EXPERIMENTAL DESIGNS. By William G. Cochran and Gertrude M. Cox. New York, John Wiley and Sons, Inc.; London, Chapman and Hall, Limited, 1957. 2d ed. xiv, 611 pp. $10.25.

This is a revision of a book which has already become established as an authoritative text on the design of experiments. It gives both an exposition of the practical aspects of this subject, as interpreted in modern statistics, and also a brief account of the mathematical model underlying each design. It is assumed that the reader has previously had an introduction to statistical methods, particularly the analysis of variance, though there is an excellent but compact review of the analysis of variance and covariance in Chapter 3.

There are many aspects of the design of experiments other than the statistical aspects. The scientist who first defines the problem is usually the one who makes the most important contribution to the design of the experiment, and this is particularly so when the experiment is concerned with theoretical issues rather than simple applications. At other times, the elaboration of a piece of apparatus, or of a technical method, may be the critical contribution to the solution of a problem. In neither of these two cases are statistical considerations usually of any importance, or, indeed, of any relevance. The experimenter who thinks of reading this, or any other statistical book on experimental design, should be warned that many things of importance to him in the design of his experiments are not within the scope of such books.

The statistical treatment of experimental design is concerned, for the most part, with the method of selecting the sample from the population of interest. Nothing that has been written above is intended to minimize the importance of this step. If due care is not taken, two types of error may be made. The least serious of these is that efficiency may be reduced, in the sense that 100 observations may be used to provide information that could have been obtained equally well from 20. This loss of efficiency may cost time and money, and, in certain cases where there are various limitations on the amount of material available, an experiment may not even be undertaken, because the experimenter is unaware of the possibility of devising a design of adequate efficiency.

The second type of error that may arise from neglect of statistical design is more important. An experiment may be set up in such a way that valid conclusions are impossible. A classical example is the Lanarkshire Milk Experiment, conducted many years ago to find whether fresh milk was any better than pasteurized milk in promoting the growth of school children. Many gallons of milk were drunk and thousands of measurements were made, but because each school in the experiment used only fresh milk or only pasteurized milk, no one can be certain whether the results obtained reflect differences in the nutritional quality of the milk or differences in the sets of school children entering the experiment.

The book under review is outstanding in its thorough account of the most useful experimental designs that have been developed. Plans for the various designs are included, and a description is given of the experimental situations for which each design is best suited. In most cases illustrations from experi-
mental data are given, the majority of these coming from agricultural experiments, but some being data from medical investigations.

The book contains 17 chapters in all. The first three consist of an introduction, an account of methods of increasing the accuracy of experiments, and the review referred to above of methods of statistical analysis. The remaining 14 chapters give the detailed account of the various designs. The second edition contains two new chapters, one on fractional replication of factorial experiments and one on methods developed recently for the study of response surfaces. In addition to making these two major changes, the authors have revised many sections of the first volume, particularly Chapters 2, 3, 4, 5, 6, 10, 11, and 13.

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EXPERIMENTS IN BIOCHEMICAL RESEARCH TECHNIQUES. By Robert W. Cowgill and Arthur B. Pardee. New York, John Wiley & Sons, Inc., 1957. ix, 189 pp. $3.50.

The authors present the material of a one-year laboratory course for first-year graduate students in biochemistry at the University of California (Berkeley). The first of three sections deals with physical chemical methods for the separation of biological materials, including distillation, countercurrent distribution, zone electrophoresis, and various modes of chromatography. The second section is devoted to the study of enzymes, employing a representative variety of preparations and assay methods. The final section provides an introduction to the use of radioactive isotopes in biochemical research. An informal and useful general introduction precedes the 37 experiments to which some glass-blowing exercises, analytical methods for protein and phosphate, lists of buffers and of required major equipment, a locker inventory, and notes to instructors are appended. A brief index satisfactorily complements a table of contents. The reviewer agrees fully with the authors' justification for a course in advanced biochemical techniques as a means to overcome the frequently encountered "inertia of ignorance" which may keep the investigator from employing useful but unfamiliar methods. This little book covers an impressively wide range of biochemical experimentation and meets the challenge implied in its justification in a very satisfactory manner. Although it is readily granted that subjective judgment and experience will determine the process of selection for any such book, the authors might have wished to place more emphasis on the purification of proteins and the study of their properties. As it is, the handling of proteins is limited essentially to a single protein crystallization (alcohol dehydrogenase) and to the electrophoretic separation of snake venom proteins. Their warning that "enzyme reactions are often influenced by variables other than those under study" would be bolstered by stressing the elimination of some such "other variables" as may be present in crude enzyme preparations. Each experiment is presented in a clear and well-organized manner. A statement of the objective of the experiment is followed by a discussion of principles, a list of equipment and supplies, and the description of the procedure. Suggestions for the treatment of data, questions effectively stimulating thought about details and implications of the experiment, and a list of