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What is the Viewpoint of Hemoglobin, and Does It Matter?

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Abstract - In this paper I discuss reductive trends in evolutionary anthropology. The first involved the reduction of human ancestry to genetic relationships (in the 1960s) and the second involved a parallel reduction of classification to phylogenetic retrieval (in the 1980s). Neither of these affords greater accuracy than their alternatives; that is to say, their novelty is epistemic, not empirical. As a result, there has been a revolution in classification in evolutionary anthropology, which arguably clouds the biological relationships of the relevant species, rather than clarifying them. Just below the species level, another taxonomic issue is raised by the reinscription of race as a natural category of the human species. This, too, is driven by the convergent interests of cultural forces including conservative political ideologies, the creation of pharmaceutical niche markets, free-market genomics, and old-fashioned scientific racism.

Keywords – Molecular anthropology, Systematics, Classification, Human evolution

Introduction

In this paper I explore the intersection of genetics, taxonomy, and evolutionary anthropology. All three fields are scientific areas saturated with cultural meanings and associations. First, genetics is the scientific study of heredity, but has historically capitalized on non-scientific prejudices about heredity to curry support: hence James Watson's epigrammatic proclamation in support of the Human Genome Project, "We used to think our fate was in the stars. Now we know, in large measure, our fate is in our genes" (Jaroff 1989; Duster 1990; Nelkin and Lindee 1995). Second, taxonomy is the practice of dividing, grouping, and naming the components of the natural world,[1] which is done according to specific criteria and for particular purposes and, consequently, is a highly

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[1] Biological taxonomy is one expression of classificatory practices. More generally, taxonomy extends beyond the natural universe, to the social and symbolic universes, which are also ordered and organized with locally meaningful criteria.

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cultural act (Durkheim and Mauss 1901-1902; Simpson 1961; Douglas 1966; Bowker and Star 2000). And third, evolutionary anthropology lays claim to scientific authority for an understanding of what Huxley termed "man's place in nature" (Huxley 1863; Marks 2002).

Let me begin with a simple paradox to demonstrate that even in the crudest assessment of the scholarly literature, the contribution of genetics to understanding the meaning of human beings in relation to our closest relatives, is not at all obvious. On the one hand, there are those who invoke the comparison of chimpanzee and human DNA to tell us that chimpanzees are so *similar* to us that they should be regarded as merely an hereditary variant of the human species, a sister species of the genus *Homo* (Wildman et al. 2003). On the other hand, there are also those who invoke the comparison of Neandertal and human DNA to tell us that Neandertals are so *different* from us that they should be regarded as a sister species of the genus *Homo* (Krings et al. 1997), rather than as a subspecies. Clearly, you do not need a philosopher to tell you that if scientific classification is to have any meaning, then these two propositions cannot simultaneously be true; the genetic difference between a human and chimpanzee is considerably greater than that between a human and a Neandertal. At least one of those two propositions is wrong. In other words, the DNA does not really tell you how to classify organisms.

If not DNA, then what does tell us how to classify primates? Interestingly, if we asked a relatively simple question of the leading primatology texts twenty years ago – how many species of primates are there? – the answer to which might allow us to contextualize our own existence in the natural order, we would tally up about 170 of them (Richard 1985; Smuts et al. 1987). Asking the same question of the leading primatology texts today, however, yields a total of about 340 primate species (Strier 2006; Campbell et al. 2006).

What is going on? Have primates undergone high speciation rates over the last few decades? Of course not; that goes against the master narrative of primatology, which is that most primate species (with few exceptions) are crashing, if not in imminent danger of extinction. Are new primate species being regularly retrieved from the unexplored regions of Africa, or the Amazon Basin? Again, of course not – there have been a small handful of previously unknown primate species discovered, mostly lemurs from Madagascar.

The doubling of primate species in the last generation has to do with the transformation of primatology by the funding and concerns of conservation. After all, a graduate student in astronomy can go to sleep reasonably secure the subject matter will still be intact when they retire; but a primatology graduate student has no such assurance. As a result they have worked to get international legislation to protect primates in the wild from habitat destruction. In fact, for the last few years, if you published an article in the leading primatology journal in the world (the *International Journal of Primatology*), it appeared with a small aye-aye logo imploring the reader in Latin to "let us live." But the conservation legislation tends to be written at the species level and can be circumvented by simply finding other extant populations of the same species, which will not be adversely affected by the proposed logging or mining or drilling or building. So, to restore the spirit of the law, we elevate those populations to the rank of species, each of which requires its own protection. The big winners are the primates – and the big loser is any thought that nature is somehow being accurately described independently of cultural concerns and values.

This practice, strategically over-counting species, is widely known today as taxonomic inflation and is not by any means restricted to the primates (Isaac et al. 2004; Marks 2007; Tattersall 2007). It simply requires acknowledging that the real-world issue of saving the species is more important than the abstract issue of tabulating them, with which, I might add, I heartily agree.

Nevertheless, there is a reality, a place for us in the diversity of life on earth, conceptualized by Linnaeus and explained as the trail of common descent by Darwin. Being composed of cells that lack chloroplasts, we fall among the group known as animals. Being supported by a bony endoskeleton, we fall among the group designated as vertebrates. Being hairy and endothermic, we fall within the mammals. Our distal extremities identify us as primates, while our mobile shoulders and short, stiff vertebral columns are the hallmarks of the brachiating ancestry of the apes.

And yet there is still a great deal of flexibility in the narratives available to us for encoding our place. In spite of our shoulders and vestigial tails, we are not particularly adept at the suspensory posture and locomotion that forms the basic adaptation of the apes and of our remote ancestors. Our own bodies are better suited for bipedalism, the mode of getting about that has essentially superseded the ape's brachiation, for us. So which, then, is a better expression of our place: to be one of five living genera that have the specializations of brachiation; or to be the only living genus that has the specializations of a striding biped? Those alternatives are equally biological, equally evolutionary, and equally valid.

We might consult a geneticist to help us decide which to emphasize, but a geneticist will not tell us anything we do not already know – namely, that we are very similar to the brachiating apes, but also divergently specialized from them. Thus, Pete Townshend's famous "windmill" style of guitar playing is predicated upon having the rotating shoulder, orthograde posture, and flexed digits of the brachiators, which facilitate grasping and swinging in the trees. In other words, the guitar style is enabled by the skeletal specializations found only among the apes and carried in the pre-history of our bodies, while at the same time being manifestly a uniquely human endeavor.

The problem is that similarity and difference are relational and oppositional concepts. We can study how similar and how different we are from the apes and we can examine the patterns of those similarities and differences, but the meanings we attach to the results are by no means self-evident.

Prioritizing Ancestry

George Gaylord Simpson recognized this when he confronted the place of humans in his influential 1945 monograph on mammalian classification. "Perhaps," he wrote (Simpson 1945, 188), "it would be better for the zoological taxonomist to set apart the human family and to exclude its place from his studies." (He could afford to be a bit sarcastic as the leading mammalian systematist in the world.)

At the time, Simpson was not particularly threatened by the relations as told by geneticists. After all, the general similarity of the blood of human and ape was known at the turn of the twentieth century (Nuttall 1904). By the 1920s, during the public furor over the trial of John T. Scopes for teaching evolution in Tennessee, that similarity – already known to be more intimate than horse and donkey – was being invoked for the evolution side (Hussey 1926). And yet, neither could any thinking person fail to note the differences between human and ape.

That situation changed, however, in the 1960s, with the stirrings of the molecular genetics revolution (Dietrich 1998; Sommer 2008; Suárez-Díaz and Anaya-Muñoz 2008). Biomolecules have a decided advantage over body parts in studies of evolution. They can be represented as linear information and so their differences can be counted up and compared far more readily than one can compare, for example, eyeballs. It is the same attraction as the IQ has to right-wing psychology (Brigham 1923; Dreary 2008): its precise biological meaning may be more-or-less obscure, but the simple fact is that some people have more of it than others, so we might as well rank them on that basis (cf. Ingold 2007).

By the 1960s, it was clear that the amino acid differences in corresponding proteins of different species could be tallied and used to produce a matrix of the species' molecular genetic affinities. And when you looked at the hemoglobin of human and gorilla, argued the biochemist Emile Zuckerkandl, you saw only two differences out of 287 possibilities. Consequently, from the viewpoint of hemoglobin, at least, the gorilla version appeared to be simply a minor variant of the human version and, thus, gorillas to be minor variants of humans: “from the point of view of hemoglobin structure, it appears that gorilla is just an abnormal human, or man an abnormal gorilla, and the two species form actually one continuous population” (Zuckerkandl 1963, 247).

Simpson (1964, 536) responded bluntly: “From any point of view other than that properly specified, that is of course nonsense. What the comparison really seems to indicate is that . . . hemoglobin is a bad choice and has nothing to tell us about affinities, or indeed tells us a lie.” Indeed, from any point of view other than that of hemoglobin – say, anatomy, ecology, or behavior, the rest of biology – you see something different from what you are inferring from hemoglobin. Does it not stand to reason that if you essentially cannot tell human hemoglobin from gorilla hemoglobin, the sensible thing to do is to look at something else? In other words, if you cannot tell a human from a gorilla, you really should not be in biology.

Simpson certainly was not compromising with creationism in highlighting the uniquely derived features of the human condition. Quite the opposite: he was speaking on behalf of normative (non-reductive) biology. The practice of scientific classification involved constructing an informed compromise among different sets of data, which may reveal different things about the species. If the DNA does not show our ecological and behavioral divergence from the apes, our ecology and behavior does. The similarities between humans and gorillas are not at issue; even creationists can see them. The issue is what the similarities mean; in particular, whether our place in the natural order is to be understood in terms of our own existence, or that of our ancestors. Are we more than just our history, detectable in our resemblances to the apes? Should our differences – that is to say, our present state – count?

Of course they should! What Simpson is saying is that it is at least as problematic to deny the differences between human and ape as it is to overstate them. If hemoglobin provides you with a lens that blurs the difference between human and gorilla, then just get a different lens. What is curious is why anyone would want to privilege such a weird dataset, a dataset that makes a human seem like a gorilla. If one searches hard enough, there are datasets by which humans can seem to resemble New World monkeys (sexual dimorphism and behavior), dolphins (subcutaneous fat and reduction of body hair), and parrots (vocal signaling) – but we should hesitate to build our overarching scientific classification around such particular relationships.

It is not that difficult to tell a human from an ape, after all. The human is the one walking, talking, sweating, praying, building, reading, trading, crying, dancing, writing, cooking, joking, working, decorating, shaving, driving a car, or playing football. Quite literally, from the top of our head (where the hair is continually growing, unlike gorillas) to the tips of our toes (the stoutest of which is non-opposable), one can tell the human part from the ape part quite readily if one knows what to look for. Our eye-whites, small canine teeth, evaporative heat loss, short arms and long legs, breasts, knees, and of course, our cognitive communication abilities and the productive anatomies of our tongue and throat are all dead giveaways. However, they are not readily apparent in a genetic comparison.

Quickly, however, Simpson realized he was engaged in a two-front war with hemoglobin. Reiterating the genetic similarity of human and African apes, Morris Goodman argued (1963, 225) that their genetic patterns necessitated a formal reclassification of the species, and he wanted to place them in the same taxonomic family. "A broadening of the Hominidae to include *Gorilla* and *Pan* as well as *Homo*," he wrote, "would reflect more closely the cladistic and genetic relationships." In other words, if Zuckerkandl was promoting the odd fact that he could not tell a human from an ape, Goodman seemed to be arguing that nobody should.

And he argued it persistently (Goodman and Moore 1971) from the assumption that the hereditary relationships (to which he had privileged access and which emphasized the temporal divergence of the orangutan) simply outweighed the ecological relationships, which emphasized the specializations of humans. Again, Simpson (1971, 370) rebutted Goodman's new classification in terms as simple as he could muster. "It is abundantly established that anatomically, behaviorally, and in other ways controlled or influenced by total genetic makeup *Homo* is very much more distant from either '*Pan*' or '*Gorilla*' than they are from each other. That fact is not overbalanced by the failure of just one kind of data to reflect that distinction clearly or in equal degree. The distinction is real, and it still justifies the classical separation of Pongidae and Hominidae in classification." That is to say, pretty much any way you can compare them, people are not apes, regardless of the fact that human ancestry is mostly ape ancestry.

But Simpson was swimming against a strongly reductive tide. Forty years after his initial foray into primate classification, Morris Goodman is now arguing not merely for putting humans and chimps into the same family, but into the same genus (Wildman et al. 2003).

The problem here is the approach that the viewpoint of hemoglobin might be considered to represent. Jared Diamond's 1992 best-seller, *The Third Chimpanzee*,[2] actually used it as a starting-off point, by assuming the equivalence of the statement that we are genetically chimpanzees with the statement that we are chimpanzees. (Perhaps that was expectable in the era of the Human Genome Project.) What that does is to make the qualifier "genetically" invisible or irrelevant. The genetic relations are the only ones that apparently matter and their meanings are transparent.

In fact, however, there is a long-standing strain in evolutionary systematics explicitly denying that very equivalence and transparency. Julian Huxley, who was an ardent believer in the humanitarian application of scientific rationality to solving the world's problems, knew that humans were the only species capable of devising and implementing such solutions, and he thought it significant enough to encode zoologically. He wanted to distinguish us from all other animals as the Subkingdom Psychozoa, that is to say, as mental life (Huxley 1957).

Obviously, Huxley was also no creationist; he was simply rejecting the proposition that Goodman takes for granted – that the genetic similarity of humans to certain species would override their anatomical, behavioral, and ecological differences from all others. To Huxley and Simpson, classification does not follow automatically from genetic patterns, for there is more to evolution than simple descent, which is what genetic data are good at revealing. There is also divergence, which is more evident ecologically. But when cladistic classification started becoming popular in the 1970s, based on the work of the entomologist Willi Hennig (1965), it also brought a new importance to genetic relationships – in Zuckerkandl's metonym, to the hemoglobin view of species. Here, classification ought to reflect only proximity of descent, privileging genetic analysis, and the extent of divergence is disregarded (Eldredge and Cracraft 1980; Wiley 1981). The system has the merit of applying a single criterion consistently (some might say obsessively) and thus establishing rigid rules where formerly there were compromises among diverse datasets and aspects of evolution. Within this scheme, only closest relatives are to be classified together.

At the heart of the antagonism between cladistic classifications and more traditional ones was the question of the meaning of difference. Should a scientific classification represent descent and divergence – that is to say, evolution – or just descent, that is to say, phylogenetic history? For example, crocodiles are more closely related to birds than to lizards – for birds diverged so dramatically from their common ancestor, by evolving

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[2] Released in the UK as *The Rise and Fall of the Third Chimpanzee*.

feathers and flying away – that the key similarities linking birds and crocodiles is dwarfed by the obviously greater suite of features unifying crocodiles and lizards as reptiles. But since crocodiles and lizards are not one another's closest relatives, cladistic classifications prevent us from grouping them together as reptiles, without including birds as well. In other words, we must cast a blind eye to the evolutionary divergence of birds from reptiles and we must only acknowledge the common history of birds and crocodiles, and the early divergence of lizards from them (de Queiroz and Gautier 1992).

In similar fashion, the coelacanth is more closely related to tetrapods, those four-legged land-dwelling creatures, than it is to other fish. Once again privileging ancestry over divergence, a cladistic classification enjoins us not to see two fish in the comparison. Rather, we have to highlight the connection between the coelacanth and tetrapod, and ignore the similarity between the coelacanth and the tuna.

That is precisely the same basis on which Morris Goodman had argued against the category of great apes, privileging the ancestry that chimps and gorillas shared with humans, over the form and mode of life that they shared with orangutans. Once again, the divergence of humans must be erased, like that of birds and of tetrapods, if we are to classify these species cladistically. It is an irony of the history of this science that Goodman was not making the argument as part of a radical reformulation of the principles of scientific classification, as cladism would actually represent in the late 1970s. Goodman was classifying this way in the early 1960s because he did not really understand how it was done (Hagen 2009).

Cladism retrospectively justified him and transformed classificatory practice within anthropological science. That is why if you encountered a paper on human fossils in *Nature* ten years ago, you learned about "hominid" evolution, for the fossil was derived from the lineage of the human family Hominidae, which we classified separately from the apes, Pongidae, because they were so different from us. Today, however, we have to lower the taxonomic difference (to reflect the genetic similarity), so we call them all Hominidae; and we segregate orangutans (the first to branch off) apart from humans, chimps, and gorillas, now in the subfamily Homininae, as hominines. Human uniqueness is then acknowledged at an even lower level, just above the genus, as the Tribe Hominini (Fig. 1). So that new fossil, in the uniquely human lineage, would be a hominin, which is what *Nature* now calls it (Schwartz et al. 2001; Cela-Conde and Ayala 2003; White 2003; Marks 2005).

Family Pongidae	Family Hominidae
Genus *Pongo*	Subfamily Ponginae
Genus *Pan*	Genus *Pongo*
Genus *Gorilla*	Subfamily Homininae
Family Hominidae (“hominids”)	Tribe Panini
Genus *Australopithecus*	Genus *Pan*
Genus *Homo*	Tribe Gorillini
	Genus *Gorilla*
	Tribe Hominini (“hominins”)
	Genus *Australopithecus*
	Genus *Homo*

Fig. 1 - Two classifications of the apes, represented by five genera. Left, the classical 20th-century arrangement, in which humans are distinguished at the Family level. Right, a cladistic classification, in which orangutans are separated at the Subfamily level, and humans are distinguished from African apes at a lower level, the Tribe. In both cases, the position of the extinct genus *Australopithecus* is also shown; other extinct genera are not given. The fossil record of bipeds divergent from the ape stock would be called “hominids” in one case, and “hominins” in the other.

What is significant here is that the disagreement is not over data, either their quality or their meaning. We have known for many decades that humans and apes are very close kin. The issue is, what information is most important to encode in a scientific classification? Obviously we want to encode their evolutionary relationships, but evolution is more than just proximity of descent.

Darwin knew that and the great evolutionary biologists of the 20th century knew that. Indeed, one could argue that adaptive divergence was Darwin’s most significant discovery. The issue is not then “are you for or against evolution,” or “whose data are better.” The issue is what counts as relevant data to the purpose at hand.

As early as 1963, Simpson was drawing the ape ancestries as the biomolecular data seemed to indicate, with the human most closely related to the chimp and gorilla, with the orangutan somewhat distant from all of them. For Simpson the important issue was to note adaptive divergence in a scientific classification. While acknowledging the orangutan as the first to branch off from the others, this fact was outweighed in the realm of scientific classification by the ecological significance of the human, traversing a “zone now unoccupied,” and becoming an utterly different sort of ape. For Simpson (1963) to reduce evolution to simply branching sequences was to restrict evolution to a minimal facet – its vertical component – on which Simpson was himself the world’s authority. But what he could not fathom was why anyone would want to bury its horizontal component, the production of diversity, that is to say, literally “the origin of species.”

Nothing-butism

This reductive approach to the representation of evolution has a venerable history and presents itself in other ways. The same eclecticism of the mid-century synthetic theory that rendered unthinkable the reduction of zoological classification to simply branching sequences, also produced a critique of similarly reductive bio-behavioral narratives of human evolution. As coined by Julian Huxley (1947) and later endorsed by Simpson in his influential 1949 book, *The Meaning of Evolution*, there is an obviously unenlightened school of evolutionists, “the ‘nothing-but’ school . . . who on realizing that man is descended from a primitive ancestor, say that he is only a developed monkey” (Huxley 1947, 20). Once again, the issue is the acknowledgment of difference, the actual product of evolution.

And yet, still to be written were some of the most famous titles of nothing-butism: *The Naked Ape* (1967), *The Imperial Animal* (1971), *The Third Chimpanzee* (1992), *Demonic Males* (1995). And these are, of course, just the Anglophone highlights. In the recent lower tiers, for example, primatologist Craig Stanford calls attention to the “erotic sexuality” of the apes, in which you are presumably exhorted to see your own sex life. “In their emotions, cognition, linguistic ability, homicidal brutality and erotic sexuality, the apes and we are far more alike than we are different” (Stanford 2001, xi). That is, if you happen to find the pink swellings of a female’s bottom irresistibly sexy, do not partake of any manual stimulation at all and have your business finished in fifteen seconds. If I have just described you, then you may well have the sex life of “nothing but” a male chimpanzee.

Similarly, and even more explicitly, an advocate for extending human rights to chimpanzees proclaims: “Chimpanzees make love rather like humans do, but they do not usually run the risk of contracting syphilis” (Ryder 1995, 220). Of course, it is not clear that chimpanzees make love at all, unless you care to use the phrase in a far more cynical way than people of ordinary sensibilities do. The point of this pseudo-evolutionary reductionism, this nothing-butism, is to illustrate what I think is a general principle of science studies: namely, that when apparently intelligent people say ridiculous things, they are generally doing it instrumentally.

In this case, the author wants to soften the reader up to construct a political argument for the extension of human rights to chimps (an issue to which I am not particularly sympathetic, in a world where it is still frustratingly difficult to guarantee human rights to humans). In other cases, the reductive exaggeration may be a rhetorical tactic with which to flog the creationists. But if we have to exaggerate or manufacture the similarities between human and ape to defeat the creationists, then the long-term risks to the credibility of evolutionary science may be far greater than the short-term gains in the name of Darwin.

One of the most under-appreciated anthropological facts is the extent to which the similarities of humans to other animals is universally recognized and appreciated. One of the principal arguments for cannibalism in the Pleistocene, for example, is the fact that early hominid bones (or perhaps hominin bones) have cut marks at the corresponding anatomical places that game animals were butchered. It is hard to escape the implication that our remote ancestors knew that their own bodies matched in some fundamental way the body of their dinner.

Figure 2 is a well-known engraving from Pierre Belon's *Natural History of the Birds*, dating from 1555. Clearly, the similarity of a bird skeleton to a human skeleton was evident long before Darwin rendered it meaningful as a trail of biological history. The correspondences between "human" and "animal" do not need to be exaggerated; they are obvious and have been long known. What is equally significant, however, from the standpoint of evolution, is the fact that in spite of the correspondences, the parts are used quite differently in human and in bird. One of them can flap and fly away, and the other can type.

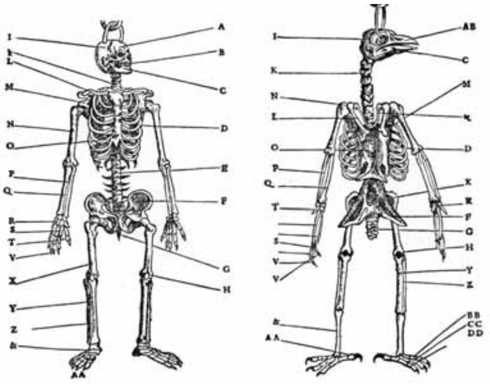

Fig. 2 - Skeletal correspondences of human and bird, from Belon's *On the Nature of Birds*, 1555 (public domain).

Further, when it comes to the primates, the correspondences have been obvious from ancient times. The Roman poet Quintus Ennius was quoted by Cicero on the similarity of human and monkey – how similar we are to that most horrid of beasts – a comment repeated by Linnaeus in *System of Nature* (1758), as he placed us alongside monkeys in the

Order Primates.[3] When the anatomist Edward Tyson had dissected the first chimpanzee to survive the trip from Africa to Europe in 1699, he was so struck by the similarity of its anatomy to ours that he could not believe it was not made to walk the same way that we do. But since he had not actually seen it walk like a person, he drew it standing up with the aid of a cane, which remained with standard depictions of the apes for over a hundred years (Montagu 1943; Gould 1983).

What is significant is how we are <u>not</u> apes. That is what evolution has done – it has made us different from apes, while nevertheless constructing that difference out of roughly the same parts in roughly the same relations. This is what the synthetic theorists appreciated when they derided the reductive approaches of "nothing-butism," cladistic classification, and the viewpoint of hemoglobin: these all fail to acknowledge evolution, namely the fact that humans and apes are different. This is the fact that requires an explanation, which Darwinism provides. To see humans as apes is to see them as <u>not</u> having evolved. It is ignoring or denying evolution; it is playing for the other team.

This is about the interpretation of difference. It can be measured, it can be analyzed, but it is only rendered meaningful in a cultural context that tells you whether the differences are more important than the similarities, or vice versa; and whether you are looking at two slight variants on a single theme, as it were, or two different kinds of beings. Genetics is valuable in a narrow context here, as documenting difference, but it does not help us to make sense of the difference we observe. Indeed in many cases, the observed difference is documented so esoterically that genetics actually obscures or mystifies the relationships, rather than clarifying them.

For example, the same base-for-base DNA comparison that has us at 98.6% identical to chimpanzees must also have us greater than 25% identical to daffodils, simply by virtue of the fact that you have a 1 in 4 chance of matching any DNA base purely at random. But there is only one way that you could see yourself as being over one-quarter daffodil, or a very abnormal daffodil, and that is genetically (Marks 2003).

For another example, a genetic test that explains a client's "ancestry" on the basis of an analysis of mitochondrial DNA (mtDNA) is subtly redefining the concept of ancestry. The client's cells inherited, on the average, 12.5% of their DNA from each great-grandparent, but inherited

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[3] Cicero's quotation from the lost work is "simia quam similis turpissima bestia nobis" in *On the Nature of the Gods*, from 46 BC; Ennius probably wrote those words 150 years earlier. The line is also quoted by Francis Bacon in *The New Organon*, ch. 30 (1620), so it was certainly not obscure.

their mtDNA from only one of the eight great-grandparents. The only way that mtDNA can be considered to represent a client's ancestry is to reduce ancestry to a tiny fraction of the client's genetic constitution, tracking a single mitochondrial ancestor in every generation, while the number of actual ancestors doubles with each past generation.

Race, Genetics and the Voice of Darwin

Genetics and taxonomy intersect in another zone of meaning, namely race. Geneticists cannot resolve race because race is not a genetic entity and thus they do not have access to it, which is why even today geneticists are multi-vocal about it. Races are not human groups that are different, since all human groups are different (Madrigal and Barbujani 2007). Races are human groups that are different in some important and meaningful way. In 2003 this still merited the cover of *Scientific American*, as geneticists squabbled about the ontology of race, assuming that race is a domain to which they have privileged access. But it is not. Race is, like the other issues I have raised here, an issue of classification and, consequently, is a bio-cultural affair. The great mistake of race is the illegitimate reduction of a biocultural reality to a biological one.

That is why, in a cultural context that highlighted differences among Europeans (but not among Asians or Africans), a racial scholar could unproblematically identify one kind of Asian and one kind of African, and several different kinds of Europeans, without bothering to confront the culturally constructed aspects of those findings (Stibbe 1938; Boyd 1963). The simple fact is that you do not have to be a trained physical anthropologist to tell northern Europeans from southern Europeans. The question is whether they represent two natural kinds of people or one. Their passports will tell you they are two kinds of people and the geneticist can measure a correlate of their difference for you and can even reduce the answer to a single number (if you are the kind of person that likes answers in single numbers). What the geneticist cannot answer is the question I actually posed. Are they representatives of two natural kinds of people, or of one natural kind of people?

There is only one natural kind of people; to the extent that humans cluster themselves into bounded groups, those groups are defined culturally, that is to say, in terms of language, beliefs, taboos, dress, passports, and the like. The fairly small proportion of human diversity that is not cultural and can be separately analyzed as biological or genetic variation, is structured principally as polymorphism (that is to say, different populations having the same variants, but in different proportions); second, as geographical gradients or clines; and third, as local idiosyncracies, the result of adaptation to local conditions, or of the vagaries of demographic history (Marks 1995).

The point I am trying to make is that in order to be a comprehensive science of human microevolution, the study of human diversity is necessarily a bio-cultural science. As the synthetic theorists recognized, a discussion of human evolution is, in multiple ways, invariably at least partly a cultural affair. Reducing the human condition to simply its genetic aspects, to the viewpoint of hemoglobin, distorts and misrepresents the nature of the data – whether macroevolutionary, in relation to the apes, or microevolutionary, in relation to one another. Indeed, contemporary genetics is commonly invoked both to negate and to reify race, to the mystification of the concept and the confusion of the public (Leroi 2005; Koenig et al. 2008).

Even if it were not ridiculous to pretend that hemoglobin has a viewpoint and that the meaning of such a viewpoint is uncomplicated and self-evident, one would still need to justify that it is somehow superior to other viewpoints, the justification that Simpson demanded but never received. When it comes to human differences, the standpoint of hemoglobin should be of minimal concern to us as classifiers, because hemoglobin has no comprehension of human rights or of political injustice, yet these are integral to the act of classifying people, which is what race was constructed in the 18th century to achieve. However, to privilege the viewpoint of hemoglobin or of genetics more broadly, because it is imagined to be free of cultural value – that is a problem.

Sadly, geneticists are commonly the scholars least formally trained to grapple with the cultural meaning of their work. The dirty little secret of human genetics is the continuity that existed between American geneticists of the 1920s and German geneticists of the 1930s. The problem is that as cultural beings, geneticists are subject to the same tugs of self-interest and ideology as everyone else is; but their statements carry the weight of scientific authority and that gives them a bit more responsibility in the public arena.

Twenty years ago, James Watson was promoting the Human Genome Project when he told the press, "our fate is in our genes." That is to say, apparently genetics is more or less like astrology, only presumably more accurate. I cannot say whether he actually believed that we have a fate, much less that we had localized it to our cellular nuclei. The important thing is that he got the money. Two decades later, Watson goes off about the innate intelligence of Africans: "There is no firm reason to anticipate that the intellectual capacities of peoples geographically separated in their evolution should prove to have evolved identically. Our wanting to reserve equal powers of reason as some universal heritage of humanity will not be enough to make it so" (Watson 2007, 326; Hunt-Grubbe 2007).

The British kept him on the front page of the newspapers for a week, looking increasingly ghoulish, and then sent him packing (Milmo 2007). Notice, however, that Watson has framed the classical racist sentiment in ostensibly microevolutionary terms. It is not about blacks being innately dumber than whites, but about blacks having evolved to be dumber than whites. Watson has established a polarity whereby evolution and racism are on the same side, and on the other side are political correctness (i.e., the bleeding hearts "wanting to reserve equal powers of reason as some universal heritage of humanity") and presumably creationism too. This is the polarity successfully (if transiently) achieved by Ernst Haeckel in late 19th-century Germany and by Charles Davenport and Henry Fairfield Osborn in early 20th-century America.

So how can we call Watson a racist, when he is merely being an evolutionist? And, rather more importantly, how can we be evolutionists and non-racists simultaneously? The answer lies in fairly normative anthropology and it is the strongest testament to the anti-intellectualism behind Watson's thought, common in the history of scientific racism (Marks 2008) – the speaker positions himself as superseding anthropology, and thus is able to dismiss it, ironically in direct parallel with the modern creationists!

Imaginary naturalistic explanations for real social inequalities have been shot down as regularly as young-earth creationism and are equally frustrating to combat – except that the anti-intellectual interlocutor in this case can claim to speak for science, rather than against it. We do know some reasons for thinking that the intellectual capabilities of humans in different places seem to be more-or-less equivalent and they mostly have to do with conceptions of history and human evolution. The modern scientific racist identifies political or economic dominance in imaginary properties of the gene pools, then explains the political or economic dominance in terms of those imaginary genetic propensities. Social history is thus reduced to genetic karma, a point of view dispatched by social scientists over a century ago (Boas 1901). Moreover, a century of studies of human evolution, immigration, acculturation, and simply the facts of economic and social mobility attest strongly to the opposite of Watson's statement (Marks 1995). As the journalist H.L. Mencken (1927) explained to another generation of readers, "There may be, at the very top, a small class of people whose blood is preponderantly superior and distinguished, and there may be, at the bottom, another class whose blood is almost wholly debased, but both are very small. The folks between are all pretty much alike."

The fact is that the ideas of geneticists about human difference, classification, and microevolution are, and always have been, just as politicized as everybody else's. Certainly times and science change, but the only real mistake we can make is to fail to educate geneticists about the broader aspects – the historical, social, meaningful aspects – of what they do. Geneticists of the 1920s commonly brandished evolutionary racism in the name of social progress and would gladly bludgeon you with Darwin if you chose to dispute their politics. Are there continuities between then and now?

Indeed, there are some continuities. In the first place, then as now, the claim that one's lot in life is dictated by internal factors has considerable political salience. Where many citizens in the modern age see inequality and consider it to derive from injustice (the solution consequently being justice, not genetics), others see the same inequality and consider it to derive from underlying, invisible, natural inequalities, the kind that cannot be ameliorated by social programs. These ideologues acknowledge inequality, but deny that it is unjust. The have-nots, in this view, have what they deserve and government intervention to correct the problem is unwarranted because there is no problem. Unsurprisingly, then as now, such political viewpoints have found much to admire in scientific claims like James Watson's. If we have fates and they are in our genes, then we do not need universal health care, because the illnesses that are not going to kill you do not really matter, and whatever will eventually kill you, you cannot escape. And in the 1920s, real geneticists tolerated all manner of callousness, bigotry, and racism in their ranks, not necessarily because they all believed it, although doubtless some did, but because it was good for business.

Madison Grant, whose book *The Passing of the Great Race* was used as a model by the Nazis, received fine reviews of the book by leading American geneticists and served over them on the Board of Directors of the American Eugenics Society (Anonymous 1933; Woods 1918; Woods 1923; Spiro 2009). Even when they voiced disagreement with him, they knew he was good for business, because he was telling the public that genetics is the most important thing in life. Decades later, the Human Genome Project, led by Watson, discovered the same Faustian bargain – regardless whether it is imaginary genes for homosexuality (Hamer et al. 1993), intelligence (Bouchard et al. 1990), religiosity (Hamer and Copeland 1998), or racial boundaries (Risch et al. 2002; Bamshad et al. 2003; Leroi 2005), however unreal they may actually be (Duster 2006; Koenig et al. 2008). If the claim promotes public interest in genetics and helps maintain funding levels, then geneticists could well imagine their short-term best interests to lie with tolerating it. After all, if you inscribe the modern genomics lexicon upon the premodern discourses of inherited innate abilities, you can make it sound as if it might be true; and better yet, scientific; and even better yet, fundable.

The extravagant and self-interested claims of modern geneticists even has a name: geno-hype (Holtzman 1999). I do not know whether Watson actually believes the things he has said, but all modern geneticists are saddled with baggage from the earlier generation, namely a necessity to reflect upon the question "What is it about me that the most politically disreputable elements of the modern age like so much?" It is a question that transcends time and space, for it is centered on the most conspicuous absence from the genetics curriculum: morality.

Finally, how are things different today in the intersection of genetics and race? There are two interesting things going on in the world of race and genetics, and both involve the convergence of science and capital. First, we are witnessing the creation of racial niche markets for the pharmaceutical industry, which must be accompanied by the reification or naturalization of race itself. We know the major patterns of human variation, however, and race (that is to say, a fairly large, fairly discrete, naturalistic division of the human species) simply violates the known patterns of human diversity as surely as a perpetual motion machine violates the laws of physics. The vanguard was BiDil, a heart medicine directed specifically at African-Americans and which nearly ruined the company because they had greedily overpriced it (Kahn 2004; 2005; 2006; Kahn and Sankar 2006). There are even geneticists actively naturalizing the category Hispanic, in spite of its being manifestly a linguistic category, transcending biology (Montoya 2007; Fullwiley 2008). And second, race is being actively reified with the emergence of new privatized services in what is often called biosociality – the construction of identities and networks of kin from presumptively scientific data (Rabinow 1992; Gibbon and Novas 2008; Lee et al. 2009).

One significant example is again targeted at African-Americans. Some companies now offer to retrieve the kin networks erased by the slave trade, by linking black Americans to Africans who have the same mitochondrial DNA sequences. And that is precisely what they do, but whether they tell you of the Asians you matched, of the other African tribes you probably matched but they have not sampled, or of the thousands of other lineal ancestors you had in the same generation that your mitochondrial ancestor came to America from Africa but are invisible to this analysis, varies from company to company (Bolnick et al. 2007; Nelson 2008). Nor do they tell you how they acquired the African samples – that is to say, whether Africans were actually asked whether they would like to donate a genetic sample so that the company could market it to wealthy African Americans who could then pretend to be their kinsman.

Conclusion

The viewpoint of hemoglobin is a metaphor for the standpoint of genetics and of geneticists. But far from being a disinterested position, it is a highly self-interested one, permeated with intersecting cultural values, economic markets, and social ideologies.

And where is Darwin in all this? Then as now, if one has an anti-democratic political discourse to rationalize by recourse to nature, Darwin's is still the scientific voice one attempts to appropriate for the job. This was true as well of *The Bell Curve*, the best-seller co-authored by a psychologist and a political scientist (Herrnstein and Murray 1994), neither of whom should be able to speak for Darwin with any authority. Moreover, that book also contained a pre-emptive appendix defending the work of the Canadian psychologist J. Philippe Rushton, whose ideas on the divergent roles ostensibly played by natural selection for life-history variables in whites, yellows, and blacks are notorious within mainstream scholarship on human diversity and evolution (Barash 1995; Lieberman et al. 2001; Graves 2002).[4]

The relevant lesson we learn, then, from the first few decades of cultural and historical studies of science, is that it is in the evolutionary biologist's and geneticist's interests to deny the scientific racists the legitimization that they seek from Darwin. Only scientists can make science look bad.

References

Anonymous, 1933, "Reich Opens Race Study: Halle University Course Said To Be Based on American Models", *The New York Times*, 2 August.

Bamshad M.J. et al., 2003, "Human Population Genetic Structure and Inference of Group Membership", *American Journal of Human Genetics*, 72: 578-589.

Barash D., 1995, "Book Review: Race, Evolution, and Behavior", *Animal Behaviour*, 49: 1131-1133.

Boas F., 1901, "The Mind of Primitive Man", *Science*, 13: 281-289.

Bolnick D.A. et al., 2007, "The Science and Business of Genetic Ancestry Testing",

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[4] On the relationship between Rushton and *The Bell Curve*, see Lane 1995. On the connection between racist psychology and James Watson, see Rushton and Jensen 2008.

Science, 318: 399-400.

Bouchard T.T.J. et al., 1990, "Sources of Human Psychological Differences: The Minnesota Study of Twins Reared Apart", *Science*, 250: 223-228.

Bowker G. and Star S., 2000, *Sorting Things out: Classification and Its Consequences*, Cambridge, MA: MIT Press.

Boyd W.C., 1963, "Genetics and the Human Race", *Science*, 140: 1057-1065.

Brigham C., 1923, *A Study of American Intelligence*, Princeton, NJ: Princeton University Press.

Campbell C. et al. (eds), 2006, *Primates in Perspective*, New York: Oxford University Press.

Cela-Conde C.J. and Ayala F.J., 2003, "Genera of the Human Lineage", *Proceedings of the National Academy of Sciences, USA*, 100: 7684-7689.

Deary I., 2008, "Why Do Intelligent People Live Longer?", *Nature*, 456:175.

de Queiroz K. and Gauthier J., 1992, "Phylogenetic Taxonomy", *Annual Review of Ecology and Systematics*, 23: 449-480.

Diamond J., 1992, *The Third Chimpanzee*, New York: Harper Collins.

Dietrich M., 1998, "Paradox and Persuasion: Negotiating the Place of Molecular Evolution within Evolutionary Biology", *Journal of the History of Biology*, 31: 85-111.

Douglas M., 1966, *Purity and Danger: An Analysis of Concepts of Pollution and Taboo*, London: Routledge and Kegan Paul.

Durkheim E. and Mauss M., 1901-1902, "De quelques formes primitives de classification", *L'année sociologique*, 6: 1-72.

Duster T., 1990, *Backdoor to Eugenics*, New York: Routledge.

Duster T., 2006, "The Molecular Reinscription of Race: Unanticipated Issues in Biotechnology and Forensic Science", *Patterns of Prejudice*, 40: 427-441.

Eldredge N. and Cracraft J., 1980, *Phylogenetic Patterns and the Evolutionary Process: Method and Theory in Comparative Biology*, New York: Columbia University Press.

Fullwiley D., 2008, "The Biologistical Construction of Race: 'Admixture' Technology and the New Genetic Medicine", *Social Studies of Science*, 38: 695-735.

Gibbon S. and Novas C. (eds), 2008, *Biosocialities, Genetics and the Social Sciences*, London: Routledge.

Goodman M., 1963, "Man's Place in the Phylogeny of the Primates As Reflected in Serum Proteins". In: Washburn S.L. (ed.), *Classification and Human Evolution*, Chicago: Aldine, 204-234.

Goodman M. and Moore G. William, 1971, "Immunodiffusion Systematics of the Primates. I. The Catarrhini", *Systematic Zoology*, 20: 19-62.

Gould S.J., 1983, "Chimp on the Chain", *Natural History*, 92(12): 18-27.

Hagen J.B., 2009, "Descended from Darwin? George Gaylord Simpson, Morris Goodman, and Primate Systematics". In: Cain J. and Ruse M. (eds), *Descended from Darwin: Insights into the History of Evolutionary Studies, 1900-1970*, Philadelphia: American Philosophical Society, 93-109.

Hamer D. et al., 1993, "A Linkage between DNA Markers on the X Chromosome and Male Sexual Orientation", *Science*, 261: 321-327.

Hamer D. and Copeland P., 1998, *Living with our Genes: Why they Matter More Than you Think*, New York: Doubleday.

Hennig W., 1965, "Phylogenetic Systematics", *Annual Review of Entomology*, 10: 97-116.

Herrnstein R. and Murray C., 1994, *The Bell Curve*, New York: Free Press.

Holtzman N., 1999, "Are Genetic Tests Adequately Regulated?", *Science*, 286: 409.

Hunt-Grubbe C., 2007, "The Elementary DNA of Dr Watson", *The Sunday Times (London)*, 14 October.

Hussey L.M., 1926, "The Blood of the Primates", *American Mercury*, 9: 319-321.

Huxley J., 1947, *Touchstone for Ethics*, New York: Harper and Brothers.

Huxley J., 1957, *New Bottles for New Wine: Essays*, London: Chatto & Windus.

Huxley T., 1863, *Man's Place in Nature*, London: Williams and Norgate.

Ingold T., 2007, *Lines: A Brief History*, London: Routledge.

Isaac N. et al., 2004, "Taxonomic Inflation: Its Influence on Macroecology and Conservation", *Trends in Ecology and Evolution*, 19: 464-469.

Jaroff L., 1989, "The Gene Hunt", *Time Magazine*, 20 March: 62-67.

Kahn J., 2004, "How a Drug Becomes 'Ethnic': Law, Commerce, and the Production of Racial Categories in Medicine", *Yale Journal of Health Policy, Law, and Politics*, 4: 1-46.

Kahn J., 2005, "Misreading Race and Genomics after BiDil", *Nature Genetics*, 37: 655-656.

Kahn J., 2006, "Race, Pharmacogenomics, and Marketing: Putting BiDil in Context", *American Journal of Bioethics*, 6: 1-5.

Kahn J. and Sankar P., 2006, "Being Specific About Race-specific Medicine", *Health Affairs*, 25: 375-377.

Koenig B.A. et al. (eds), 2008, *Revisiting Race in a Genomic Age*, Piscataway, NJ: Rutgers University Press.

Krings M. et al., 1997, "Neandertal DNA Sequences and the Origin of Modern Humans", *Cell*, 90: 19-30.

Lane C., 1995, "The Tainted Sources of 'The Bell Curve'", *New York Review of Books*, 1 December: 14-19.

Leroi A.F., 2005, "A Family Tree in Every Gene", *The New York Times*, 14 March.

Lee S. et al., 2009, "The Illusive Gold Standard in Genetic Ancestry Testing", *Science*, 325:338.

Lieberman L., 2001, "How 'Caucasoids' got Such Big Crania and Why they Shrank: From Morton to Rushton", *Current Anthropology*, 42: 69-95.

Madrigal L. and Barbujani G., 2007, "Partitioning of Genetic Variation in Human Populations and the Concept of Race". In: Crawford M.H. (ed.), *Anthropological Genetics: Theory, Methods and Applications*, New York: Cambridge University Press, 19-37.

Marks J., 2002, *What It Means to Be 98% Chimpanzee*, Berkeley: University of California Press.

Marks J., 2003, "98% Chimpanzee and 35% Daffodil: The Human Genome in Evolutionary and Cultural Context". In: Goodman A., Heath D. and Lindee M.S. (eds), *Genetic Nature / Culture: Anthropology and Science Beyond the*

Two-culture Divide, Berkeley, CA: University of California Press, 132-152.

Marks J., 2005, "Phylogenetic Trees and Evolutionary Forests", *Evolutionary Anthropology*, 14: 49-53.

Marks J., 2007, "Anthropological Taxonomy As both Subject and Object: The Consequences of Descent from Darwin and Durkheim", *Anthropology Today*, 23: 7-12.

Marks J., 2008, "Scientific Racism, History of". In: Moore J.H. (ed.), *The Encyclopedia of Race and Racism,* Volume 3, Detroit, MI: Macmillan Reference USA, 1-16.

Milmo C., 2007, "Fury at DNA Pioneer's Theory: Africans Are Less Intelligent Than Westerners", *The Independent*, 17 October.

Montagu M.F.A., 1943, "Edward Tyson, M.D., F.R.S., 1650-1708 and the Rise of Human and Comparative Anatomy in England", *Memoirs of the American Philosophical Society*, 20.

Montoya M., 2007, "Bioethnic Conscription: Genes, Race and Mexicana/o Ethnicity in Diabetes Research", *Cultural Anthropology*, 22: 94-128.

Nelkin D. and Lindee M. S., 1995, *The DNA Mystique: The Gene as Cultural Icon*, New York: Freeman.

Nelson A., 2008, "Bio Science: Genetic Genealogy Testing and the Pursuit of African Ancestry", *Social Studies of Science*, 38: 759-783.

Nuttall G.H.F., 1904, *Blood Immunity and Blood Relationship*, Cambridge: Cambridge University Press.

Rabinow P., 1992, "Artificiality and Enlightenment: From Sociobiology to Biosociality". In: Crary J. and Kwinter J. (eds), *Incorporations*, New York: Zone, 234-252.

Richard A.F., 1985, *Primates in Nature*, San Francisco: W.H. Freeman.

Risch N. et al., 2002, "Categorization of Humans in Biomedical Research: Genes, Race, and Disease", *Genome Biology*, 3: comment 2007.2001-2007.2012.

Rushton J.P. and Jensen A.R., 2008, "James Watson's Most Inconvenient Truth: Race Realism and the Moralistic Fallacy", *Medical Hypotheses*, 71: 629-640.

Ryder R.D., 1993, "Sentientism". In: Cavalieri P. and Singer P. (eds), *The Great Ape Project: Equality Beyond Humanity*, New York: St. Martin's, 220-222.

Schwartz J.H. et al., 2001, "Systematics of 'Humankind'", *Evolutionary Anthropology*, 10: 1-3.

Simpson G.G., 1945, "The Principles of Classification and a Classification of Mammals", *Bulletin of the American Museum of Natural History*, 85: 1-350.

Simpson G.G., 1949, *The Meaning of Evolution*, New Haven: Yale University Press.

Simpson G.G., 1961, *Principles of Animal Taxonomy*, New York: Columbia University Press.

Simpson G.G., 1963, "The Meaning of Taxonomic Statements". In: Washburn S.L. (ed.), *Classification and Human Evolution*, Chicago: Aldine, 1-31.

Simpson G.G., 1964, "Organisms and Molecules in Evolution", *Science*, 146: 1535-1538.

Simpson G.G., 1971, "Remarks on Immunology and Catarrhine Classification", *Systematic Zoology*, 20: 369-370.

Smuts B. et al. (eds), 1987, *Primate Societies*, Chicago: University of Chicago Press.

Sommer M., 2008, "History in the Gene: Negotiations between Molecular and Organismal Anthropology", *Journal of the History of Biology*, 41: 473-528.

Spiro J., 2009, *Defending the Master Race: Conservation, Eugenics, and the Legacy of Madison Grant*, Burlington, VT: University of Vermont Press.

Stanford C., 2001, *Significant Others*, New York: Basic Books.

Stibbe E., 1938, *An Introduction to Physical Anthropology*, London: E. Arnold.

Strier K.B., 2006, *Primate Behavioral Ecology, 3ª ed.*, New York: Allyn and Bacon.

Suárez-Díaz E. and Anaya-Muñoz V., 2008, "History, Objectivity, and the Construction of Molecular Phylogenies", *Studies in History and Philosophy of Biology and Biomedical Science*, 39: 451-468.

Tattersall I., 2007, "Madagascar's Lemurs: Cryptic Diversity or Taxonomic Inflation?", *Evolutionary Anthropology*, 16: 12-23.

Washburn S.L., 1978, "Human Behavior and the Behavior of Other Animals", *American Psychologist*, 33: 405-418.

Watson J., 2007, *Avoid Boring People*, New York: Alfred A. Knopf.

White T.D., 2003, "Early Hominids – Diversity or Distortion?", *Science*, 299: 1994-1997.

Wildman D.E. et al., 2003, "Implications of Natural Selection in Shaping 99.4% Nonsynonymous DNA Identity between Humans and Chimpanzees: Enlarging Genus *Homo*", *Proceedings of the National Academy of Sciences, USA*, 100: 7181-7188.

Wiley E.O., 1981, *Phylogenetics: The Theory and Practice of Phylogenetic Systematics*, New York: John Wiley.

Woods F.A., 1918, "The Passing of the Great Race, 2ª ed. (review)", *Science*, 48: 419-420.

Woods F.A., 1923, "A Review of Reviews of Madison Grant's *Passing of the Great Race*", *Journal of Heredity*, 14: 93-95.

Zuckerkandl E., 1963, "Perspectives in Molecular Anthropology". In: Washburn S.L. (ed.), *Classification and Human Evolution*, Chicago: Aldine, 243-272.