

theories propounded. The names of Wissler, Spier and Dixon are absent from the bibliography; Nordenskiöld's *Comparative Ethnographical Studies* are not discussed.

Canals Frau's thinking has been heavily influenced by the writings of his fellow countryman José Imbelloni, whose "culturology" has its roots in the work of Graebner and Schmidt. Imbelloni's ascendancy in academic anthropology in Argentina in recent years is very striking. It is curious and rather unfortunate that his theories have received so little critical attention in the United States.

It would be a waste of space to call attention to the numerous factual errors, the misrepresentations resulting from the author's process of selection, and the defective documentation, especially of the illustrations, that mar Canals Frau's book. As I suggested above, the book is chiefly an exposition of the author's theories and the amount of descriptive information given is very limited.

While waiting for the ideal synthesis of American prehistory the reader will still do best to go to Martínez del Río's *Ortogenes americanos* (Mexico, 1943) rather than to Canals Frau's new book.

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PHYSICAL ANTHROPOLOGY

Genetics and the Races of Man. An Introduction to Modern Physical Anthropology.

WILLIAM C. BOYD. (xvii, 453, pp., 53 illustrations and index, \$6.00. Little, Brown and Co., Boston. Published simultaneously by D. C. Heath and Co., Boston, and by McClelland & Stewart, Ltd., Toronto, Canada, 1950).

Since publication in 1928 of his first scientific paper, and especially since the appearance of his strictly anthropological papers starting in 1935, Professor Boyd—academically identified as an immunochemist—has been the leading proponent in this country of genetic methods in physical anthropology. His latest work is the first book by an American on human races which exclusively supports a methodology fundamentally different from comparative morphology. It is the first such book that would be completely new to the 19th century founders of physical anthropology. The central theme developed in the book is: "The origin of the present human races will be cleared up if we can account for the origin of the differences in frequencies of various genes which we now observe" (p. 329).

Population genetics, with its statistical theory of evolution, is held to furnish a method which can answer this problem. The difference between any two populations (races) can be expressed in terms of a single concept—change of gene frequency. Further, in an abstract way, population genetics provides what appears to be a short but exhaustive list of processes which operate to change gene frequencies. The theory has been developed by workers like Dahlberg, Fisher, Haldane, Hardy, Kolmogorov, Weinberg, and Wright. Boyd has translated an introductory survey of their work into anthropological terms.

Like most important works which appear in and make for transitional periods in science, Boyd's book will be received with reservations. I can hear my more orthodox colleagues say: "Boyd's survey of blood groups and population genetics is triply interesting, competent, and important, but it most certainly is not 'An Introduction to

Modern Physical Anthropology'." They would have in mind the subject matter assignment of modern physical anthropology. Present knowledge is substantial for some of these subjects; yet genetic notions have made little or no contribution to such physical anthropological topics as fossil primates, the identification and interpretation of archeological skeletal material, human growth, constitutional classification and correlation with behavior, or the application of anthropometric data to problems on the design of things like clothing, train seats, or airplanes. Proper solution of these problem areas will always require a foundation in morphology and biometry. Genetics can, and I think will, contribute more to the conceptualization of such problem areas. Actually, human genetics itself is handicapped by lack of a sound human morphology. Aside from selection of an unfortunate subtitle, Boyd is well aware of all this (see especially paragraph 2, p. 262). His work should be examined for what it is about, and not, after we are aware of the omissions, for what it is not about. It *is* about the meaning of important and revolutionary findings of population genetics for some parts of physical anthropology.

The content of the 13 chapters is clear from their headings: Possible approaches to a study of man; Genetics, Heredity and environment; Gene equilibrium without evolution; Factors modifying gene frequencies (evolution); The influence of geography on racial distribution; The concept of race; Blood groups; Use of blood groups in human classification; Other human genes; Incompletely analyzed genetic characteristics; Man's past; Man's future. There is an appendix on statistical methods plus other appendices on mathematical treatments (most adopted from Haldane) of problems in population genetics.

The book is well made, attractive, and highly readable. A few errors and misprints appear in formulas or tables of general interest. Because this work is important and will receive, I believe, much student use, I list most of them: Column headings of Table 3 (p. 37) should read $A-B-$, $A-bb$, $aaB-$, $aabb$. Any particular pair of chromosomes represents one-fourth (not one-half, p. 57) of like pairs of chromosomes in that individual's grandparents. With no crossing over, the probability that an individual will receive no chromosomes from one grandparent is one in $(1/2)^{24} = 16,777,216$ rather than one in 8,388,608. In Table 5 (p. 67) the chromosomes are wrongly marked for the linked corn genes, sugary, starchy, lazy and non-lazy. When the cross is $sula/SLa\sigma^7 \times sula/sula\text{♀}$ the row should read $sula$ and the columns SLa , $sula$, for non-crossover gametes and (Sla) , $(suLa)$ for crossover gametes. The four cells, then, are $SLa/sula$, $sula/sula$, $Sla/sula$, $suLa/sula$. The situation (p. 70) for sex linked vs. sex-influenced gene frequencies is not "much the same": rather it is $p\sigma^7:p^2\text{♀}$ for sex linkage vs. $p^2+2p(1-p)\sigma^7:(1-p)^2\text{♀}$ for sex-influenced. Thus when $p=(1-p)=0.5$, for sex-linkage we have $0.50\sigma^7:0.25\text{♀}$ vs. for sex-influenced $0.75\sigma^7:0.25\text{♀}$.

The percentage of heterozygotes in succeeding generations of brother \times sister matings (p. 124, Table 11) is a series of common fractions $2/4$, $3/8$, $5/16$, $8/32$, where the numerators are the successive numbers of the Fibonacci series (each equalling the sum of the two preceding) and the denominators double each generation. The fractions for the three genotypes should be corrected accordingly. Haldane's first estimate of mutation rate for hemophilia (p. 137) was 1 mutation in 100,000 genes, (50,000 ♀ or 100,000 σ^7 individuals) or a rate of 10^{-5} . The terms "dominant" and "recessive" should be used for genes which occupy a single locus—that is, alleles. Most of the characters

listed in Table 40 (p. 318) have not been demonstrated to be controlled by known alleles. Correlation coefficients are of high importance in mathematical genetics (p. 393). P. 409, paragraph 2 should read Yy equal to $q(1-q) + q(1-q) = 2q(1-q)$. The expected offspring from $D \times D$ matings in Table 57a (p. 410) are $1D'$. On p. 417, the new frequency for $0 = 79.7$. In the footnote, p. 424, $k = 0.001$, rather than 0.0001. The three types (p. 427) exist in the ratio $v_n^2ZZ:2v_nZz:1zz$ rather than v_n^2ZZZ for the first term.

Two general topics require comment. The first, although perhaps a matter of taste, can be insidious and thus important. We have had too many books on physical anthropology of late which contain adjectival phrases aimed toward opponents, like "grotesque misconceptions" (p. 66) or "regrettable and pathetic ignorance" (p. 79). Arguments like (p. 199) "X lacks a fundamental understanding of the basic principles of taxonomy and evolution," or in effect, "X is a lousy geneticist" do not help much. For example, regarding human taxonomy, Boyd and Gates, both claiming to represent "genetics," have used identical *ad hominum* arguments to support opposite sides of the same question. The honorific use of "scientific" has no proper place in scientific discourse.

The second general topic is more telling. In my opinion, Boyd has been unduly optimistic about present accomplishments of interpretations concerning human empirical genetic data on statistical models furnished by population genetics. The models we have (especially as formulated by Wright) are things of abstract beauty. But in many crucial respects they are vast oversimplifications far removed from unexpurgated empirical experience. Even neglecting those simplifications for mathematical convenience (a polite way of saying, "We don't know how to write the more appropriate, complicated situation"), application of the statistical models in interpretation of empirical data presupposes estimates of parameters for which all available estimates are bad. Consider the faults in the best worked-out cases: For the serological characters, we know little about the breeding structure of the many populations which have been sampled—in published compilations geographic, linguistic, political, and ethnic groups have been indiscriminately listed. The incomplete state of knowledge for such "well known" genetic characters as hemophilia (Haldane), juvenile amaurotic idiocy (Sjögren), and sickle cell trait (Neel) should give pause to the anthropologist who thinks that population genetics can immediately solve his problems.

Returning to the central theme of the book, we should ask what has the genetic method contributed toward solution of the problem of the origin of present human races? *First* comes a classification of races. This result is quite similar to some classifications based on morphology—the serological races are mostly continental populations, differing in the frequency of certain characters (genes). A time dimension is entered into the classification for Europe alone, where the Basques are considered examples of Early European, the other peoples of that continent being simply European. For many anthropological problems, this classification will be too crude. Asia, for example, with a population of a billion highly variable individuals is a unit too large for much current use. Both cultural and physical anthropology treat mostly of problems having to do with local populations. An urgent task for genetic anthropology is to examine the breeding structure of the rather diverse entities which have been sampled for serological characters. It seems fairly certain that the more meaningful units for human evolution will be of a size smaller than continents. Nonetheless, Boyd's result is

fundamentally different from the continental classifications based on pure morphology. It is a dynamic product, which provides a model to explain differences in terms of a single concept (change in gene frequency), and this concept fits into a statistical model which can be made to give a highly satisfactory account of evolution, both of fruit flies and of men.

A *second* major result has to do with the processes of race formation. Many of the morphological classifications (Hooton, von Eickstedt, the Polish School, etc.), like the serological ones for Europe, explain the observed distribution of characters in an area by race mixture (= migration for the genetic model). Boyd presents an objective method for testing such hypotheses. He demonstrates, for example, that the high frequency of blood group A in American Indians cannot be explained by white admixture. It would be instructive to apply this method to the results obtained by the morphologists, but using serological characters in the tests.

Even if genetics has not yet solved all the empirical problems of physical anthropology, in an important part of the subject it has given us a conceptual base from which solutions can proceed. Professor Boyd's contributions in this direction are first rate. Under the old scheme, we could often tell that something was wrong, but it was difficult to enter corrections into a general conceptual scheme. The type of physical anthropology which Professor Boyd supports will make this possible. The concepts and results of population genetics together with a more dynamic morphology (including the constitutional method) are ways out of the impasse that has characterized the technique-bound, interpretation-deficient, anthropometric variety of physical anthropology during recent decades. I think the general methods described by Professor Boyd will be the basis for significant contributions to knowledge of human races in the near future.

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OTHER

Hollywood, The Dream Factory—An Anthropologist Looks at the Movie-Makers. HORTENSE POWDERMAKER. (342 pp. and Index, \$3.50. Little Brown and Company, Boston, 1950.)

This book is an impressive example of the broadening of anthropological interests which has taken place within the last twenty years. Near the beginning of this period, an Editor of the *American Anthropologist* felt it necessary to raise the question at an annual meeting whether he should accept articles dealing with acculturation. He doubted whether this subject fell within the scope of the science. Today it would be more pertinent to ask whether there are any subjects involving human behavior which have not been considered within the scope of anthropology. In particular, the border line between anthropology and sociology has become so vague that many recent works would seem to defy classification.

The present volume is a case in point. Its subject matter would ordinarily be classed as lying within the field of sociology, yet the treatment is avowedly anthropological. It does agree with the anthropologist's methods in studying non-literate societies inso-