CHAPTER 2

Our Last Common Ancestor With The Apes

"While phylogenetic evidence points toward chimpanzees, and fossil evidence remains ambiguous, experimental studies of humans and other primates point squarely toward an arboreal, climbing ancestor of hominids."
[Schmitt, 2003, p. 1441]

"The last common ancestor of chimpanzees and hominins was a predominantly arboreal, orthograde, short-legged, long-armed great ape with long, curved fingers and toes."
[Crompton, et al., 2008, p. 533]

When and where did our lineage begin? For well over a century evolutionary scientists have known that we are descended from an ancient primate ancestor that lived mainly in the trees, an ancestor that also gave rise to the surviving great apes. Man's place in nature is with the arboreal apes, Huxley asserted in 1863, based on his studies of comparative anatomy. Darwin [1871] thought it was likely that the human lineage had its origins in Africa, the homeland of chimpanzees and gorillas. The discovery there by Dart [1925] of an ancient, ape-like creature that walked upright (*Australopithecus africanus*) has focused the search for our earliest ancestors on that continent ever since. Numerous potential human predecessors have subsequently been found in Africa, some younger and more human-like than *A. africanus,* others older and more ape-like.

The oldest have features that make it difficult to decide if they are ancestors of hominins, ancestors of apes, or simply ancient apes who left no descendants and became extinct. The *where* question seems settled: our lineage arose in Africa.

When did the African apes arise? Our arboreal ancestry goes back well beyond the time hominins first appeared. The last common ancestor of all the primates arose about 77 Mya [Steiper and Young, 2006]. Subsequently, ape and monkey lineages split around 24 to 35 Mya [Kumar, et al., 2005; Bradley, 2008; Harrison, 2010]. The orangutan branched off about 18 Mya in Asia, and the first of the African apes (the gorilla) diverged approximately 9 Mya by molecular analysis [Steiper and Young, 2006] or 10-12 Mya, according to fossil evidence [Suwa, et al., 2007b]. This left a separate line of descent, the last common ancestor of chimpanzees (panins) and hominins.

When did the first hominins appear? The answer to this question is unknown, but estimates derived from fossil and molecular evidence are gradually narrowing the range of possibilities. The classical scientific plea that *more evidence is needed* applies here, because fossils from the relevant time range are very scarce and not readily identified as hominin, panin or something else. They are few in number, no knowledge is available about individual variability in apes or hominins from that era and the similarities between the earliest hominins, panins, and their immediate ancestors may have persisted for many generations until natural selection produced changes that allow paleontologists to distinguish them. Interbreeding could have occurred for a long time before they became reproductively isolated from each other [Patterson, et al., 2006]. A precise date for human origins will be very difficult to determine.

Estimates of the time of the hominin/panin split are based on a combination of fossil evidence (dated by geological techniques) and molecular genetic evidence. Branch points derived from analyses of DNA changes have to be calibrated by a divergence event documented in the paleontological record. For example, analysis of protein-coding genes suggests that the divergence of humans and chimpanzees took place about 20% of the time back to the divergence of apes and Old World monkeys, which is taken (from fossil evidence) to be 24 to 35 Mya. When the minimum of this range is used, it yields a hominin-panin split at 5-7 Mya [Kumar, et al., 2005]. If instead the African ape-orangutan divergence is taken as 12 to 16 Mya, this leads to an estimate that hominins and panins diverged 4.6 to 6.2 Mya [Chen and Li, 2001].

Currently, the earliest undisputed hominin is *Australopithecus anamensis* at 4.2 Mya [Kumar, et al., 2005; Wood and Harrison, 2011]. This provides a *minimum* constraint; the divergence from the common ancestor must have been earlier than that. However, there are three older candidate hominins not yet certified by a consensus of expert opinion. They are *Sahelanthropus*, dated at 6-7 Mya, *Orrorin* at 5.8-6.1 Mya, and *Ardipithecus,* known from 4.4-5.8 Mya. If these are hominins, the first members of our lineage must have arisen before then.

Paleontologists use two markers of hominin status: reduced canine tooth size and skeletal evidence indicating some sort of bipedal behavior. Wood and Harrison [2011] argue that in these three candidate hominins, smaller canines and bony evidence for bipedality may not signify hominin status because they also occur in Miocene apes which are not in the hominin lineage — apes such as *Oreopithecus*, dated at about 8 Mya [Rook, et al., 1999; Begun, 2007]. The broad ilium in *Oreopithecus* tends towards the hominin condition [Harrison, 1991]. So does stance, because the associated iliofemoral ligament stabilizes the knee and hip joints and increases the mechanical advantage of thigh muscles in upright postures [Straus, 1962; Harrison, 1991]. Wood and Harrison [2011, p. 348] note that several aspects of human anatomy (such as the foramen magnum, pelvis and proximal femur) "typically identified as being uniquely related to bipedalism, are, in fact, also found in non-hominoid primates associated with quite different locomotor behaviors" and may not signal "human-like" bipedalism. Similar traits

observed in the three candidate hominins could be due to parallel evolution in similar environments, rather than common descent [Wood and Harrison, 2011].

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