

in the text; there is an appendix with a valuable roster of Ostwald's unpublished manuscripts held by the Central Archives of the East German Academy of Sciences; and the bibliography following the editors' introduction is useful as a guide to secondary literature on Ostwald.

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Quantitative Genetics

Quantitative Genetic Variation. JAMES N. THOMPSON, JR., and J. M. THODAY, Eds. Academic Press, New York, 1979. xiv, 306 pp., illus. \$19.50.

During the 1950's quantitative characters were the paradigm of population genetics, the component of genetic variance having almost the status of a conceptual primitive. All phenomena were to be explained by reference to variance components rather than genes. This heyday did not last long, as mathematical approaches based on components of variance reached their limits of usefulness and as electrophoresis and the study of human genetic diseases provided a source of single loci to study. As might have been expected, the glamour of these new pursuits pushed the study of quantitative characters into an undeserved obscurity.

With increased concern with human quantitative traits and with increased attention to polygenic characters in evolution and ecology, the balance is now changing. In this timely book Thompson and Thoday have collected 18 papers on methods of analyzing quantitative characters. The papers tend to be concise and to the point. They are predominantly experimental or discuss experimental methodology in a qualitative fashion. Though there is some mathematics, the emphasis is decidedly nontheoretical.

The contributors include Thoday, Mather, Parsons, Jinks, Rendel, Milkman, and Mukai. Many of the major theoreticians of quantitative genetics are noticeably absent, including the groups at Edinburgh, Iowa State, and North Carolina State. This may be due partly to the empirical emphasis, but perhaps also to the lack of concern in this volume with problems of animal and plant breeding, where quantitative genetic theory has been most elaborate and successful.

The range of organisms covered is

wide, from mice to wheat to fungi, with an equally wide range of approaches. We hear a great deal about the mapping of polygenes, a Thoday specialty. A number of papers use or explain the "biometrical" approach, in which two inbred lines are crossed and the means and variances in the subsequent generations can be expressed in terms of quantities differing from the usual Fisherian additive, dominance, and environmental variance components. This approach is due to Mather and Jinks. It suffers from having its own notation and far too little explanation of how quantities like *D*, *H*, and *E* relate to the three components of variance found in outbred populations.

After reading the papers in this collection, one is vaguely uneasy. It is not at all clear what questions are being asked. Much effort is devoted to reminding us that these methods tell us only about those genes affecting the trait that are actually segregating in our populations or crosses. It is repeatedly emphasized that variation of a quantitative character may be largely due to a few segregating loci. Well and good, but there is no discussion of what biological questions are to be resolved by these studies, aside from questions arising from our interest in the particular characters under study.

I am being unfair. Many of the contributors to this volume believe themselves to be addressing general questions—it is just that I have difficulty in believing that these studies can resolve them. Quantitative genetics has passed through periods of enthusiasm in which it was imagined that rather murky studies at a highly aggregated level would provide insight into molecular processes. Thirty years ago it was often asserted that polygenes were more equal than other genes, and they were imagined as hiding in that repository of mysticism, the heterochromatin. Heterosis was likewise imagined to be a general biological principle, resulting directly from heterozygosity rather than from the phenotypic effects of the two particular alleles.

The belief that in quantitative genetic studies we obtain insights into molecular processes has been accompanied by a tendency toward nonmaterialist holism. This has been most visible in the belief in interactions so strong as to make effects of individual genes uninvestigable.

This volume shows those particular tides as having receded, but shows also that there is no less enthusiasm than before for the prospect of discovering general principles from data on quantitative characters. That quantitative variation may be due to only a few loci is indisput-

able, but I see no reason to believe that there is any general principle to that effect. It should depend entirely on the sort of character under consideration. It is unlikely that a character like body weight has most of its genetic variation at a few loci but quite plausible that sternopleural chaeta number in *Drosophila* will show such a pattern.

Interestingly enough, the very latest wave of enthusiasm is not much represented in the book. This is the suggestion that quantitative traits are varying as a result of variation at "regulatory" loci, with protein polymorphism mostly a result of structural loci. This is in effect the old polygene theory come back to haunt us. Perhaps the contributors to this volume are skeptical of this particular notion, if not of others.

It is to the credit of Thompson and Thoday that they have assembled a volume that gives a reasonably broad view of quantitative genetic studies, one capable of giving rise to such a degree of skepticism on the part of the reader.

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Vestibular Neurophysiology

Mammalian Vestibular Physiology VICTOR J. WILSON and GEOFFREY MELVILL JONES. Plenum, New York, 1979. xii, 366 pp., illus. \$32.50.

In recent years, there has been a heightened interest among neurophysiologists in the workings of the vestibular system. The reasons are fairly obvious. The kinds of sensory information handled by the vestibular labyrinth are relatively simple, so that it has been possible to specify most aspects of the sensory coding process. There is a wealth of detail concerning the intrinsic structure and connections of the vestibular nuclei, and this has provided a challenge to the neurophysiologist interested in correlating structure and function. The vestibular nuclei are heavily interconnected with the reticular formation, the spinal cord, the oculomotor pathways, and the cerebellum. To many workers, the central vestibular pathways have seemed a particularly fruitful focus for the study of sensorimotor integration. Much of vestibular function is expressed in reflex pathways, which are particularly amenable to neurophysiological analysis. Many of the reflexes can be specified in

precise functional terms, and this makes it easier to relate observations at the single-cell level to the operation of the entire system.

Wilson and Melvill Jones have done a commendable job of summarizing the progress made in vestibular neurophysiology over the past 20 years or so. They concentrate on those areas of research where it is becoming possible to synthesize anatomical, physiological, and behavioral findings. Approximately the first third of the book is devoted to peripheral mechanisms. There follow chapters on the vestibular nuclei, on vestibulocerebellar relations, on vestibulospinal systems, and on vestibuloocular pathways. A final section of this last chapter provides a detailed consideration of the adaptive plasticity of the vestibuloocular reflex. Not only is past work summarized in a concise and lucid manner, but some of the more promising directions for future research are also clearly indicated. Some subjects have been deliberately omitted, including forebrain projections, the etiology of motion sickness, and the general problem of spatial orientation.

Even with these omissions, this is certainly the most comprehensive review of the vestibular system currently available. The book is well written and profusely illustrated. It should be of value as a reference work for those active in vestibular research and also as an introduction for others with more general interests in neurobiology.

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Quaternary Vegetation

The Equatorial Rain Forest. A Geological History. JOHN R. FLENLEY. Butterworths, Boston, 1979. viii, 162 pp., illus. \$69.95.

The equatorial rain forest was long believed to be a stable vegetation growing in a stable climate. During the past 20 years, and especially during the past ten, this belief has been tested against fossil evidence of past climate and past vegetation in equatorial areas around the globe and has been found wanting.

Flenley has gathered the new information together, assimilated it thoroughly, and presented the main findings in a book that is clear, well illustrated, and thought-provoking. It contains new syntheses, such as plots of treeline move-

ment on equatorial mountains, and enough original pollen diagrams to give the informed reader a basis for evaluating its conclusions.

Of particular significance are accounts of the pre-Quaternary history of equatorial forest and the influence of humans in the late Quaternary. The early record is most remarkable for its poverty; with such a factual base most current ideas about the age, time range, areal extent, and place of origin of the equatorial forest and its constituent taxa can be little more than reasonable conjecture. Human effects on vegetation, especially in the past 10,000 years, are more firmly established, and from tropical America a useful history of crop plants is beginning to emerge.

The heart of the book covers the Quaternary vegetation of equatorial Africa, America, and Indo-Malesia. The fossil pollen evidence for each region is accompanied by enough information about present vegetation and pollen rain to make it interpretable and enough information about biogeographic problems to make it interesting.

Signs of vegetational change are all but universal in sequences extending back more than 10,000 years. The vegetation from 14,000 to 20,000 years ago is strikingly different from that of the present. The mountain vegetation was of types generally found at lower altitudes, the lowland vegetation of types generally found today in areas with a more pronounced dry season. The late-Pleistocene climate was drier and cooler than that of today. Between 14,000 and 7,000 years ago, vegetation migrated to its modern locations, probably developing some new communities at the same time.

Flenley disputes the common view that equatorial forest owes its richness in species to long stability. The forest has existed in something close to its present composition and extent for only a few tree generations and seems still to be changing. Flenley concludes that "Quaternary climatic variations are sufficient to prevent any climax phase being reached." His information also indicates much individualistic behavior of tree species: "There is no simple upward movement of forest limits . . . one observes the gradual synthesis of the forest that we know today." Plant successions in newly colonized wet or dry habitats seldom follow the trends of classical Clementsian theory with slavish regularity.

This is a careful and reliable guide to the main features of tropical forest history. It is not a compendium of settled matters, for tropical paleobotany has hardly begun. Even at the present rate of

research the next decade should uncover many more surprises than the last one. A research effort commensurate with the possibilities of ancient lakes in the African Rift Valley might yield sequences unbroken since the Miocene.

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Books Received

Acoustic Imaging with Electronic Circuits. Henning F. Harmuth. Academic Press, New York, 1979. xvi, 232 pp., illus. \$25. *Advances in Electronics and Electron Physics, Supplement 11.*

Advanced Electronic Circuits. U. Tietze and Ch. Schenk with the assistance of E. Schmid. Springer-Verlag, New York, 1978. x, 510 pp., illus. \$42.90.

Advances in Biochemical Engineering. Vol. 10. T. K. Ghose, A. Fiechter, and N. Blakebrough, Eds. Springer-Verlag, New York, 1978. x, 178 pp., illus. \$34.

Advances in Carbohydrate Chemistry and Biochemistry. Vol. 36. R. Stuart Tipson and Derek Horton, Eds. Academic Press, New York, 1979. xii, 372 pp., illus. \$33.

Advances in Graphite Furnace Atomic Absorption Spectrometry. Papers from a symposium, New York, Nov. 1977. T. Y. Kometani, Ed. Franklin Institute Press, Philadelphia, 1978. x, 116 pp., illus. Paper, \$14.40.

The Body in Question. Jonathan Miller. Random House, New York, 1978. 352 pp., illus. \$15.95.

Brain Death. Interrelated Medical and Social Issues. Papers from a conference, New York, Nov. 1977. Julius Korein, Ed. New York Academy of Sciences, New York, 1978. viii, 454 pp., illus. \$59. *Annals of the New York Academy of Sciences*, vol. 315.

A Brief Atlas of Histology. Thomas S. Leeson and C. Roland Leeson. Saunders, Philadelphia, 1979. vi, 276 pp., Paper, \$18.50.

Chemistry of Oil Recovery. Papers from a symposium, Anaheim, Calif., Mar. 1978. Robert T. Johansen and Robert L. Berg, Eds. American Chemical Society, Washington, D.C., 1979. x, 182 pp., illus. \$21.50. *ACS Symposium Series*, 91.

Child Development and Personality. Paul Henry Mussen, John Janeway Conger, and Jerome Kagan. Harper and Row, New York, ed. 5, 1979. xii, 580 pp., illus. \$15.95.

The Child's Conception of Language. Papers from a meeting. May 1977. A. Sinclair, R. J. Jarvella, and W. J. M. Levelt, Eds. Springer-Verlag, New York, 1978. x, 270 pp., illus. \$20.90. *Springer Series in Language and Communication*, vol. 2.

The Domestic Rabbit. J. C. Sandford. Halsted (Wiley), New York, ed. 3, 1979. xiv, 258 pp., illus. \$13.95.

Doomsday Has Been Cancelled. J. Peter Vajk. Peace Press, Culver City, Calif., 1978. xviii, 238 pp., illus. Paper, \$7.95.

Dying, Death, and Grief. A Critical Annotated Bibliography and Source Book of Thanatology and Terminal Care. Michael A. Simpson. Plenum, New York, 1979. xii, 288 pp. \$21.95.

Dynamic Programming and Its Applications.