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Appendix A, Vol I. Census of the Commonwealth of Australia. The Mathematical Theory of Population, of its Character and Fluctuations, and of the Factors which Influence them by G. H. Knibbs

Review by: G. U. Y.

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REVIEWS OF STATISTICAL AND ECONOMIC BOOKS.

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1.—Appendix A, Vol I. *Census of the Commonwealth of Australia. The Mathematical Theory of Population, of its Character and Fluctuations, and of the Factors which influence them.* By G. H. Knibbs, C.M.G., F.S.S., F.R.A.S., &c. Commonwealth Statistician. xvi + 466 pp., fol. Melbourne, 1917.

This lengthy mathematical monograph, Mr. Knibbs tells us in his "foreword," "is intended to serve a double purpose. It aims on the one hand at supplying the elements of a mathematical technique, such as are needed for the analysis of the various aspects of vital phenomena that come under statistical review, and, on the other, at interpreting material made available by the first census of Australia which has been carried out upon uniform lines and by a central authority."

It is difficult, within the necessarily brief limits of a review, to do justice to so encyclopædic a work. The earlier chapters deal mainly with method—various types of population fluctuations; the determination of curve-constants and of intermediate values; special types of curves; group values, their adjustment and analysis; summation and integration for statistical aggregates; the place of graphics and smoothing. Later chapters are preponderantly devoted to special subjects—the distribution of population according to sex and age; masculinity (the sex-ratio); natality; nuptiality; fertility and fecundity; mortality; migration—but in each case the method and mathematics of the subject occupy a considerable share of the author's attention.

Readers of Mr. Knibbs' writings have learned to expect from him a treatment largely on his own lines and developing his own ideas, and will find this characteristic in the present volume. There is much citation, and development of a number of known and tried methods and formulæ, but also much that is original. So much, in fact, that the older methods are sometimes a little crowded to the wall. Thus in Chapter IV Professor Pearson's frequency curves are mentioned, their equations given, and sketches of their forms. But the new types appear to have been overlooked; and after three pages of description the curves are dismissed with brief statements to the effect that they can be fitted by means of moment (the general method of moments being nowhere adequately dealt with), or by means of a combination of graphical and numerical methods. The author then proceeds to his "flexible curve," the curve which was more fully treated in his *Studies in Statistical Representation*,

$$y = Ax^me^{nx},$$

to which five pages are given, and to curves which are obtained by projecting the normal curve either on to a plane or on to a curved surface. Again, in the case of mortality (Chapter XV), a knowledge of the elementary theory and practice of construction of a life-table appears to be assumed and is not treated, the chapter in this respect hardly fulfilling the intention stated in the passage cited above from the "foreword." The reader finds a section on the "fluent life-table" (§ 6) which appears to contain the first mention of a life-table, and several of the commoner terms and symbols are only defined later in § 21 on the "theory of an actuarial population."

We have, however, said sufficient to indicate that with its wide scope and originality of treatment the volume is one to which reference should be made by every student of vital statistics. The illustrations from Australian data given in the chapters on Nuptiality, Fertility and Fecundity, Mortality and Migration are of particular interest. The last-named chapter, in particular, though brief, deserves special mention for its treatment of a subject usually unduly neglected—often from the inadequacy and untrustworthiness of the data. G.U.Y.

2.—*Birth-Rate and Empire*. By James Marchant. xi + 226 pp., 8vo. London: Williams and Norgate, 1917. Price 7s. 6d. net.

The bibliography of the birth-rate grows apace, and if a Rabelais were among us, his immortal chapter wherein Panurge sets forth the pros and cons of marriage would have a worthy sequel in the quandary of the modern Benedict in regard to parenthood. He would find it strenuously asserted, on the one hand, that civilization is incompatible with prolificity and that a low birth-rate is the infallible proof of culture and prosperity. On the other, he might turn to the volume under review, and following the plan to which Sir Robert Baden Powell confesses of reading the right hand pages only, he would soon have serious doubts as to whether the case is quite as simple as above suggested. To Mr. Marchant, indeed,

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