with Rh− erythrocytes. In this way two antistromata testing sera were prepared.

TABLE 1

COMPARATIVE SPECIFICITIES OF Rh TESTING SERA

| Commercial anti-$Rh_o$ | Antirhesus guinea pig | Antistroma guinea pig No. 516 | Antistroma guinea pig Sg | No. of cell specimens |
|---|---|---|---|---|
| + | + | + | + | 79 |
| − | − | − | − | 20 |
| + | − | − | − | 2 |
| − | + | − | − | 2 |
| + | − | − | + | 2 |
| + | + | + | − | 1 |
| + | − | + | + | 1 |
| + | + | − | + | 1 |
| + | + | − | − | 1 |
| Total | | | | 109 |

The specificities of these sera were determined by testing them against 109 blood specimens chosen at random. For comparative purposes simultaneous tests were also performed with commercial anti-$Rh_o$ serum (Blood Transfusion Betterment Association, New York City) and guinea pig antirhesus serum. The results of these tests are summarized in Table 1.

It is apparent that the stromata of Rh+ human red blood cells can serve as a suitable antigen for the production of Rh testing sera in experimental animals. With the particular stromata used in our experiments sera approximating the specificity of human anti-$Rh_o$ serum were produced. The few divergent results noted in the data may be ascribed to the well-known differences in avidity of some red cells for antibodies in the sera or to inherent reactive characteristics of guinea pig serum.

Some of our other experiments, which are not sufficiently developed to report at this time, suggest that Rh subtype sera may be produced experimentally by careful selection of the cells used for immunization and absorption.

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# *Book Reviews*

***Principles of radar.*** (2nd ed.) Members of the Staff, Radar School, Massachusetts Institute of Technology. New York–London: McGraw-Hill, 1946. 12 Chapters. (Illustrated.) $5.00.

This book was originally written for use as a reference text at the M.I.T. Radar School during the war. Although the second edition has been reworked and brought reasonably up to date, there remains some evidence of the high security classification of radar during the war years. This eliminates much of the most recent work on the subject. The book brings together in one place something of all the important wartime radar developments for the use of students and the numerous technical people who have been kept away from radar activity by other pursuits.

The radar art has grown in the last few years to such an extent that it is not possible in this one volume to cover completely all phases of the subject. For this reason the quantitative details which are necessary to an equipment design are missing, and the field of radar test equipment has been entirely excluded. However, a sufficient description of each technique is included to show its field of applicability.

Advantage is taken of the numerous specialists available to M.I.T. by having a large number of contributors, each in his own field. It is surprising that the tones of the various chapters, written by different authors, have been kept as similar as they have.

In a few instances the authors have made that mistake which is too common with technical writers—the procedure of giving the details of operation of a particular circuit or device without first having given both the purpose of the device and an outline of the fundamental concepts upon which its operation depends. The reader thus finds it necessary to read the exposition at least twice. However, on the whole, this kind of thing has been avoided, and the book has been kept reasonably easy to read. The action of multivibrators, for instance, has been well handled to avoid making this relatively simple device seem complicated.

The early chapters cover an "Introduction" to radar; "Timing Circuits," including ringing circuits, blocking oscillators, and pulse-forming networks; and cathode-ray "Indicators," with the many possible circuits for producing sweep voltages or currents. A chapter is devoted to wide-band "Receivers," their noise problems, and the automatic frequency-control systems necessary at the extremely high radio frequencies sometimes employed. Transmitters are covered by three chapters on "Magnetrons," "Triode Transmitters," and "Modulators." The changes required in these components to obtain short, high-power pulses in packages consistent with the low average power are significant. Separate chapters are provided on "Radio-Frequency Lines" and "Wave Guides and Cavity Resonators" in order to outline the many new techniques in these two fields. An especially long chapter on "Radar Antennas and Propagation" is needed to cover adequately the many forms which highly directive antennas may take. A chapter on "Transmit-Receive Devices" points out antenna-switching methods to permit the use of a single antenna alternately for transmitting and receiving. The text is concluded with a chapter on "Synchros and Servo-Mechanisms" to show, very briefly, how antenna position information may be delivered to suitable indicators and computers.

The book should serve very well in promoting a general knowledge of radar techniques and thus permitting these techniques to receive widespread application in a peacetime world.

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***Lectures on the calculus of variations.*** Gilbert A. Bliss. Chicago: Univ. Chicago Press, 1946. Pp. ix + 296. $5.00.

This book, written by a mathematician who exerted a profound influence upon the modern development of calculus of variations, represents a most significant addition to textbook literature on the highest level. It contains both the fundamentals of the theory and a judicious selection of advanced results. In particular, it contains an integrated exposition of the many significant results that were obtained by the author and his pupils in the problem of Bolza over a period of years.

The book is divided into two parts. Part I, on the simpler problems of the calculus of variations, is concerned with problems in three-space of a relatively elementary character and is comprised of six chapters, as follows: "The Calculus of Variations in Three-Space"; "Sufficient Conditions for a Minimum"; "Fields and the Hamilton-Jacobi Theory"; "Problems in the Plane and in Higher Spaces"; "Problems in Parametric Form"; and "Problems With Variable End-Points." Part II, on the problem of Bolza, is subdivided into the following chapters: "The Multiplier Rule"; "Further Necessary Conditions for a Minimum"; and "Sufficient Conditions for a Minimum." The appendix which follows gives an excellent exposition of the existence theorems for implicit functions and for differential equations that are needed in the theory. The bibliography contains 77 titles, many of which represent the work of members of the Chicago school.

Even though moderate in size, the book contains a very complete account of the field covered. The exposition is uniformly excellent. The decision of the author to begin with a development of the theory in three-space is a wise one. The plane case is deceptively simple in many ways and, as a first study, is unsuited to prepare the reader for the phenomena that arise in the general case. The restriction to simple integral problems is justified, perhaps, for the opposite reason. Indeed, double integral problems present so many distressing features that the enthusiasm of the beginner may not survive the initial shock. Analogous remarks apply to various other topics that are not discussed in detail in the book. The so-called direct method, for example, involves an excessive amount of the general theory of functions of real variables, and the specific features that make calculus of variations such a fascinating study may become obscured thereby in a first introduction to the field. In view of the fact that the author contributed a beautiful study of several important special problems in an earlier volume (*Calculus of variations*, in the Carus monograph series), the lack of applications in the present volume is also justified, even though the reviewer had welcomed some further detailed studies of classical variation problems (for example, the isoperimetric problem on surfaces of constant curvature).

The reviewer feels that the book fills a very definite need in a very admirable manner. It is indispensable for those who wish to study or teach the subject.

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# *Scientific Book Register*

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