

apt illustration drawn from actual statistics. This with the many references to the literature makes the book very useful. The probability of life is kept in the foreground throughout. The author discriminates between mathematical and statistical probability, and holds that the two have a priori nothing in common. He gives methods of testing the identity of mathematical and statistical probability, that is to say, whether deviations are such as should be expected in the taking of a random sample.

The author divides statistical constants (Masszahlen) into intensive and extensive. Statistical probability belongs to the former and the various kinds of averages to the latter. On page 74 is the statement that the mode (*dichteste Werte*) is far the most important of the extensive statistical constants. The justification of this statement would be of interest when we consider it in connection with the almost universal acceptance of the arithmetic mean as a statistical average.

The representation of mortality by the formulas of Moivre, Lambert, Wittstein, and Babbage are classed as empirical representations, while the formula of Makeham is classed as an analytic representation. The chapter on the adjustment of observations contains in a clear form the methods of moments and least squares for fitting curves to observations; and criteria for the critical examination of the best adjustment.

Taken as a whole, the book is a useful contribution to that portion of mathematical statistics which finds its application in the probability of life.

H. L. RIETZ.

*Elektrische Wellen-Telegraphie*, vier Vorlesungen gehalten von J. A. FLEMING. Autorisierte deutsche Ausgabe von E. ASCHKINASS. Leipzig, B. G. Teubner, 1906. 185 pp.

IN 1903 Fleming delivered the Cantor lectures before the London Society of Arts. These lectures on wireless telegraphy were for a popular audience and necessarily were descriptive and general, not mathematical. The translation by Aschkinass enables German readers to follow the author in their own language — which is very important for the class of readers for whom the lectures are primarily intended. Perhaps the most noteworthy characteristic of the style which is adopted is the constant close touch with nature and the forcefulness of analogy between disturbances in the ether, with which most of Fleming's

audience were probably but poorly acquainted, and the disturbance due to sound in air with which they were certainly much more familiar. This method of exposition is typically English; it is found constantly in the writings of Faraday, Kelvin, J. J. Thomson, and other British physicists; it is met but rarely in the writings of French and German investigators even when they give popular expositions of physical science. Although analogies and mechanical models may be carried to a point where they confuse instead of enlighten and in many cases serve but to disguise the vital truth at the bottom of phenomena, it is probable that a greater use of them would be not without advantage to readers other than English. The translation of Fleming's lectures is therefore undoubtedly of considerable value to German students entirely apart from the matter which the lectures contain.

The first lecture proceeds at once to the presentation of electric force, magnetic induction, electrons, and electromagnetic waves. The analogy between the vibration and pressure in a closed organ pipe and the electric flux and tension on the antennæ of a wireless transmitter is set forth with great force. The function of the condenser is explained and numerous cuts illustrating different fundamental parts of apparatus devised for transmitting electromagnetic waves are given. The second and third lectures deal respectively with the chief points of the transmitting and receiving apparatus. The text by exposition and the cuts by illustration give the reader many of the smaller details as well as the general principles of the apparatus used in wireless telegraphy. In the fourth lecture are discussed numerous matters of a practical bearing on the availability of wireless telegraphy for commercial purposes. To all who realize the difficulties of the purely theoretical investigations in the transmission and reception of electromagnetic waves and who are aware of the many points in which the results of practical experience have been forced to come to the aid of the theory, it will at once appear that Fleming's lectures can be of considerable value not only to general readers but even to those who are primarily interested in and tolerably familiar with the purely theoretical side of the subject.

E. B. WILSON.