CHAPTER 6

The Transition to *Homo Erectus*

PART I. THE EVIDENCE

"Only with Homo erectus might body size, culture and other factors have combined to release hominids from their dependence on trees"
[Susman, et al., 1984, p. 113].

"The arrival of Homo… marks the single most important transformation below the neck in the entire course of human evolution"
[Tattersall, 1995, p. 238].

Introduction. The transition from *Australopithecus* to *Homo erectus* in Africa involved the most profound metamorphosis in the history of the hominin lineage. The appearance of *Homo erectus* announced an abrupt evolutionary divergence from an ancestral anatomy that had been stable for millions of years. This took place during a brief interval around 1.9 Mya [Asfaw, et al., 2002]. In the process, a group of small, partly arboreal, partly bipedal, long-armed, short-legged hominins abandoned the trees and were transformed into much larger hominins with a body form similar to our own, fully dedicated to bipedal behavior on the ground. If we seek to understand how we came to be the way we are today, this transition looms large. What caused this abrupt alteration? *What were the reproductive advantages?*

The australopithecine stage of hominin evolution, from about 4 to 2 Mya, was a relatively stable period. Body size and physical form, brain size and limb proportions were not conspicuously modified, an arboreal adaptation was evident, as was bipedal behavior on the ground. About 2.6 to 1.8 Mya a group branched off, distinguished by their massive and powerful jaws and teeth, becoming a different species (*Australopithecus robustus,* a.k.a *Paranthropus*). Apparently they were dietary specialists. Their postcranial bones (the skeleton below the neck) remained similar to those of other australopithecines.

Another divergence from structural conservatism that continued in these *Australopithecus* species concerns the canine teeth. Long and sharp at the start of the lineage, they gradually diminished in size and became more incisor-like. The hand also changed: its long, curved fingers became shorter and straighter,

the diminutive thumb became larger, stronger and more mobile. Two new handgrips emerged. These modifications in the hand (Chapter 9) and canine teeth (Chapter 11) were largely completed before the transition to *Homo erectus*. While retaining their adaptation to life in the trees, the australopithecine were evidently practicing a bipedal behavior involving the hand and one type of tooth — a behavior that was yielding reproductive advantages, thereby causing natural selection of inherited traits that changed these body structures.

Otherwise, during and after *A. anamensis* (~4.2-3.9 Mya), the general body plan of the australopithecines remained intact for two million years. If the small body, long arms and short legs had been disadvantageous, natural selection would have had ample time to alter them [Ward, 2002]. Why did they persist for so long, then suddenly change?

Perhaps climate played a role. From 8 to 3 Mya, parts of Africa were warmer and more humid than at present, nurturing wet, lowland, rainforest vegetation in regions that today support seasonally dry, savannah grasses and shrubs [deMenocal, 1995]. Cooling after 3.0 Mya in Africa seems tied to a shift from relatively stable global warmth to high-amplitude cooling and warming cycles [Marlow, et al., 2000]. The emergence of *Homo* might have been due to "climate forcing" as fluctuating cooler, drier conditions promoted more open habitats in tropical Africa [Behrensmeyer, et al., 1997]. East Africa experienced an increase in wooded grasslands between 2.5 and 1.5 Mya [Cerling, et al., 2011]. The appearance of some new species at this time may have been "climatically mediated" by ecologic fragmentation and genetic isolation that favored adaptations to aridity [deMenocal, 1995]. Possibly an irregular but overall expansion of open habitats combined with persisting woodlands and forests to provide increased opportunities for mammals and a rise in diversity from 3.0 to 2.0 Mya [Behrensmeyer, et al., 1997]. It may have provided new opportunities for hominins.

The evidence of the anatomical changes that took place during the transition from *Australopithecus* to *Homo erectus* will be examined below, after a brief look at hominins that may have participated in that event. In Chapter 7, explanations that have been proposed to account for the new hominins will be presented, including the idea than an adaptation to bipedal use of hand-held weapons seems to have been a significant factor.

When did *Homo erectus* appear*?* An occipital bone fragment from the Koobi Fora region of the Lake Turkana basin in Kenya (KNM-ER 2598, dated at 2.0-1.9 Mya) is considered by some to be the earliest evidence of *H. erectus* [Antón, 2003; Ferring, et al., 2011; Wood, 2011]. However, Suwa, et al. [2007a] note that the fossil was found on a surface that may sample overlying deposits. Other fossils from that area include postcranial remains from large-bodied hominins that may be *H. erectus* (KNM-ER 3228, 2.0 Mya and KNM-ER 1481, 1.9 Mya), and a partial skeleton (KNM-ER 1808) from 1.7-1.8 Mya [Klein, 1999; Antón, 2003]. The earliest definitive *H. erectus* cranium is KNM-ER 3733 at 1.8

Mya [Walker and Shipman, 1997; Antón, 2003; Suwa, et al., 2007a; Wood, 2011]. KNM-WT 15000 (Nariokotome boy), found on the west side of the Turkana basin, dates to 1.5 Mya [Brown and McDougall, 1993]. The term, *Homo ergaster,* has sometimes been used to designate early African *Homo erectus*, but some find this "doubtfully necessary or useful" [Asfaw, et al., 2002].

Who were the transitional hominins? Most authorities currently agree that the lineage to *Homo* passed through *A. afarensis,* which was present in East Africa until ~3.0 Mya. Since *H. erectus* is first documented in that same region about 2 Mya, the transition from *Australopithecus* to *H. erectus* may have occurred there before that date. Several possible transitional hominins have been reported.

Hominin remains from Ethiopia's Middle Awash region, dated at 2.5 Mya and assigned to the species *Australopithecus garhi*, might be an ancestor for early *Homo* [Asfaw, et al., 1999]. A femur and arm elements suggest that the humero/femoral index would have been "humanlike," possibly marking the earliest sign of the femoral elongation that characterizes later hominins. *A. garhi* is in the right place at the right time to be the ancestor of early *Homo* [Asfaw, et al., 1999], insofar as all the earliest *H. erectus* specimens are from East Africa.

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