

# HUMANITY'S ORIGINS

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This contribution sets out three “origins” problems within paleoanthropology. Where and when did the hominin clade originate, and what distinguished the first hominins from non-hominin close relatives? Where and when did the genus *Homo* originate, and what distinguished the most primitive taxon in that genus from members of other closely related genera? Where and when did modern humans originate? Attempts to come up with a satisfactory answer to all three of these “origins” problems are hampered by a paucity of fossil evidence and by a growing realization that recovering phylogeny is complicated because shared morphology does not always mean shared evolutionary history.

One of Charles Darwin's many achievements is that he began the process of converting the Tree of Life (TOL) from a religious metaphor into a biological reality. All types of living organisms, be they animals, plants, fungi, bacteria, or viruses, are at the end of twigs that reach the surface of the TOL, and all the types of organisms that have ever lived in the past are situated somewhere on the branches and twigs within the tree. The types of creatures alive today are a small fraction of those that have lived in the past and most of the branches within the TOL stop before they reach the surface. Those belong to organisms that are extinct. Darwin was a forceful proponent of the idea that we, modern humans, are just one of the many types of life on the surface of the TOL. The extinct organisms on the branches just beneath the surface of the TOL that connect us directly to the base of the TOL are the ancestors of modern humans, and the ones on nearby extinct branches are our close relatives.

A very long version of humanity's origins would be an evolutionary journey that starts approximately three billion years ago at the base of the TOL with the simplest form of life, and then passes into the relatively small section of the tree that contains all animals, and then into the even smaller section that contains all the animals with backbones. Around 400 million years ago (mya) we would have entered the section of the tree that contains vertebrates with four limbs, then around 250 mya into the branch that contains the mammals, and then into successively smaller branches that contain, respectively, the primates, the monkeys and apes, and then just the great apes. Sometime between 15 and 12 mya the journey would take us into the small branch that gave rise to modern humans and the living African apes. Between 11 and 9 mya the branch for the gorillas split off to leave a slender branch consisting of the ancestors and extinct close relatives of chimpanzees and bonobos (chimps/bonobos) and modern humans. Around 8 to 5 mya this very small branch split into two twigs. At its root is the creature that was the most recent common ancestor of chimps/bonobos and modern humans. One of the two twigs ends on the surface of the TOL with the living chimps/bonobos; the other leads to modern humans.

For our version of humanity's origins we will take a much shorter evolutionary journey, one that starts at the base of the twig of the TOL that leads to modern humans, and use that branch point as our "origin". Seen from a

distance, the 8 to 5 million years-long twig of the TOL that leads to modern humans looks straightforward, but when examined more closely it has its own branching points that lead to smaller twigs that do not reach the surface of the tree. These extinct twigs represent organisms that are our close relatives, but they are not our ancestors. Researchers familiar with the fossil record suggest that a major branching point in the evolutionary history of the section of the TOL that leads to modern humans, the species *Homo sapiens*, occurred more than two million years ago, and maybe closer to three million years ago when our own genus *Homo*, originated. So a second, even shorter, version of humanity's origins would focus on the base of the twig that contains all the species included in the genus *Homo*.

The third and shortest version of humanity's origins involves looking at the tip of the modern human twig of the TOL in even greater detail. A few researchers claim that *Homo* has no branches, in which case all the species that have come to be recognized within *Homo*, such as *Homo habilis*, *Homo erectus*, and Neanderthals (i.e., *Homo neanderthalensis*) are all ancestors of modern humans. But most researchers interpret the fossil evidence differently and suggest that there is at least one, and maybe more, branches within the *Homo* twig of the TOL. In this scenario, the most recent branching event on the *Homo* twig was the one that gave rise to modern humans and to Neanderthals.

This contribution will briefly review the latest scientific evidence for all three versions of the origin of humanity, starting with the one furthest back in time. This latter task means looking at the evidence for when, where, and in what circumstances, did the twig, or clade, that leads to modern humans and to all our extinct recent ancestors and close relatives split off from the rest of the TOL?

## The Origin of the Modern Human Clade

In the 19<sup>th</sup>C, the relationships between two types of living animal could only be assessed on the basis of how similar they were in terms of their gross morphology. For instance, how much of their skeletal anatomy and how many soft tissue structures (e.g., muscles, nerves, etc.) did they share? The assumption was that the more closely they resembled each other, the closer their "natural" relationship. One of the first people to undertake a systematic review of the differences between modern humans and the apes, in this case the gorilla and the chimpanzee, was

Thomas Henry Huxley. He summarized his views in an essay entitled *On the Relations of Man to the Lower Animals* that formed the central section of a book *Evidence as to Man's Place in Nature* published in 1863.<sup>1</sup> In that essay he concluded that the morphological differences between modern humans and the gorilla (and also the chimpanzee) were less marked than the differences between the gorilla and the orangutan and gibbon. It was on the basis of this evidence that Darwin, in *The Descent of Man* in 1871, suggested that because the African apes were morphologically closer to modern humans than the apes from Asia, the ancestors of modern humans were likely to be found in Africa.

Despite Huxley's prescient observations made 150 years ago, until recently it was usual for modern humans to be distinguished from the great apes at the level of the family. Traditionally, the non-human great apes (i.e., orangutans, gorillas, and chimpanzees/bonobos) were included in the family Pongidae, with a separate family, the Hominiidae, accommodating modern humans. That is the reason why modern humans, and all the extinct close relatives of modern humans judged to be more closely related to modern humans than to any other living taxon, are called "hominids".

During the first half of the 20<sup>th</sup>C, developments in immunology and biochemistry enabled the search for evidence about the nature of the relationships between modern humans and the great apes to be shifted from traditional macroscopic morphology to the morphology of molecules. The earliest attempts to use proteins to determine the relationships among primates were made just after the turn of the century, but it was in the early 1960s when Morris Goodman and Emil Zuckerkandl began to use molecular methods to address the relationships among the great apes and modern humans.<sup>2</sup> Morris Goodman used what was then the new technology of immunology, specifically a process called immunodiffusion, to investigate what one of the proteins in clotted, albumin, suggested about the affinities of monkeys, apes and modern humans. He found that the patterns produced by modern human and chimpanzee albumin in the immunodiffusion gels were identical, and from this he concluded that the structure of the albumins were, to all intents and purposes, also identical.<sup>3</sup> Emil Zuckerkandl investigated another much larger molecule, hemoglobin, found in red blood cells. He used enzymes to break up the protein component of hemoglobin into its

<sup>1</sup> HUXLEY, T. H. *Evidence as to Man's Place in Nature*. London: Williams and Norgate, 1863.

<sup>2</sup> ZUCKERKANDL, E.; JONES, R. T. & PAULING, L. A Comparison of Animal Hemoglobins by Tryptic Peptide Pattern Analysis. *Proceedings of National Academy of Science*, 46:1349-60, 1960.

GOODMAN, M. Immunology of the Primates and Primate Evolution. *Annals New York Academy of Science*, 102:219-234, 1962.

GOODMAN, M. Man's Place in the Phylogeny of the Primates as Reflected in Serum Proteins. p. 204-234. In: WASHBURN, S. L. (Ed.). *Classification and Human Evolution*. Chicago: Viking Fund. Publ., 1963.

ZUCKERKANDL, E. Perspectives in Molecular Anthropology. p. 243-272. In: WASHBURN, S. L. *Op. cit.*

<sup>3</sup> GOODMAN, M. Man's Place in the Phylogeny of the... *Op. cit.*

component peptides, and then used a method called starch gel electrophoresis to separate them. When he did that, he found the same as Goodman had for albumin; the patterns the peptides belonging to modern humans, chimpanzee and gorilla made in the gel were indistinguishable.<sup>4</sup>

The protein components of hemoglobin, and a protein molecule like albumin, consist of a string of amino acids. In some cases the type of amino acid, and their order, is critical for the function of that molecule, but in many instances one amino acid can be substituted for another without changing the function of the protein. In the 1960s, Vince Sarich and Allan Wilson exploited these minor variations in the type and sequence of amino acids to determine the evolutionary history of the protein molecules, and based on this could infer the evolutionary history of the taxa whose proteins had been sampled.<sup>5</sup> They also found that modern humans and the African apes, and in particular modern humans and the chimpanzee, were very closely related and in a later paper in the 1970s, Mary-Claire King and Alan Wilson suggested that 99% of the amino-acid sequences of chimps and modern humans were identical.<sup>6</sup>

The discovery by James Watson and Francis Crick of the structure of DNA, and the subsequent discovery by Crick and others of the nature of the genetic code, showed that it was the sequence of bases in the DNA molecule that determined the nature of the proteins manufactured within a cell. This meant that the affinities between organisms could be pursued at the level of DNA (i.e., at the level of the genome), which eliminated the need to rely on morphological proxies, be they traditional morphology or the morphology of proteins, for information about how closely two types of animals were related. The DNA within the cell is located either within the nucleus as nuclear DNA (nDNA) or within the mitochondria as mitochondrial DNA (mtDNA). Comparisons between the DNA of organisms can be made using two methods. Before DNA sequencing was possible on a large enough scale, genomes were compared using DNA hybridization, a method that compares the entire DNA, but at a relatively crude level. In the early days of DNA sequencing, it was only possible to determine and compare the base sequences of relatively small amounts of DNA. So before it was possible to sequence whole genomes, DNA hybridization was used to tell researchers “a little about a lot” of DNA, whereas the early sequencing methods could be used to tell you “a lot

<sup>4</sup> ZUCKERKANDL, E. Perspectives in... *Op. cit.*

<sup>5</sup> SARICH, V. M. & WILSON, A. C. Immunological Time Scale for Hominid Evolution. *Science*, 158: 1200-1203, 1967.

<sup>6</sup> KING, M.-C. & WILSON, A. C. Evolution at Two Levels in Humans and Chimpanzees. *Science*, 188:107-116, 1975.

about a little piece" of DNA. Nowadays technological advances mean that whole genomes can be sequenced at an impressive level of detail. They provide "a lot" of information about "all of" the DNA.

Sequencing is favored because knowledge about the type of differences between the base sequences provides clues about how easy, or difficult, it is to generate the observed differences, and thus what can be concluded about the generation of those differences. This is because not all base changes are equivalent. For example, base changes called transitions ("A to G" and "T to C") readily switch back and forth, whereas transversions ("A to C" and "T to G") switch back and forth less readily. Thus, transversions are more reliable indicators of "genetic distance". Initially, only hybridization methods were applied to the living great apes and modern humans, but once sequencing became possible on a large-scale, hybridization methods were completely superseded by sequencing methods. Information from both nuclear and mtDNA has provided overwhelming evidence in favor of the hypothesis that modern humans and chimpanzees and bonobos are more closely related to each other than modern humans, chimpanzees and bonobos are to the gorilla. When these differences are calibrated using the best paleontological evidence for the split between the apes and the Old World Monkeys, and if the DNA differences are assumed to be neutral, then this predicts that the hypothetical common ancestor of modern humans and chimpanzees and bonobos lived between about 8 and 5 mya, and probably closer to 5 than to 8 mya.<sup>7</sup> When other, even older, calibrations are used, the predicted date for the split is also somewhat older.

<sup>7</sup> BRADLEY, B. Reconstructing Phylogenies and Phenotypes: A Molecular View of Human Evolution. *Journal of Anatomy*, 212:337-353, 2008.

Thus, there is now overwhelming evidence that chimpanzees and bonobos are the closest living relatives of modern humans, and it is very likely that the modern human twig, or clade, separated from the rest of the TOL approximately 6-5 million years ago. Because chimpanzees and bonobos are both only found in Africa, Africa is likely to have been the continent where the modern human clade emerged. This is consistent with claims that the earliest evidence for extinct creatures that *might* belong to the modern human clade comes from Africa. So it looks as if Darwin's 1871 prediction was correct. Also, given the abundant evidence for a closer relationship between *Pan* and *Homo* than between *Pan* and *Gorilla* (see above), many researchers take the view that the human clade does not

need to be distinguished in the Linnaean hierarchy at the level of the family. The researchers who have come to that conclusion mostly now use the family Hominidae for *all* of the great apes (including modern humans), and they use a lower level distinction, the subfamily, for just *Pan* and *Homo*. In that case the subfamily Homininae is used for *Pan* and *Homo* combined, with *Pan* and *Homo* each being a tribe within the Linnaean hierarchy. So the human clade is referred to as the tribe Hominini, and the individuals and taxa within it are referred to as “hominins”. In this scheme, chimpanzees and bonobos are referred to as the tribe Panini, and the individuals and taxa within it are referred to as “panins”. This is the terminology I will use for the rest of this essay.

### The Origin of the Genus *Homo*

The most widely used genus concept is the one suggested by Ernst Mayr, who proposed that a genus should consist of “one species, or a group of species of common ancestry, which differ in a pronounced manner from other groups of species and are separated from them by a decided morphological gap”.<sup>8</sup> He also suggested that the species in a genus must “occupy an ecological situation which is different from that occupied by the species of another genus, or, to use the terminology of Sewall Wright, they occupy a different adaptive plateau”.<sup>9</sup> Thus, according to Mayr, a genus is a group of species of common ancestry that is adaptively both homogeneous and distinctive. Wood and Collard suggested that Mayr’s definition of the genus should be modified so that only clades should qualify, and they saw no reason why the shared adaptive zone had to be unique. For Wood and Collard<sup>10</sup> all genera must be a clade, but for the reasons set out above, not all clades are genera.

There are two options for putting the principles of genus identification (i.e., an adaptively coherent clade) into practice. You can either start in the present, or in the past. If one starts in the present, and adopts the “top down” option, one begins with the type species. In the case of the genus *Homo*, one takes stock of the derived morphology and behavior of *H. sapiens*, decides on the cardinal features and behaviors one will use to determine the adaptive zone of *H. sapiens*, and then choose a way of generating hypotheses about which species should be included in the *Homo* clade (the technical term for this is monophyly). Then one works backwards into the past, and by applying the same two tests to each hominin taxon one encounters (i.e., starting from the

<sup>8</sup> MAYR, E. Taxonomic Categories in Fossil Hominids. *Cold Spring Harbor Symposium on Quantitative Biology*, 15:109-118, 1950. p. 110.

<sup>9</sup> MAYR, E. *Op. cit.* p. 110.

<sup>10</sup> WOOD, B. A. & COLLARD, M. C. The Human Genus. *Science*, 284: 65-71, 1999.

present, they are *H. neanderthalensis*, *H. heidelbergensis*, *H. erectus* and *H. habilis*), it is asked whether there is reliable evidence that the taxon is in the same adaptive zone (i.e., reliable qualitative or quantitative proxies of important behaviors) and in the same clade as *H. sapiens*?

If the “bottom up” approach is adopted, one has to make a subjective judgment about whereabouts in the past one should start to pick up the trail leading to *Homo*. One then works towards the present applying the tests set out above to the hominin taxa that are encountered. The difference between this approach and the “top down” option is that the evidence is sketchier, and thus the likelihood that one can satisfy the “reliability” criterion of the two tests, monophyly and adaptive coherence, is diminished.

Ironically, there have been very few attempts to formally assess the relationships of modern humans with respect to *H. neanderthalensis* and *H. erectus*. Eldredge & Tattersall<sup>11</sup> included all three taxa in the cladogram<sup>12</sup> presented in their seminal paper that pioneered the application of cladistic methods to hominin relationships. However, the authors did not carry out a formal analysis of the relationships among the taxa, nor did they refer to any specific characters when considering the merits of different branching patterns (called cladograms) for expressing the relationships among the pre-modern *Homo* taxa within the hominin clade. Since most researchers then considered the hypothesis of monophyly of later *Homo* (i.e., *H. sapiens*, *H. neanderthalensis*, *Homo heidelbergensis*, *H. erectus*) to be so well supported, the matter was not considered to require formal investigation. Although there are grounds for adding *H. habilis* to the *H. sapiens*, *H. neanderthalensis*, *H. heidelbergensis*, and *H. erectus* clade, I think even the supporters of such an interpretation would accept that the evidence for doing so is not as strong as the evidence for including *H. neanderthalensis* and *H. erectus* within the clade that includes modern humans. Thus, as far as relationships are concerned, there seem to be two options. One either draws the lower boundary of the genus *Homo* so that it includes *H. habilis*, or one draws it beneath early African *H. erectus* so that it excludes *H. habilis*.

As far as adaptive grade is concerned, the problem is more complicated. If the criteria are restricted to what can be deduced about the adaptive grade of a taxon from its morphology, then it could be argued that if the combination of a modern human-sized brain and obligate long range

<sup>11</sup> ELDREDGE, N. & TATTERSALL, I. Evolutionary Models, Phylogenetic Reconstruction, and Another Look at Hominid Phylogeny. p. 218-242. In: SZALAY, F. S. (Ed.). *Approaches to primate paleobiology*. New York: Karger, 1975.

<sup>12</sup> See ELDREDGE, N. & TATTERSALL, I. *Op. cit.*, fig. 4.



bipedalism are the criteria, then the boundary of *Homo* would be set so that it includes *H. heidelbergensis*, but not *H. erectus* or *H. floresiensis*. If a modern human body shape and obligate bipedalism of any form are deemed to be the criteria, then the boundary would be set so that *Homo* would include early African *H. erectus*, but not *H. habilis*.<sup>13</sup>

But even that solution results in a hominin genus that embraces a substantial range of life histories.<sup>14</sup> If *H. habilis* is included in *Homo* for relationship reasons, this poses problems for any genus definition that insists on adaptive coherence, for the same genus would include taxa with a range of cranial, dental and postcranial morphology and relative size relationships (including very different semi-circular canals and limb strength proportions) that imply different dietary and locomotor adaptations. Furthermore, the adaptive strategies of *H. habilis* are probably closer to the adaptive strategy of the type species of the genus *Australopithecus* (i. e., *Au. africanus*) than they are to *H. sapiens*, the type species of *Homo*.

## The Origin of Modern Humans

Just what are the features of the cranium, jaws, dentition and the postcranial skeleton that are only found in *H. sapiens*, and what are the limits of living *H. sapiens* variation? How far beyond these limits, if at all, should we be prepared to go and still be prepared to assign the fossil evidence to *H. sapiens*? These are simple enough questions, to which one would have thought there would be ready answers, yet the assembly of a set of morphological criteria for “modern humanness” is a surprisingly difficult task, and little progress has been made since W. W. Howells’ seminal study of modern human cranial variation.<sup>15</sup> Using a comprehensive sample of modern human cranial measurements, Howells showed that the totality of variation as measured in Mahalanobis D<sup>2</sup> distances among his 28 groups is comparable to the distance that separates all modern human crania from his relatively small sample of Neanderthal crania. Small-bodied modern humans tend to have smaller crania, but overall there is very little among-sample difference in the overall size of the modern human cranium. Howells comments that modern human crania share a “... universal loss of robustness,” and goes on to write that within modern humans “variation in shape seems to be largely located in the upper face, and particularly the upper nose and the borders of the orbits”.<sup>16</sup> Others have attempted to specify

<sup>13</sup> HAEUSLER, M. & McHENRY, H. M. Body Proportions of *Homo habilis* Reviewed. *Journal of Human Evolution*, 46:433-465, 2004.

HAEUSLER, M. & McHENRY, H. M. Evolutionary Reversals of Limb Proportions in Early Hominids? Evidence from KNM-ER 3735 (*Homo habilis*). *Journal of Human Evolution*, 53:383-405, 2007.

<sup>14</sup> ROBSON, S. L. & WOOD, B. A. Hominin Life History: Reconstruction and Evolution. *Journal of Anatomy*, 219:394-425, 2008.

<sup>15</sup> HOWELLS, W. W. *Cranial Variation in Man: A Study by Multivariate Analysis of Pattern of Differences Among Recent Human Populations*. Cambridge, MA: Harvard, 1973.

HOWELLS, W. W. *Skull Shapes and the Map: Craniometric Analysis of Modern Homo*. Cambridge, MA: Harvard, 1989.

<sup>16</sup> HOWELLS, W. W. *Skull Shapes and the Map... Op. cit.* p. 83.

<sup>17</sup> STRINGER, C. B.; HUBLIN, J. J. & VANDERMEERSCH, B. The Origin of Anatomically Modern Humans in Western Europe. p. 51-135. In: SMITH, F. & SPENCER, F. (Ed.). *The Origins of modern humans: A world survey of the fossil evidence*. New York: Alan R. Liss, 1984.

DAY, M. H. & STRINGER, C. B. Les restes crâniens d'Omo-Kibish et leur classification à l'intérieur du genre *Homo*. *L'Anthropologie*, 95:573-594, 1991.

<sup>18</sup> LAHR, M. M. *The Evolution of Modern Human Diversity: A Study of Cranial Variation*. Cambridge: Cambridge University Press, 1996.

- <sup>19</sup> LIEBERMAN, D. E. Sphenoid Shortening and the Evolution of Modern Human Cranial Shape. *Nature*, 393: 158-162, 1998.
- <sup>20</sup> SPOOR, F.; O'HIGGINS, P.; DEAN, C. & LIEBERMAN, D. E. Anterior Sphenoid in Modern Humans. *Nature*, 397:572, 1999.
- <sup>21</sup> LIEBERMAN, D. E.; McBRATNEY, B. M. & KROVITZ, G. The Evolution and Development of Cranial Form in *Homo sapiens*. *Proceedings of the National Academy of Sciences*, 99:1.134-1.139, 2002.
- <sup>22</sup> HILLSON, S. *Dental Anthropology*. Cambridge: Cambridge University Press, 1996.
- <sup>23</sup> TRINKAUS, E. Neanderthal Limb Proportions and Cold Adaptation. p. 187-224. In: STRINGER, C. B. (Ed.). *Aspects of Human Evolution*. London: Taylor and Francis, 1981.
- <sup>24</sup> HOLLIDAY, T. W. Body Size and Proportions in the Late Pleistocene Western Old World and the Origins of Modern Humans. Unpublished Doctoral Dissertation. University of New Mexico, Albuquerque, 1995.
- <sup>25</sup> RUFF, C. B.; TRINKAUS, E. & HOLLIDAY, T. W. Body Mass and Encephalization in Pleistocene *Homo*. *Nature*, 387:173-176, 1997.
- <sup>26</sup> PEARSON, O. M. Postcranial Remains and the Origins of Modern Humans. *Evolutionary Anthropology*, 9:229-247, 2000.
- <sup>27</sup> RUFF, C. B.; TRINKAUS, E. & HOLLIDAY, T. W. Body Mass... *Op. cit.*
- <sup>28</sup> PEARSON, O. M. Has the Combination of Genetic and Fossil Evidence Solved the Riddle of Modern Human Origins? *Evolutionary Anthropology*, 13, 4:145-159, 2004.
- <sup>29</sup> WHITE, T. B. *et al.* Pleistocene *Homo sapiens* from Middle Awash, Ethiopia. *Nature*, 423:742-747, 2003.
- <sup>30</sup> McDOUGALL, I.; BROWN, F. H. & FLEAGLE, J. G.

acceptable ranges of morphometric variation for the cranium of *H. sapiens*,<sup>17</sup> but the authors conceded that a sample need comply with only ca. 75% of the defining characteristics in order to qualify for inclusion in *H. sapiens*. In a more recent review of variation in regional samples of modern human crania, Lahr<sup>18</sup> emphasized that regional peculiarities should not be incorporated into criteria for inclusion in *H. sapiens*. Lieberman<sup>19</sup> distilled existing cranial definitions of *H. sapiens* and suggested that to be regarded as "anatomically modern human," crania need to have "a globular braincase, a vertical forehead, a diminutive brow ridge, a canine fossa and a pronounced chin". Others suggested that all these features may be related in one way or another to a reduction in facial projection<sup>20</sup>, and Lieberman *et al.*<sup>21</sup> suggested that what modern human crania really have in common is an unusually globular neurocranium.

Dentally, the postcanine teeth of modern humans are notable for the absolutely and relatively small size of their crowns, and for a reduction in the number of cusps and roots<sup>22</sup>; presumably this would also be the same for fossil representatives of *H. sapiens*. As for the postcranial skeleton in comparison with Neanderthals and what little is known of the postcranial skeleton of *H. heidelbergensis*, anatomically modern humans have elongated distal limb bones<sup>23</sup>, limbs that are long relative to the trunk<sup>24</sup>, a relatively narrow trunk and pelvis, and low body mass relative to stature.<sup>25</sup> Many of these traits cause the earliest fossil modern humans (e.g., those from Skhul and Qafzeh) to resemble living modern humans from hot, arid climates, and the contrasts in postcranial morphology between modern humans and Neanderthals probably have more to do with the uniqueness and distinctiveness of Neanderthal morphology than with the ability of researchers to define the distinctive characteristics of *H. sapiens*.<sup>26</sup> In summary, compared to their more archaic immediate precursors, modern humans are characterized postcranially by their reduced body mass,<sup>27</sup> their more linear physique, and a distinctive pelvic shape that includes a short, stout, pubic ramus, and a relatively large pelvic inlet.<sup>28</sup>

So when and where do we see the earliest evidence of modern human morphology in the fossil record? The simple answer is Africa, where at two sites in Ethiopia, the ca. 170 ka Herto site<sup>29</sup> and the ca. 190 ka site at Omo-Kibish<sup>30</sup>, there is good evidence of modern human-like crania. There is also molecular evidence that is consistent with a ca. 300-200 ka African origin for modern humans.<sup>31</sup>

## Conclusions

The three choices provided by fossil and molecular evidence for humanity's origin – ca. 6-5 mya for the origin of the human clade, ca. 2 to 3 million years ago for the origin of our own genus, or ca. 200 thousand years ago for the origin of modern human morphology – are not the only ones available. Modern humans are distinguished from all other living animals by their behavior as well as by their morphology. The extent of our behavioral uniqueness has almost certainly been exaggerated, and the more that is found out about the behavior of other primates, and especially the behavioural repertoire of the great apes, the more researchers realize that our distinctiveness is a matter of degree rather than kind.<sup>32</sup> Archaeologists try diligently, but not always successfully, to seek for evidence of symbolism and language in the archaeological record, but there is accumulating evidence that just as modern human *morphology* seems to be emerging in Africa, modern human behaviour may do so as well, but intriguingly the evidence for the latter may antedate the former.<sup>33</sup> So there is no simple answer to the deceptively simple question “what are the origins of humanity”? It depends on the aspect of our humanity that the questioner wants to stress. If it is what makes us different from our closest living relatives, chimpanzees and bonobos, then the origins of those features date back to at least five million years ago. If it is our own species, then we are still thinking about several millions years ago. But if it is the origin of the way we look today, then the time elapsed shrinks to two hundred thousand years ago. If the question refers to the acquisition of apparently unique aspects of our behaviour, such as our complex human language, the questioner will be disappointed for there is no obvious proxy in the fossil or archaeological records for language ability. If it is the origin of complex tool manufacture, then that came relatively late in our evolutionary history, but not as late as had been assumed. Remember, also, that the actual time of origin of any trait must be *at least as old* as the first evidence for it in the fossil or archaeological records. The latter are minimum estimates and must be viewed as hypotheses ripe for testing by the acquisition of new evidence. We should all resist the temptation to include the word “earliest” in the title of a paper announcing a fossil or archaeological discovery.

Stratigraphic Placement and Age of Modern Humans from Kibish, Ethiopia. *Nature*, 433:733-736, 2005.

<sup>31</sup> PEARSON, O. M. Has the Combination of... *Op. cit.*

<sup>32</sup> HASLAM, M. *et al.* Primate Archaeology. *Nature*, 460: 339-344, 2009.

<sup>33</sup> McBREARTY, S. & BROOKS, A. S. The Revolution That Wasn't: a New Interpretation of the Origin of Modern Human Behavior. *Journal of Human Evolution*, 39:453-563, 2000.

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