the bulk of the data, may not have true Alzheimer's disease. Although these patients have typical Alzheimer's symptoms, the two researchers point out that previous reports indicate that they also display pathological and clinical changes, such as a spongy degeneration in the cerebral cortex of the brain and the presence of jerky movements (known as myoclonus), that do not usually occur in Alzheimer's patients.

Nevertheless, the Seattle workers note that the Alzheimer's diagnosis was confirmed by autopsy for at least one patient in all of the German Volga families except one on which no autopsies were performed. The disease can be hard to diagnose, but the brains of patients show characteristic pathological changes, called plaques and tangles, that can be detected by autopsy. Moreover, Schellenberg notes that myoclonus does occur in a minority—perhaps 25 or 30%—of Alzheimer's patients. "Everything we know about the Volga Germans suggests that they are typical, mainstream Alzheimer's patients," he maintains.

As things now stand then, two groups have found linkage between early-onset Alzheimer's disease and chromosome 21 and one group has not. This raises the possibility that the condition may be caused by more than one gene defect, as Schellenberg and his colleagues suggest. The issue is a critical one for the purposes of gene isolation. If two or more different genes can cause a disease, and if they are randomly distributed in the patient population, then gene isolation efforts will be impeded.

Researchers have been trying to zero in on the Alzheimer's gene on chromosome 21, for example, by finding new markers that are progressively closer to the gene. But the presence of a second disease-causing gene randomly distributed in the patient population can essentially cause them to lose their place on the gene map by making a new marker appear to be farther away from the target gene than it actually is.

Among the additional evidence that would help to confirm the genetic heterogeneity of early-onset Alzheimer's disease is a positive demonstration of linkage to markers located somewhere other than the long arm of chromosome 21. The Seattle group is now pursuing that goal. If such a second chromosomal location can be found, the apparent genetic homogeneity of the Volga Germans may facilitate efforts to isolate the gene itself.

In addition, St George-Hyslop is currently participating in a 40-family study that may also help to resolve the issue of the genetic heterogeneity of Alzheimer's disease. Results are expected in a few months.

■ JEAN L. MARX

Hip Joints: Clues to Bipedalism

The distinctly odd human habit of walking around exclusively on two limbs rather than four, as most good mammals do, has long demanded an explanation from anthropologists, and for good reason. For instance, if our ape-like ancestor of some five or so million years ago had not adopted this bipedal mode of locomotion, then farther down the evolutionary line the development of manipulative skills—the basis of material "culture"—might not have emerged as it did. Whatever was the immediate engine for the evolution of hominid bipedalism—and almost certainly it had to do with the energetics of collecting food—there also remains the question of how quickly and completely it was adopted. Two schools of thought exist. The first, promulgated principally by Owen Lovejoy of Kent State University, is that right from the beginning hominids were fully bipedal, much like modern humans. The second, collectively argued by several researchers at the State University of New York at Stony Brook, is that the adoption of bipedalism was a more gradual affair, with our early ancestors dividing their time between walking upright on the ground and climbing in trees.

The question is, how to distinguish between these two possibilities? The debate so far has centered on the anatomy of the pelvis, which is shaped dramatically differently between apes and humans, for instance, and the form of the hands and feet. In apes, which spend a lot of time climbing, the hand and foot bones are curved, the result of the stresses of climbing. In humans, these bones are more or less straight. And in early hominids? Somewhat in between, which can be taken as merely a genetic holdover, having no functional significance (school 1) or to indicate some continued adaptation to climbing (school 2). This debate has ranged back and forth now for half a dozen years, apparently with no resolution in sight.

The latest contribution to the debate is from William Jungers, one of the Stony Brook team, and it shifts the focus of attention from bones to the joints between them. As anyone with a "bad back" knows, the human habit of walking around exclusively on two limbs has its special stresses and strains. A less obvious sign of these stresses and strains than the nagging pain in the lower back is the unusually large size of the joints involved in keeping us upright: specifically, the junction between the spine and the pelvis, and the hip and knee joints. Following an extensive statistical analysis of limb joints in apes and humans, Jungers concludes that "Regardless of the method, the observation that emerges conspicuously is that modern humans possess exceptionally large hindlimb and lumbo-sacral joints for their body size." The obvious biomechanical reason for this pattern is that humans must bear all their weight on two limbs rather than distributing it among four. As a result, the joints have to be considerably more extensive in surface area so as to maintain stresses within safe limits.

In all the diagrammatic representations of the analyses, the apes cluster rather closely together on one side while humans stand alone on the other. And what of early hominids, specifically "Lucy," the specimen of *Australopithecus* that Jungers chose to examine? Once again the early hominid falls in between modern humans and apes: the size of her thigh joint, for instance, was bigger for her body size than the average ape's, but not as big as a human's. The clear implication is that Lucy routinely experienced less total pressure across her thigh joint than modern humans do. "When on the ground, Lucy no doubt walked bipedally," says Jungers. "However, the decidedly nonhuman degree of relative joint size in [Lucy] implies that this adaptation was far from complete and scarcely full-blown or functionally equivalent to that seen in modern humans."

If, as Jungers claims, the first known hominid was not a habitual biped in the sense that modern humans are, when did out ancestors develop the habit? "It seems highly likely that a Lucy-like locomotor adaptation was a stable one that persisted perhaps until the time of *Homo erectus*," says Jungers. *Homo erectus*, which first appeared about 1.6 million years ago, was different from other hominids in several respects, perhaps including an adaptation to a habitual striding gait. If Jungers is correct, the origin of *Homo erectus* would indeed have involved a real adaptive transition in hominid history.

■ ROGER LEWIN

ADDITIONAL READING

William Jungers, "Relative joint size and hominoid locomotor adaptations," *J. Hum. Evol.* **17**, 247 (1988).