

Web Box 3.1 Mosaic Nature of Human Evolution

It is easy to distinguish modern humans from other living primates, but this is not always the case when fossilized bones and teeth are the only clues we have to go on. Confusing these distinctions even further is the fact that the three major systems we can decipher from fossils—locomotion and posture, chewing and food processing, and cranial capacity—evolved at different rates in hominids, resulting in what is called the **mosaic nature of evolution** (McHenry, 1975).

Bipedality, with its upright stance and two-legged locomotion, has long been the main distinguishing feature of early hominids (see Figure 1.9). The first bipedal hominids may not have been as efficient on two legs as we are today, partly because they retained greater flexibility in their ankle joints that would be helpful in climbing. Over at least a four-million-year period, bipedal hominids diversified into multiple species. Some became heavier, more robust creatures whose teeth and jaws imply a rough, fibrous diet. Others retained their lighter, more generalized dentition. But none of those early bipedal hominids had brains much bigger than other apes of similar body size.

This first set of bipedal hominids and their relatively small-brained descendants have been grouped into a variety of species, beginning with *Orrorin* and possibly *Sahelanthropus*, the recent *Ardipithecus*, all the way through to the diverse members of the *Australopithecus* genus. The traits that set the first members of our own genus, *Homo*, apart from the australopithecines and their antecedents are related, in part, to our bigger brain-to-body size ratio (Wood, 1992; Wood and Collard, 1999; Lovejoy, 2009). For example, both increased cranial capacity and shifts in the pressures and forces associated with eating cause changes in the shape of the skull. Other changes associated with hominid dietary strategies inferred from the fossil record may have been direct results of locomotor shifts and either results of or causes for changes in the brain (see Web Box 2.1). Recently discovered fossils from the Rising Star Cave in South Africa have been provisionally classified as a new species of *Homo*, known as *H. naledi*, despite having relatively small brains, but the place of these fossils in the evolution of our genus is still unclear (Berger et al., 2015).

Bipedality is not a superior mode of locomotion in many respects, and there is wide disagreement about the selective pressures that might have led to its evolution in the first place (Steudel, 1996). Some researchers believe that the benefits of traveling long distances between food resources or shelter may have provided the selective pressures that made bipedality such a successful adaptation. Others suggest that it grew out of the upright feeding postures that prehomonid ancestors had begun to adopt. Still others have argued that bipedality was beneficial for cooling the body because it reduced the surface area of the body exposed to the sun and facilitated heat loss (Wheeler, 1985). And a recent scenario links bipedality and endurance running, which is thought to have improved access to the protein and fat that were ultimately necessary for fueling the evolution of hominid brains (Bramble and Lieberman, 2004). Indeed,

from this perspective, bipedality was a key factor that permitted the evolution—and cooling—of large hominid brains.

WebBox 3.1 Bibliography

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