Book Reviews

Mammalian Variation

Variability of Mammals. A. V. YABLOKOV. Translated from the Russian. L. Van Valen, Ed. Published for the Smithsonian Institution and the National Science Foundation by Amerind, New Delhi, 1974 (available as TT-58007 from the National Technical Information Service, Springfield, Va.). xvi, 350 pp., illus. $10.

Variation and variability have always been leading subjects and problems of organismal biology. The science of systematics was based on interpopulation variation. A classical attitude, still not entirely abandoned, was that intrapopulation variation is merely a nuisance, to be ignored or somehow canceled out as far as possible. Nevertheless the science of genetics arose from the study of intrapopulation variation and still rests largely, although no longer entirely, on that basis. It is curious, but for purposes of the present review is a side issue, that the "classical" or "wild type" school of genetics paralleled the classical view in systematics and again held that in its field the intrapopulation norm was essentially an absence of variation. The difference of opinion between that school and the now dominant "balance" school still has not wholly disappeared.

The fact is that within every population studied hereditary variation has been found to occur and moreover that it is a necessary condition for the evolution of a population. Thus in systematics it is a condition for the origin of a new taxon. It has come to be generally realized, perhaps rather more slowly than it should have been, that somatic variation is an inherent and literally vital characteristic of populations and as such requires and rewards study on its own account. Darwin was well aware of that, and since Darwin there has been a flood of studies, still increasing every day, of intrapopulation somatic or phenotypic variation. Yet there have been relatively few attempts to bring together the increasingly abundant data and to organize them into a consistent body.

A. V. Yablokov achieved such a synthesis and organization for a large, representative group of animals in his book on variability of mammals (*Izmenchivost Mlekopitayushchikh*) published in Russian in 1966. It has been recognized that this was, and remains, the most important recent work in its field, but the linguistic difficulty has impeded its general use by non-Russian scientists and, still more, students. That difficulty has now happily, although somewhat tardily, been overcome by publication of an English translation. Some changes were made by Yablokov up to 1972, and the scientific editor suggests that "comments on single passages . . . should be based on both versions." Such changes as I have noticed do not seem to require that precaution, especially as Yablokov himself checked the later, English version.

The translation, by Jayant Honmode, is always clear even if occasionally somewhat stilted. The scientific editor, Leigh Van Valen, has contributed a brief foreword and with the assistance of Vaclav Laska has usefully combined the extensive bibliography into a single alphabet, with English translations of Russian titles. (As in most Russian scientific works, the original bibliography gave Russian titles in a Cyrillic alphabet, without transliteration or translation of titles, and others in a Roman alphabet.) The Russian version has an (inadequate) subject index and a separate index of Latin names (of taxa), but the English version unfortunately has no index, a fact that appreciably decreases its usefulness. Misprints or lapses in the text are somewhat common, but they need not be seriously confusing.

Throughout the book the usual measure of variation is the well-known coefficient $100s/\bar{x}$, and all the mathematical treatment is simple. The approach is usually that of empirical observation, and the many coefficients tabulated throughout the text and in an extensive appendix provide much reference material. Generalizations are also usually empirical; for example, from data in chapter 2, 24 variates in mammals are divided into three groups with coefficients less than 10, 10 to 15, and more than 15, but it is not clear what else the members of a group may have in common or why the variation is itself so variable from one character to another.

The next chapter deals with comparisons of homologous intrapopulation variations among related populations within species and within increasingly higher taxa up to orders. The general conclusion is that intrapopulation variation does not depend on taxonomic relationships. Here and increasingly in some later chapters, one feels that when the study departs from the purely empirical and moves further into generalization and theorizing it also takes shades of thought subtly but distinctly different from those more usual in Western studies. Indeed this introduction to an interesting psychological variant is one of the attractions of the work.

The "classification of variability phenomena," next discussed with many examples in the longest chapter of the book, may be found unexpectedly complex. Yablokov ends with a proposed classification by "manifestation" (kind of measurement, nine specified), "category" (continuous or quantitative as opposed to discontinuous or qualitative), "type" (structural, functional, or ethological), and "form" (a miscellany ranging from age to teratological). Yablokov does not expect this classification to be definitive, and it is indeed inadequate and somewhat obscure in tabular form, but the examples and discussion clear up most of the difficulties.

The next chapter, in many respects the most interesting and stimulating and yet also inconclusive, deals with regularities among variations of different characters. There are, as is well known, great differences in variability, and Yablokov adds to evidence that different variates in the same population and the same variates in different populations do not tend to be equally variable. Some consistent differences in variability do seem to arise from methodological causes or inherent relationships. A simple example, well demonstrated by Yablokov, is that weights almost always vary more (have larger indices of variation) than linear dimensions of the same anatomical parts. That seems natural enough, as weights have a strong tendency to vary with the cube of linear dimensions. Yet the coefficients for weights are far from being the cubes of those for lengths, and the nature of the tendency, let alone its cause, is not made evident. It would be expected that variability for volume would tend to equal that for weight, as Schmalhausen suggested long ago (in 1935), because both tend to vary with the cube of length. Yet Yablokov finds that volume is consistently less variable than length, the opposite of the tendency for weight. These and various other empirical observations call for more complete mathematical formulation and, as Yablokov repeatedly emphasizes, for testing against other variables and controls.

After a short and not wholly apropos chapter on vestigial organs, the text ends with a chapter on variability as an adaptation. Here discussion is in terms of magni-

tude of variation and of selection pressure in a given population. It appears that any of the four combinations of low and high variation with weak and strong selection may be expected. In fact a linear relationship between these variables is quite improbable because adaptation involves the nature (not only intensity) of variation, of environmental factors, and of selection, and these have no simple linear scale of low to high or weak to strong. All this is either hypothetical or ex cathedra as here presented. There is not a single example of competent measurement of selection and variation in the same population, either in nature or in laboratory. The relationship between variation and adaptation is indeed the most interesting theoretical point of the whole investigation of variability, and that subject does have an extensive literature, much of it in molecular or genetic terms, outside Yablokov's field, and much of it published since 1966. This is not said in criticism of the present book, far the best we have within its scope and of its date. It should rather be an incentive for a student of variability to go on from there.

The need for translations such as this and for more intercultural studies is illustrated by the fact that an English symposium on variation in mammals published in 1970 does not contain any reference to Yablokov or to any of the numerous Russian publications cited by him. On the other side, although some revision of Yablokov's work for this translation was made as late as 1972, he makes no reference to that English publication. (It is just listed by title in the scientific editor's foreword.)

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A View of the Hominid Lineage

Uniqueness and Diversity in Human Evolution. Morphometric Studies of Australopithecines. CHARLES E. OXNARD. University of Chicago Press, Chicago, 1975. viii, 134 pp., illus. $15.

In this semicentennial year of Dart's announcement of the first fossil man-ape, *Australopithecus africanus*, the study of human origins proceeds with ever-increasing sophistication and controversy. Charles Oxnard's book is a very sophisticated study of these fossils which leads him to a controversial opinion. It draws together evidence derived mostly from multivariate statistical analyses of metrical data to support the unorthodox view that "human bipedality was not the only experiment in this functional direction. The australopithecines may well be displaying for us another experiment in bipedality—one that failed" (p. 120). And further, "the australopithecines had to have been off the main stream of man's development" (p. 121).

This heresy against the prevailing paleoanthropological dogma is not a bolt from the blue, but has survived in isolated pockets since the conversion of most of the scientific hierarchy in the late 1940's. Although few believed that australopithecines were our ancestors at first, the discoveries of Broom, Robinson, Dart, and the Leakeys convinced almost everyone that some of the fossils were on or close to our branch of the primate family tree. Resistance to this view remained, however, especially among certain members of the University of Birmingham anatomy department, notably Solly Zuckerman, Eric Ashton, and later Charles Oxnard (now at the University of Chicago).

Curiously, the multivariate methodology which forms the backbone of Oxnard's book was first applied to australopithecines in *reply* to the Birmingham freethinkers. Zuckerman and Ashton presented *univ*ariate studies of australopithecine teeth that contradicted the widely accepted belief that these teeth were basically human in form. The late J. Bronowski and his colleague W. Long addressed themselves to this seeming paradox: Why should statistical techniques show different results from what the majority of anthropologists and anatomists believed to be correct conclusions? The problem was the "piecemeal" approach of comparing single measurements. The solution, they proposed, was in the application of *multi*variate analysis, in which measurements are combined into a single analysis to represent the overall affinities of the fossil. The example they gave showed that the australopithecine deciduous canine was human.

Since Bronowski and Long's suggestion, multivariate analysis has been applied to the australopithecines by numerous investigators, and Oxnard is certainly a leader in this effort. His work with colleagues on the shoulder, hip, and foot is well known. This book draws these and other multivariate analyses together in support of the view that australopithecines are not human ancestors. The argument moves from a discussion of animal form and function to a review of primate locomotion, and finally to a review of multivariate analyses of the shoulder, pelvis, talus, toe, metacarpal, and humerus. The concluding chapter brings in some other lines of evidence such as body proportions and other fossils. It also adds some interesting speculations about human evolution.

Oxnard's approach may still be too piecemeal to convince everyone. For example, the Olduvai talus which is a keystone to his argument comes from a nearly complete fossil foot, but little reference is made to this fact in the text. This is unfortunate because many claim that this foot is the best evidence there is proving the human affinities of the australopithecines. Likewise the Sterkfontein pelvic bone, which is the structure upon which much of Oxnard's proof rests, derives from a complete (although reconstructed) pelvic girdle which is very humanlike in the opinion of all who have seen it. There are also some methodological problems that detract from the argument. The unusual way Oxnard and his colleagues measure the pelvic bone, for example, appears to bias the results so that one unique feature of the australopithecine pelvis (wide flaring of the iliac blades) greatly affects a large proportion of the measurements. The effects of violating such statistical assumptions as multivariate normality, homogeneity of covariance or dispersion, and unequal sample sizes, as is often done in canonical variate analysis, are not fully evaluated. The fragmentary Sterkfontein scapula is really too poorly preserved to be measured and counted as evidence.

There is no doubt that Oxnard is one of the leading practitioners in the new science of form, the quantifunctional approach to understanding organic structure. His application of this approach to fossil hominids may eventually lead to widely accepted changes in prevailing ideas about human evolution, but this book is too limited in scope to convert most paleoanthropologists. The fossil record is now too complete and too well studied for multivariate analyses of less than a dozen isolated fossil bones and a few additional studies to change many minds.

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Hybrid Discipline

The Genetics of Behavior. J. H. F. VAN ABEELEN, Ed. North-Holland, Amsterdam, and Elsevier, New York, 1974. xxiv, 450 pp., illus. $42.50. Frontiers of Biology, vol. 38.

Francis Galton "invented" the scientific study of the genetics of human behavior over a century ago with his pioneering