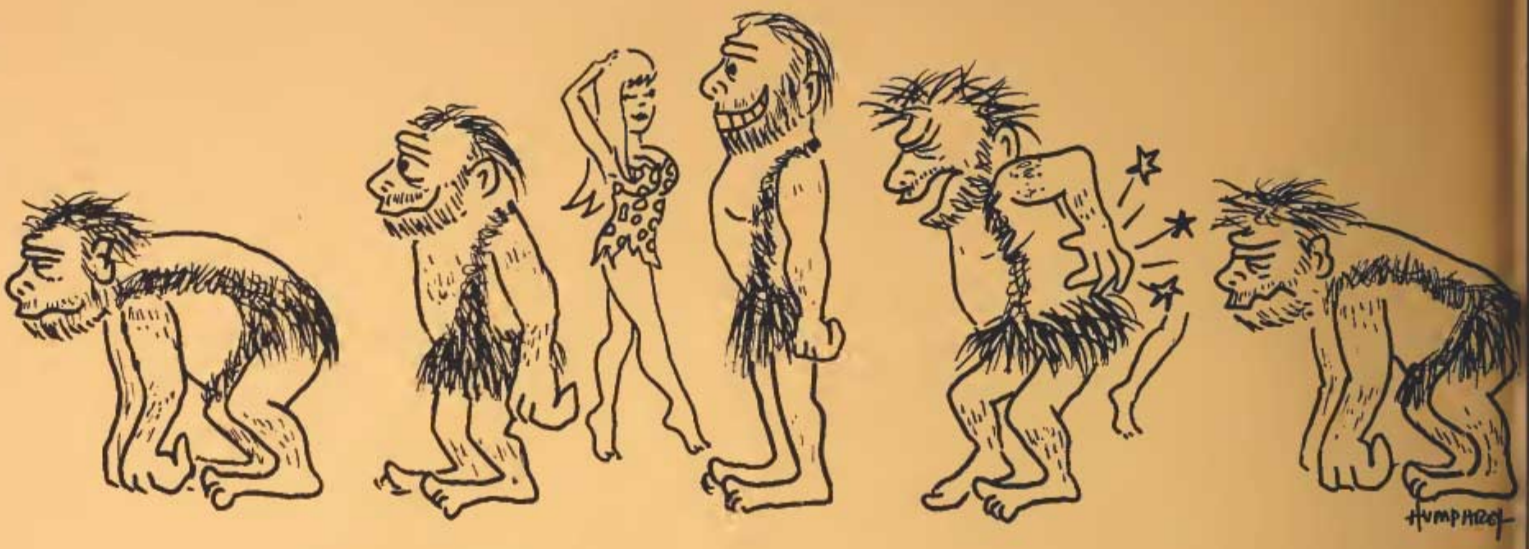

LUCY, UP A TREE?

Paleoanthropologists no longer question that Lucy, a 3 1/2 foot hominid female with a chimp-sized brain, walked on two legs in Ethiopia about 3.5 million years ago. Neither do they argue that the anatomy of Lucy's species, Australopithecus afarensis, is fully modern; all agree it is a "mosaic of human-like and ape-like features." No one seriously disputes that bipedalism was more important to their lifestyle than for any non-human primate, living or dead. However, Lucy's discoverers, Donald C. Johanson and Tim White, claim that the bipedalism seen in A. afarensis differs insignificantly from that of modern humans. Other scientists disagree.

Recently two noted anatomists from the State University of New York at Stony Brook, Jack Stern and Randall L. Susman, called for new interpretations of Lucy and her contemporaries. After carefully examining some original A. afarensis bones, casts of others, and the set of 3.7 million year old footprints at Laetoli in Tanzania, Susman and Stern argue that A. afarensis moved bipedally, but with a bent-knee, bent-hip posture. Also, they argue, at least some of the A. afarensis hominids, especially the smaller ones like Lucy, no doubt slept, hid, and fed in trees enough of the time so that we can recognize some arboreal features in their anatomy.

Susman and Stern presented their evidence and analysis in an extensive article in the Journal of Physical Anthropology (March 1983), and at an exciting and often boisterous conference in April. The conference, held at the Institute of Human Origins in Berkeley, was directed by Donald C. Johanson, founder of the Institute. There the different factions met to examine the bones and thrash out their many different views about two controversies: 1) When did bipedalism begin and to what extent was Lucy bipedal? 2) Did A. afarensis make the footprints at Laetoli or did members of the genus Homo?

Why the Trees?

Why do Susman and Stern conclude that A. afarensis retained arboreal adaptations? The shoulder socket faces upwards 15 degrees more than in a human. This greater angle is

better for the overarm movement and branch hanging involved in climbing. In this respect A. afarensis is closer to a chimp's anatomy and almost identical to a gorilla's. An even stronger argument rests on the finding that A. afarensis' hands and feet both have long, slender curved bones and their arms and legs are relatively heavily muscled. Both conditions are found in apes and both are suitable for grasping and moving along tree branches and trunks. While Johanson et al. consider these as primtive patterns held over from an arboreal past, Susman and Stern argue that 1.5 to 2 million years is too long to retain morphological traits which are no longer consistent with daily behavior. "The possibility of lesser developed... ligaments [in the sacroiliac area] suggests a lesser frequency of terrestrial bipedalism" than in humans, they wrote. Looking at the knee area, they conclude that, "the hamstring moment arm [which acts to straighten the leg and is more efficient and powerful when short] is not as short as modern humans' and is not as long as monkeys' and apes'." Since leg straightening is crucial to walking but not climbing, this intermediate condition suggests A. afarensis was both a climber and walker.

Since the most compelling evidence for retained arboreality is in the shoulder, arm, fingers and toes, Susman and Stern are more cautious in arguing that A. afarensis walked on two legs in a significantly different way than a modern human does. Because the iliac blades face backwards more than sideways, the pelvic balance is closer to apes than humans, yet the rest of the pelvis is more typical of humans. A. afarensis probably straightened the knee and hip in walking less than modern humans do and also transferred less weight onto the ball of the big toe. But the anatomy of the hip and knee in no way suggests they ever were quadrupedal knucklewalkers.

Hence, Susman and Stern conclude that A. afarensis were probably both arboreal and bipedal, using the trees for sleeping, escape, and food.

Females Up, Males Down

Susman and Stern tentatively propose that sexual dimorphism explains the differences in skeletal size within the A. afarensis sample and they link this dimorphism to different degrees of arboreal adaptations. If the different sizes are different sexes, the females were smaller in stature and lighter and the males were taller and heavier. The femurs in the larger specimens (supposedly male) are more like human femurs than the smaller specimens. The knees of the small hominid are not very human-like and are more compatible with arboreality. The larger specimens probably walked bipedally more frequently than did the smaller ones. Therefore, Susman and Stern suggest that all specimens of A. afarensis may not have had "identical locomotor profiles." Perhaps the females moved in and used the trees more than the males did, a pattern also seen with orangutans and gorillas.

Who made the Laetoli footprints? Susman and Stern examined the prints and even had two subadult male chimpanzees walk on two legs in wet sand to compare to the casts of the Laetoli footprints. Susman and Stern agree with Johanson and White that the A. afarensis footbones could have made the Laetoli footprints, but they see the prints as those of walkers still climbing as well. (The Leakeys deny this interpretation.)

It is unfortunate that Susman and Stern attach the label "missing link" to the A. afarensis specimens considering the emotions surrounding that phrase. It suggests only one link, a highly linear pattern to evolution, and perhaps subtly influences their research to see these specimens as transitional. Johanson and White, on the other hand, emphasize the hominid qualities of the finds and would expect to find more

(continued)

transitional specimens further back in the past.

No Resolution

Why can't a consensus emerge? Consider these variations. Paleoanthropologists interpret biomechanics differently. While Susman and Stern use a variety of electrical methods, such as electromyography, to study muscle and movement in living apes, other scientists question whether living ape's biomechanics are similar to those of apes in the past. Paleoanthropologists must struggle to overcome problems with different measurement techniques, the effects of post-mortem distortion, and the differences between working with casts and with the original bones. Finally, they have to assess what is the expected range of morphological and behavioral locomotor variation in humans.

Moreover, paleoanthropologists interpret anatomical functions differently. For example, Owen Lovejoy, the scientist arguing for bipedalism in the A. afarensis specimens, does not accept that curved toes and fingers necessarily indicate grasping -- and therefore arboreality. He says the A. afarensis hand is smaller than an ape's, and the fingers are shorter and straighter. "If you were still climbing, why would you shrink your hand?" Lovejoy asks. Furthermore, the big toe is not divergent, as in the apes, which would certainly handicap climbing. In line with this position, Johanson and Edey argue that the long curved toes were needed to "move over rough stony ground or in mud, where some slight gripping ability would have been useful."

One certainty that all agree on is the necessity to find more bones in order to sort out the evidence and arguments, particularly bones from 4-5 million years. If only Lucy could talk, as well as walk.

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