic theorems of modern statistical inference. Granted certain fundamental properties of these generating functions, the proofs given are not only complete, but throw light on the character of the approximations involved, if any. (3) The collections of well-chosen exercises at the end of each chapter which provide the reader with opportunities for trying out the methods to which he has been introduced.

A major shortcoming of the book is its failure to make the reader feel "at home" in the application of the methods presented. It falls in that intermediate zone between a purely formal mathematical treatment, on the one hand, and a manual of procedures, on the other, where it is difficult to strike a satisfactory balance between mathematical rigor in the proofs and stimulating illustrations of the scope and power of the applications. The author has tended to favor rigor of development, at the expense of giving the reader a "practical feel" for the applications. As anyone who has made the attempt knows, the latter is more difficult to achieve. As W. Edw. Deming has so admirably put it, ". . . it is fairly easy to write mathematical books and papers, and even easy to make the exposition clear, but . . . it is quite a different matter to try to explain *how to use theory in practice.* This is *very difficult.*" Also, the reference material cited is insufficient and inadequately tied in with the text material. For example, in connection with discriminant functions, B. L. Welch's "Note on Discriminant Functions" (*Biometrika,* 1939, **31**, 218–220) is not cited. This important note relates the problem of constructing an optimal "discriminant function" to Bayes's Theorem and to the Neyman-Pearson likelihood ratio test for