This beautifully presented book clearly will find a place on the bookshelves of those seriously interested in the history of biology. It is a mine of information for those concerned with the issues of classification. One can hope that it will stimulate others to continue where the author leaves off, to follow the story through the years when the biogenic law came into full flower and when the compilation of phylogenetic trees played an important role.

JOHN FARLEY

Biology Department,
Dalhousie University,
Halifax, Nova Scotia, Canada

Bases of Personality Variance

Heredity, Environment, and Personality. A Study of 850 Sets of Twins. JOHN C. LOEHLIN and ROBERT C. NICHOLS. University of Texas Press, Austin, 1976. xii, 202 pp. $8.95.

In one of the earliest efforts to examine personality in a scientific manner, Gordon Allport (1937) pointed out that the term was one of the most abstract in our language, it suffered from excessive use, "its connotative significance is very broad, its denotative significance negligible." Many advances have been made since that time, some of which are exemplified by the research monograph under review. Little did the identical (monozygotic) and same-sex fraternal (dizygotic) twins among the 596,241 high school juniors taking the National Merit Scholarship Qualifying Test (NMSQT) in 1962 realize that they and their parents would soon have the opportunity to volunteer for a mailed-questionnaire study of personality. Of the 1507 self-identified pairs of same-sex twins in the NMSQT population, 79 percent cooperated by returning a questionnaire from which zygosity could be determined with defensible accuracy; in due course, 56 percent or 850 pairs in the starting sample of twins turned in complete data for the battery of personality and interest tests together with the data supplied by their parents. Very few studies of either physical or psychological characteristics have ever achieved such large samples. The final sample represents about 1 in every 18 same-sex twin pairs in the entire United States of that age group, admittedly selected for intellectual ability.

What is the relative contribution of genes and environment to the development of variation in personality, ability, and interests? The empirical findings of the Loehlin-Nichols study are brought to bear on this extraordinarily difficult question. Specialists will find much to challenge their complacency, and generalists should consult the monograph for the clear exposition it provides of the classical twin method and its defense in psychological research. Nichols, an educational psychologist, designed the study and supervised the collection of the data. Loehlin, a behavioral geneticist and computer science specialist, assumed primary responsibility for the reported data analyses and the writing of the monograph. More than half the pages of this book are given over to reproducing the questionnaires and the basic data (processed into intraclass correlations, means, or both) for some 1600 twin variables and 300 parent-derived variables, while the remaining text is heavily punctuated with 51 tables and figures. Kudos to the publisher, for such luxuriance is warranted; having the data bank made public will permit further analyses and hypothesis testing.

The low-keyed approach to potentially controversial topics and conclusions chosen by the authors is refreshing in today's emotionally charged atmosphere in respect of mankind's social biology. With an elegance of language (and even wit) and precision rare in this field, Loehlin is content to let the genes fall where they may. We would expect such concepts as heritability to be used circumspectly and we are not disappointed. Most analyses are in terms of correlations, difference scores, and variances. The orientation of the authors toward their masses of empirical findings is psychometric, as opposed to the view that would be taken by personality theorists; in this they can be faulted for keeping too close to their data or can be praised for staying close to them.

Despite genuine efforts to test the assumptions behind the classical comparison of identical and fraternal twin resemblances and the generalizability of twin results to singletons, the assumptions and the generalizability remain intact. Monozygotic and dizygotic twins, as individuals, do not differ from each other and do not differ from singletons in ways that would bias studies of personality.

Personality was assessed by means of H. Gough's California Psychological Inventory (CPI), consisting of 18 standard scales plus nine special ones, and an ad hoc clustering of questionnaire data that yielded 70 clusters containing three or more items. Even those steeped in the same empirical tradition may anticipate an overdose of empiricism. The atheoretical approach is both a virtue and a vice. The CPI was premeditatedly atheoretical; its scales sample "folk concepts" of personality with nary a thought for differences between traits and states or between measurements of temperament-related traits and so-called superficial or surface traits. The clustering strategies will be subject to criticism from numerical taxonomists as well as from those concerned with construct validity. These strictures anticipate the findings. No consistent tendency was found for certain personality variables to show larger differences in correlation between monozygotic and dizygotic twins than others, both within and across sexes. (Their sample was large enough to permit division into random half-samples by zygosity and by sex.) The authors' conclusion, after surveying their groups of measures, is indeed challenging: "Identical twins correlate about .20 higher than fraternal twins, give or take some sampling fluctuation, and it doesn't much matter what you measure—whether the difference is between .75 and .55 on an ability measure, between .50 and .30 on a personality scale, or between .35 and .15 on a self-concept composite."

The quotation must be seen in the context of the authors' own range of twin correlation differences (monozygotic minus dizygotic) for the CPI of .03 to .44 and the demonstration by others using the CPI with twin samples (smaller by far in size but possibly more representative) of probable differential heritability of traits reminiscent of "temperament vs. surface" distinctions. The differential heritability of abilities may not be testable with Loehlin and Nichols's own data if all five specific abilities (English, mathematics, social studies, natural science, and vocabulary) tested by the NMSQT are mainly measures of "g" or general intelligence; however, their review of the literature on special abilities supports their conclusions, and the burden is now shifted to those who believe in differential genetic loadings. To support the lack of differentiation Loehlin and Nichols make frequent use of a statistical test of agreement across ranks (Kendall's W) in different studies using the same or similar scales; lack of agreement *is* demonstrated, but agreement and disagreement are not symmetrical opposites (see M. G. Kendall, *Rank Correlation Methods*, ed. 4, 1970, p. 95).

The findings about the role of the environment in the development of the measured personality variables, insofar as it could be assessed from parent question-

naires, should also prove heuristically challenging. The authors admit perplexity. Environment appeared to account for half the variance in personality variables, but the environment was one for which the twin pairs were correlated close to zero. "We seem to see environmental effects operate almost randomly with respect to the sorts of variables that psychologists . . . have traditionally deemed important in personality development. [Environment] operates in remarkably mysterious ways, given traditional views on personality and motivational development." Loehlin and Nichols call for better ways of assessing both personality and environment in further explorations of the relationships between them; we second that call.

In this study there is generally a lack of support for a number of conventional hypotheses (innovatively tested) concerning personality—little evidence for differential heritability of traits, for any particular characteristics of twins as individuals, for sex differences, or for effects of early intrapair differences in identicals on later personality. If the authors' adolescent-sample-based conclusions are generalizable, it will be sobering. Personality researchers pride themselves on their gourmet tastes, with palates finely trained to detect subtle nuances in the flavor of their favorite traits or dimensions. Loehlin and Nichols seem to be telling us that we have fooled ourselves with the bright food colorings: everything is vanilla. In the 14 years since this study began remarkable advances have been made in neurobiology and biochemistry. The advances have been characterized by the large number of specificities uncovered neuroanatomically and functionally. Different brain sites, for example, are differentially sensitive to different neurotransmitters. We would speculate that it is only a matter of time before individual differences in the various specificities are related to individual differences in, first, abnormal and, later, normal behavior, including personality traits. Just as the venerable and revered internal combustion engine was the forerunner of solar power, the classical twin method using questionnaire measures of personality will be revered as a force moving psychology toward developmental biology. We owe a debt of thanks to Loehlin and Nichols for "hardening" the foundation for the construction of an integrated natural and social science approach to personality.

I. I. GOTTESMAN
H. H. GOLDSMITH
Behavioral Genetics Center, Elliott Hall, University of Minnesota, Minneapolis

Books Received

American Ethnic Revival. Group Pluralism Entering America's Third Century. Jack Kinton, Ed. Social Science and Sociological Resources, Aurora, Ill., 1977. iv, 204 pp. Cloth, $9.95; paper, $6.95.

American Men and Women of Science. Edited by the Jaques Cattell Press. Bowker, New York, ed. 13, 1976. Seven volumes. xiv, 5044 pp. Each volume, $50; the set, $300.

The Amphibian Visual System. A Multidisciplinary Approach. Katherine V. Fite, Ed. Academic Press, New York, 1976. xiv, 374 pp., illus. $29.50.

Ancestors. Papers from a congress, Chicago, 1973. William H. Newell, Ed. Mouton, The Hague, 1976 (U.S. distributor, Aldine, Chicago). xvi, 404 pp. $26.50. World Anthropology.

The Anthropological Study of Education. Papers from a conference, Oshkosh, Wis., Aug. 1973. Craig J. Calhoun and Francis A. J. Ianni, Eds. Mouton, The Hague, 1976 (U.S. distributor, Aldine, Chicago). xii, 360 pp. $18.50. World Anthropology.

Anti-Invariant Submanifolds. Kentaro Yano and Masahiro Kon. Dekker, New York, 1976. viii, 184 pp. Paper, $19.75. Lecture Notes in Pure and Applied Mathematics, vol. 21.

Cerebral Radionuclide Angiography. Frank H. DeLand. Saunders, Philadelphia, 1976. x, 310 pp., illus. $39.75.

Chemical Evolution of the Giant Planets. Papers from a meeting, Oct. 1974. Cyril Ponnamperuma, Ed. Academic Press, New York, 1976. xii, 240 pp., illus. $11.50.

Collected Papers of Sir Harold Jeffreys on Geophysics and Other Sciences. Vol. 5, Astronomy and Geophysics. Harold Jeffreys and Bertha Swirles, Eds. Gordon and Breach, New York, 1976. xviii, 494 pp. $46.

Control Mechanisms in Essential Hypertension. W. H. Birkenhäger and M. A. D. H. Schalekamp. Elsevier, New York, 1976. xiv, 182 pp., illus. $24.95.

Decision Making and Medical Care. Can Information Science Help? Proceedings of a conference, Dijon, France, May 1976. F. T. de Dombal and F. Grémy, Eds. North-Holland, Amsterdam, 1976 (U.S. distributor, Elsevier, New York). xviii, 604 pp., illus. $55.

Dictionary of Biology. English/German/French/Spanish. Günther Haensch and Gisela Haberkamp de Anton. Elsevier, New York, 1976. xii, 484 pp. $61.50.

Digital Computer Design. Raymond M. Kline. Prentice-Hall, Englewood Cliffs, N.J., 1977. xiv, 430 pp., illus. $19.50. Prentice-Hall Computer Applications in Electrical Engineering Series.

Dynamic Programming and Stochastic Control. Dimitri P. Bertsekas. Academic Press, New York, 1976. xvi, 398 pp. $22.50. Mathematics in Science and Engineering, vol. 125.

Early Childhood Education. An International Perspective. Gilbert R. Austin. Academic Press, New York, 1976. xiv, 370 pp. $17.50. Educational Psychology.

The Edge of the Forest. Land, Childhood and Change in a New Guinea Protoagricultural Society. E. Richard Sorenson. Smithsonian Institution Press, Washington, D.C., 1976. 278 pp., illus. $18.50.

Employability, Employment, and Income. Garth L. Mangum. Olympus, Salt Lake City, 1976 (available from the National Commission for Manpower Policy, Washington, D.C.). 318 pp. Paper, $9.95.

Essays on the History of Medicine. Selected from the *Bulletin of the New York Academy of Medicine*. Saul Jarcho, Ed. Science History Publications (Neale Watson), New York, 1976. xii, 446 pp., illus. $15. The History of Medicine Series, No. 47.

Exploring Sex Differences. Barbara Lloyd and John Archer, Eds. Academic Press, New York, 1976. xii, 280 pp. $11.

Mathematical Tools for Applied Multivariate Analysis. Paul E. Green with contributions by J. Douglas Carroll. Academic Press, New York, 1976. xiv, 376 pp., illus. $24.50.

The Measures of Man. Methodologies in Biological Anthropology. Eugene Giles and Jonathon S. Friedlaender, Eds. Peabody Museum Press, Cambridge, Mass., 1976. xl, 654 pp., illus. Cloth, $30; paper, $15.

Medical Anthropology. Papers from a conference, Chicago, Aug. 1973. Francis X. Grollig and Harold B. Haley, Eds. Mouton, The Hague, 1976 (U.S. distributor, Aldine, Chicago). xviii, 486 pp., illus. $27.50. World Anthropology.

Microbiology—1976. Papers from meetings. David Schlessinger, Ed. American Society for Microbiology, Washington, D.C., 1976. viii, 588 pp., illus. $22.

The Mineral and Nuclear Fuels of the Indian Subcontinent and Burma. A Guide to the Study of the Coal, Oil, Natural Gas, Uranium and Thorium Resources of the Area. J. Coggin Brown and A. K. Dey. Oxford University Press, New York, 1975. xx, 518 pp., illus. + plates. $38.

Molecular Spectroscopy. Modern Research. Vol. 2. K. Narahari Rao, Ed. Academic Press, New York, 1976. xiv, 280 pp., illus. $29.50.

Morphology and Evolution of the Insect Abdomen. With Special Reference to Developmental Patterns and Their Bearings upon Systematics. Ryuichi Matsuda. Pergamon, New York, 1976. viii, 534 pp., illus. $35. International Series in Pure and Applied Biology, Zoology Division, vol. 56.

Mortality Patterns in National Populations. With Special Reference to Recorded Causes of Death. Samuel H. Preston. Academic Press, New York, 1976. xii, 202 pp., illus. $16.50. Studies in Population.

A Natural History of Marine Mammals. Victor B. Scheffer. Illustrations by Peter Parnall. Scribner, New York, 1976. xii, 158 pp. $7.95.

Perception and Misperception in International Politics. Robert Jervis. Princeton University Press, Princeton, N.J., 1976. xii, 452 pp. $22.50.

Probability Theory with the Essential Analysis. J. Susan Milton and Chris P. Tsokos. Addison-Wesley Advanced Book Program, Reading, Mass., 1976. xxii, 340 pp. Cloth, $24.50; paper, $14.50. Applied Mathematics and Computation, No. 10.

Problem Solving in Chemistry. A Dimensional Approach. Glen Tilbury. Rand McNally, Chicago, ed. 3, 1976. iv, 236 pp., illus. Paper, $2.16.

The Professor, the Institute, and DNA. René J. Dubos. Rockefeller University Press, New York, 1976. x, 238 pp. $14.50.

Tall Timbers Fire Ecology Conference and Fire and Land Management Symposium. Missoula, Mont., Oct. 1974. Tall Timbers Research Station, Tallahassee, Fla., 1976. x, 676 pp., illus. Paper. Proceedings Tall Timbers Fire Ecology Conferences, No. 14.

What Makes It Work. George Papallo. Technical illustrations by Graham Forsaith. Arco, New York, 1977. 144 pp. $8.95. Reprint of *How It Works* and *More How It Works*.