THE USES OF PALEOANTHROPOLOGY

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This essay began life as a "Big Question" discussion document prepared at the request of the John Templeton Foundation. But it seems to fit very neatly within the theme of this forum exploring the value of various scientific disciplines to society at large.

Wherever our origins ultimately lie, there is no rational doubt that we *Homo sapiens* are proximally the product of an eventful evolutionary past. Our ancient history is richly documented by a fossil record that is remarkably abundant for one single family of primates, and that is certainly a lot better than most paleoanthropologists are prepared to concede as they write funding proposals for more fossil exploration. Saying this is not, of course, to deny the huge value of such exploration. Fossil records are by their nature incomplete; and in a science in which every answer leads to compelling new questions, it is important to flesh them out as much as possible.

Still, what we already know allows us to construct a fairly convincing outline sketch of human prehistory, and of the natural context in which it played out. What's more, as members of an intensely curious species that instinctively wants to know the "why" of everything, most of us are naturally interested in knowing more about this drama of human becoming. But in trying to learn as much as possible about our evolutionary background, are we merely satisfying an innate genealogical inquisitiveness? Or can we take this enterprise beyond the satisfaction of superficial curiosity, to discover more profound implications about ourselves and our essential natures? I would argue that we can, and indeed that only by knowing the nature of the process that produced us can we begin to understand the rather bizarre and contradictory ways in which humans sometimes behave.

Several years ago, I attracted some mostly good-natured ribbing from friends and colleagues by arguing in my book *Becoming Human* that we can learn nothing about human nature from studying the deep human past that we cannot learn by looking around at ourselves today, in all our

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murky complexities. And while this claim might seem rather an odd one for a paleoanthropologist to make, I still believe there is truth in it. Our species is fully integrated into the Great Tree of Life that unites all living things. There is nonetheless something about the way in which modern *Homo sapiens* mentally processes information that makes our species qualitatively different from all other creatures, including our own evolutionary predecessors. In purely historical terms, we are not simply an extrapolation of any trends those predecessors might have embodied. Still, the emergent nature of our cognitive processes most emphatically does not mean that there is no value in closely scrutinizing the long process that produced us.

This is because the exact manner of our evolution cuts straight to the heart of who we are. There are basically two possibilities here. If our biological history consisted simply of the gradual modification of a central hominid lineage over the eons, as most of us were taught in school (if evolution was mentioned at all), then we might legitimately conclude that natural selection has in some sense fine-tuned us to an identifiable human condition. This would certainly be the clear implication if our fossil and archaeological records were to show that slow and steady biological and technological change was the rule among our extinct predecessors. In contrast, if those records were in fact to reveal a picture of diversity and morphological experimentation, interspersed with periods of nothing much happening, the inference would be entirely otherwise. If we were to find a bewildering variety of hominid species, all buffeted over time by the vagaries of climate and habitat change, the conclusion would have to be that *Homo sapiens* is simply the eventual victor in a long-running battle for ecological space among diverse hominids living in a constantly changing world. Under conditions like these, long-term refinement would not have been the issue for our precursors; immediate exigency would have been what counted.

Homo sapiens is the only hominid species in the world today. This clear reality intuitively favors the first scenario, in which our predecessors gamely and single-mindedly struggled toward the end-point that is us. As a result, paleoanthropologists have all too often tried to reconstruct hominid history by projecting our lone species far back in time, via a lineage of increasingly primitive predecessors. However, in the last few decades, as the hominid fossil record has increased by leaps and bounds, such views have become ever harder to justify. In 1950 it was possible for the great evolutionist Ernst Mayr to argue that human phylogeny consisted of a mere three species in a single lineage. By 1993, my first attempt at a hominid genealogical tree already contained twelve species, spanning the past four million years. The latest version of that tree covers seven million years and twice as many species, with as many as seven separate hominid

lineages coexisting at a single point in time. And the very clear implication of this very bushy family tree is that there was no single central tendency in hominid evolution. Rather, new variations on the hominid potential were continually thrown out to compete in the ecological arena, until one species finally emerged that somehow contrived to eliminate the competition—an event that was (very significantly) entirely unprecedented in all of hominid history.

A closer look at the details supports this broad picture, and helps us to understand the complexities of how our unusual species came to be. The earliest possible fossil hominids come from African sites between seven and four million years old. They make an oddly assorted group, united mainly by the claim that they moved upright when on the ground. Terrestrial bipedality was definitively established over four million years ago, among "australopiths" that had ape-sized brains, projecting faces, and small bodies that retained excellent climbing capabilities. This basic structure remained essentially unaltered for over two million years, although behaviorally something crucial happened with the first manufacture of stone cutting implements about 2.5 million years ago—almost certainly by an australopith. Essentially modern body form seems to have emerged at less than two million years ago, but in the absence of any technological change. Such change had to await the invention of the "handaxe" at some time over 1.5 million years ago, at which point taller obligate bipeds assigned to our genus *Homo* had already been in existence for some time. The next major technological leap came over a million years later, when several species of the genus *Homo* had already come and gone. The pattern is clear: technological and biological innovations in human evolution were both highly sporadic, and unconnected with each other.

Our anatomically distinctive species *Homo sapiens* arose in Africa at about 200 thousand years ago, again in the absence of any evidence for significant behavioral change. Only some 100 thousand years later do we begin to find early indicators of the symbolic mode of cognition that today sets our species apart from all others, living and extinct. To cut a long story short, our ability to form complex associations in the brain makes us modern *Homo sapiens* uniquely able to deconstruct and re-form the world around us world in our minds, and to visualize alternatives. Evidently, while the *potential* for this radically new cognitive mode was most likely acquired with the developmental reorganization that gave rise to our distinctive anatomy, its novel *uses* were discovered only significantly later. Since the biology clearly had to be in place already before it could be used, the momentous discovery of our new potential must have been spurred by a cultural stimulus, plausibly the invention of language. This would actually have been a routine "exaptive" evolutionary event, comparable to the tardy discovery by ancestral birds that they could use their feathers

to fly. So, purely in terms of evolutionary mechanism, there was nothing special about the emergence of our functionally altogether remarkable species.

The pattern of human evolution I have described has huge implications for the kind of creature we are. When we single out particular human characteristics, it is easy—and tempting—to make up a story about how each one evolved, and about how each is adapted for some purpose. But in any species huge numbers of features are inextricably bundled together, both in the genome and in the entire functioning individual. And this makes it difficult to see how each could have been refined individually over the eons by classic processes of natural selection. More commonly, natural selection on the individual turns out to be a stabilizing influence, while a lot of the evolutionary pattern we empirically observe reflects not individual reproductive success, but the fates of entire populations and species. What's more, we see few if any indications of steady progression in the human fossil record: something that is hardly surprising since we evolved over a period of notable environmental instability. Combine such considerations with the empirical evidence of multiple hominid speciations and extinctions, and it is hard to avoid the conclusion that individual human beings can have been programmed by nature for few if any specific behavioral function(s).

Our remarkable ability to create new realities in our minds wonderfully enables us to perceive things that lie beyond the material and the scientifically accessible. This ability is essentially limitless; for although we are individually formed and bound by social influences of many kinds, there are no clear intrinsic restrictions on how we express our cognitive capacities. On the plus side, this lack of constraint provides the basis for our free will. But being unconstrained has its dangers. These furnish the principal reason why we should indeed care, deeply, about accurately understanding the nature of the process that produced us. For knowing how non-directionally we evolved not only helps us comprehend why our behaviors are so frequently conflicted, contradictory, and unhelpful; it also forces us to realize the extent to which we are individually responsible for them.