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