Humerus of Robust Australopithecus

McHenry's (*1*) discriminant analysis of the large robust *Australopithecus* humerus, KNM-ER 739, from strata east of Lake Rudolph, Kenya (*2*), demonstrated that it is morphologically and, presumably, functionally distinct from the humeri of extant large hominoids. He concluded that his results could not determine whether this early hominid used its forelimbs for both manipulation and locomotion or just for manipulation. I suggest that his data do contribute a possible solution to this problem.

I have estimated the values for each hominoid taxon on the first discriminant function of McHenry's study from his figure 1 (*1*). Among extant hominoids which use their forelimbs in locomotion, these values are significantly correlated with body weight ($r = -.95$, $P < .01$). The regression equation for body weight (W) in this group is $W = 305 - 25F_1$, where body weight is in pounds and F_1 is the value of the first discriminant function. In a plot of F_1 against W (Fig. 1), *Homo sapiens* lies well away from the other extant hominoids. The body weight of *Homo* estimated from the first discriminant function is less than one-fourth the known body weight for this species; man has a humerus which is smaller than would be expected for a hominoid of his body size. This is probably related to the fact that man's forelimbs are not used in locomotion.

Body weights for the robust *Australopithecus* have been estimated at between 135 and 200 pounds (~ 60 to 90 kg). A body weight of 143 pounds (65 kg) would be assigned to KNM-ER 739 from the regression equation for hominoids which use their forelimbs in locomotion. Therefore, the humerus of robust *Australopithecus* was of a size to be expected if it was used for locomotion, unless the estimates of body weight are grossly incorrect (*3*).

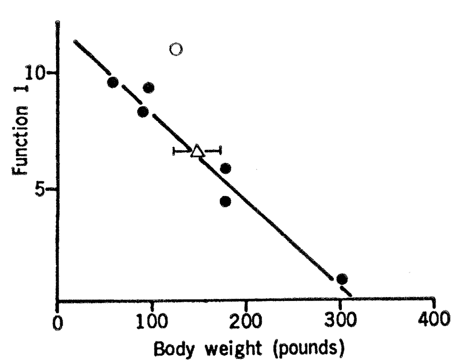

Fig. 1. Plot of McHenry's (*1*) first discriminant function against body weight; (closed circles) extant hominoids which use their forelimbs in locomotion; (open circle) *Homo sapiens*; (triangle) fossil *Australopithecus* humerus KNM-ER 739. The regression line was calculated for hominoids which use their forelimbs during locomotion.

If the forelimbs of *Homo sapiens* are smaller because they are not used in locomotion, the absence of a similar reduction in the forelimbs of robust *Australopithecus* implies that these animals were using their forelimbs in some form of locomotion. The possibility should be considered that robust *Australopithecus* species were facultative rather than habitual bipeds.

RICHARD F. KAY*

Department of Geology and Geophysics, Yale University, New Haven, Connecticut 06520

References and Notes

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* Present address: Department of Anatomy, Duke University Medical School, Durham, North Carolina 27706.

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Kay's point is well taken and he could be entirely correct in suggesting that the robust *Australopithecus* used its forelimbs in some form of locomotion. However, his argument depends on the estimated body weight of the robust *Australopithecus*, which he gives as between 135 and 200 pounds. These estimates are based primarily on the South African robust forms which are smaller than the hyper-robust hominids of East Africa. The individual represented by the KNM-ER 739 humerus might have weighed much more than Kay's prediction of 143 pounds. Certainly, some of the fossil femurs from the East Rudolf site indicate that a very large bodied hominid was present. If the body weight of the KNM-ER 739 individual was 225 to 250 pounds (102 to 113 kg), the humerus would bear the same relationship to Kay's regression line as does *Homo sapiens*.

H. M. MCHENRY

Department of Anthropology, University of California, Davis 95616

Insulin Activity: The Solid Matrix

The topic of discussion between Katzen and Vlahakes (*1*) and Cuatrecasas (*2*) on Cuatrecasas's experiments (*3*) on the biological activity of insulin coupled covalently to agarose is of far-reaching importance. Prior to 1968 there was a large amount of evidence, albeit indirect, indicating that most polypeptide hormones, including insulin, stimulated target cells by interacting with receptors on the cell surface. In 1968 Schimmer *et al.* (*4*) reported that the polypeptide hormone ACTH covalently linked to large cellulose particles stimulated adrenal cells, and this activity was unaccounted for by solubilization of ACTH. In 1969, in a similar but more extensive study, Cuatrecasas reported that insulin covalently linked to agarose (Sepharose) particles was almost as potent as native insulin (*3*). These data have been cited as a major direct experimental support to widely held notions that polypeptide hormones act through surface receptors.

In his experiments Cuatrecasas incubated isolated fat cells with insulin coupled to agarose beads and found that the immobilized insulin was nearly as potent as native insulin. Katzen and Vlahakes agreed with Cuatrecasas that insulin most likely acts at the cell membrane and that insulin coupled to agarose may be biologically active, but they felt that the studies by Cuatrecasas needed clarification. In particular, Katzen and Vlahakes recalculated Cuatrecasas's published data and concluded that in several key experiments there was less than one insulin-agarose bead per incubation flask. This conclusion was based on the fact that Cuatrecasas used insulin-agarose preparations containing 171, 320, and 360 μg of insulin per milliliter of agarose (*3*) and that 1 ml of agarose has about 5×10^5 beads per milliliter (*1*). They stated that one was "faced with a dilemma of explaining how it would be operationally possible to dilute a sus-