EVOLUTION, LECTURE 10: HUMANS & CULTURAL EVOLUTION (728-733)

The mammals belong to the ancient **synapsid** lineage that first appeared in the fossil record more than 300 million years ago (Figure 25.6). Basal synapsids were the most abundant large terrestrial vertebrates in the Permian, and more derived synapsids coexisted with the dinosaurs in Mesozoic ecosystems.

It has been generally understood, until recently, that the ancestors of mammals were small, shrew-like creatures without much ecological importance during the Age of the Reptiles (the Mesozoic). But a series of finds over the last ten years has altered this view. First, in terms of body size, these mammalian ancestors from the Mesozoic ranged from extremely small (2 grams in the case of *Hadrocodium*) up to the size of a large opossum. Second, in terms of ecology, the Mesozoic mammals were diverse: there were armadillo-like types such as *Fruitafossor*; otter-like types such as *Castorocauda*; and dinosaur-eaters such as *Repenomamus*.

It has also been generally understood that the radiation of modern mammals occurred after the K-T extinction event, when the global ecosystem was cleared of so many potential competitors (including the non-avian dinosaurs). Although it is true that mammals did radiate in the early Cenozoic (in the Eocene and Oligocene), there is also evidence that mammals underwent an earlier radiation before the K-T extinction.

The Primates are one of the modern mammal groups that radiated prior to 65 Ma. After a long period of primate evolution during the Cenozoic, the **hominins** evolved in the Late Miocene of Africa. The common ancestor of hominins and chimps had been estimated to have existed ~ 7 Ma based on molecular clock studies. Recent discoveries of ancient bipedal hominins (e.g., ***Sahelanthropus*** and *Orrorin*) date to 6–7 Ma, which is very close in time to that hypothetical common ancestor.

Remarkably, these earliest hominins, as well as the somewhat later ***Ardipithecus***, were associated with forested and swampy environments (based on analyses of other fossils from the same sites, as well as on the geological evidence). It had been traditionally hypothesized that bipedalism evolved on the open savannah. Now most paleoanthropologists argue that bipedalism arose in forest conditions.

We discussed in lecture several more recent hominin types that are also covered in your text, including ***Australopithecus afarensis*** (the "Lucy" species) and ***Australopithecus africanus*** (the species that was first named in 1925 by Raymond Dart based on the Taung child skull). Neither of these species has been found with preserved artifacts ("tools"). The first evidence of stone tools is at **2.6 Ma**, around the time when early members of our own genus existed, such as ***Homo habilis***.

The date of **2.6 Ma** also marks the emergence of the remarkable lineage of robust australopithecines (the members of which are usually assigned to the genus ***Paranthropus***). The robust australopithecines were characterized by massive skulls with strong masticatory muscles and broad, heavily enameled teeth. At all of the major robust australopithecine fossil sites, there exists fossil evidence for more gracile types of hominin (such as early *Homo*). On this basis, paleoanthropologists assume that *Paranthropus* and *Homo* coexisted on the African landscape for as long as one million years. As we will see in the Ecology section, this presents a challenge to scientists to explain how two such closely related species could have lived in sympatry for so long without severe competition. It is generally understood that the robust australopithecines went extinct without leaving descendants.

Until 1.8 Ma or so, the evolution of the hominins was a strictly African affair. After that time, there is fossil evidence for the existence of *Homo* outside of Africa, first in Asia, later in western Europe, and *much* more recently in the Americas (c. 13 ka).

The **archaeological record** of tool use is increasingly complex with time. Tool use is known to have evolved in other animal lineages (there many extant examples), but humans greatly refined the techniques of artifact creation and manipulation during their evolutionary career. Only humans use tools to make other tools, according to the existing evidence. Humans are also distinguished from other animals by their sophisticated use of syntactical language, as well as a wide range of culturally mediated behaviors.

Since the first appearance of genus *Homo*, there exists a trend of steadily increasing brain size up to the anatomically modern humans that appeared in Africa around 200 ka (note that brain size is generally analyzed relative to overall body size because of the close correlation between these variables). The implications of the evolution of large brain size are many. Of great importance is the fact that big brains are metabolically *expensive*: a big brain must be fed a steady diet of relatively high quality food, or else some other metabolically demanding part of the organism (such as the gut) must be reduced as compensation (this is the expensive tissue hypothesis).

The anatomically modern humans that left Africa (in a second "Out of Africa" event) encountered the **Neanderthal** populations of Europe and western Asia. A controversial question in anthropology is whether the *Homo sapiens* immigrants interbred with the resident Neanderthals, or whether the Neanderthals were driven to extinction by these upstart humans (or perhaps the Neanderthals were driven to extinction by some other mechanism). Studies of ancient DNA from Neanderthal bones generally indicate that the Neanderthals made little genetic contribution to the gene pool of *Homo sapiens*.

We will return to our study of the evolution of *Homo sapiens* in the Ecology section when we look at the possible role of humans in the end Pleistocene and present-day extinction events.