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Evolution of Long Head Hair in Humans

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Abstract

In many humans, head hair can grow to a much greater length than hair elsewhere on the body. This is a "derived" form that evolved outside Africa and probably in northern Eurasia. The ancestral form, which is frizzier and much shorter, survives in sub-Saharan Africans and in other groups whose ancestors never left the tropics. This original hair form is nonetheless relatively straight and silky during infancy. Head hair thus seems to have lengthened in two stages: 1) retention of the infant hair form at older ages; and 2) further lengthening to mid-back and even waist length. These changes seem to have gone farther in women, whose head hair is thicker and somewhat longer. The most popular evolutionary explanations are: 1) relaxation of selection for short hair; and 2) sexual selection for women with long hair. Neither hypothesis is satisfactory. The first one cannot explain why head hair lengthened so dramatically over so little time. The second hypothesis suffers from the assumption that some populations have remained naturally short-haired because they consider long-haired women undesirable. Almost the opposite is true in traditional African cultures, which have a long history of lengthening and straightening women's hair. It is argued here that sexual selection produced different outcomes in different populations not because standards of beauty differed but because the intensity of sexual selection differed. In the tropical zone, sexual selection acted more on men than on women and was thus too weak to enhance desirable female characteristics. This situation reversed as ancestral humans spread northward into environments that tended to limit polygyny while increasing male mortality. Because fewer men were available for mating, women faced a more competitive mate market and were selected more severely.

Keywords

Head Hair, Human Evolution, Sexual Selection

1. Introduction

In many humans, head hair can grow to a much greater length than hair elsewhere on the body. This lengthening

has been made possible by several evolutionary changes: faster rate of growth, longer growing phase, higher density, and greater resistance to physical damage (Khumalo, 2005; Loussouarn, 2001; Loussouarn et al., 2005). Such changes have gone farther in some human groups than in others. Darwin noted "the extraordinary difference in the length of the hair in the different races; in the negro the hair forms a mere curly mat; with us it is of great length, and with the American natives it not rarely reaches to the ground" (Darwin, 1936 [1888]: p. 906).

Long head hair is the "derived" form. It evolved in humans whose ancestors left Africa some 60,000 years ago, particularly in those groups that are native to northern Eurasia or were initially and then back-migrated to the tropics, such as the Austronesians in Southeast Asia and Oceania and the Amerindians in the tropical New World.

The ancestral hair form is frizzier and much shorter. It survives in sub-Saharan Africans and in other groups whose ancestors never left the tropics, notably the Andamanese, the Semang, the Aeta, and the natives of Australia and Papua New Guinea. The latter groups are descended from humans who spread out of Africa along the southern route into South and Southeast Asia.

The ancestral hair form is, however, relatively long and straight during the first year of life: "[...] the majority of African babies are not born with springy tight curls, the African child at birth is either bald or has silky loose curls similar to the Jheri curls" (Ajose, 2012). African adults can revert to the loose and silky hair of infancy as a result of some illnesses: AIDS, rheumatoid arthritis, systemic lupus erythematosus, pulmonary tuberculosis with cachexia, and Behçet's disease (Ajose, 2012). No one knows what biochemical process is disrupted by these diseases, but it is plausible that a similar disruption of genetic origin, i.e., a loss-of-function allele, was the first stage in the evolution of long head hair in normal adults. It is doubtful that this first stage occurred in sub-Saharan Africa. Although long head hair exists in healthy adults of some sub-Saharan groups, like the Fulani, these groups also have considerable genetic admixture of North African origin.

As ancestral humans spread out of Africa and northward, the infant hair form must have persisted into adulthood while becoming ever longer and straighter, eventually reaching down to the waist if left uncut. This evolutionary trajectory has gone farther in women, their scalp hairs having a greater mean diameter and hence more volume, even in the shorter-haired New Guineans (Walsh & Chapman, 1966). Hair growth rate and final length are also somewhat greater in women than in men (Sigler, 2011: p. 13). Furthermore, men tend to lose their head hair, often as early as their 20s. In general, head hair growth is under stronger hormonal inhibition in men than in women (Kondo et al., 1990). The capacity to grow long head hair is thus sex-linked, albeit weakly.

In sum, it looks like human head hair initially grew longer as a result of adults keeping the infant hair form. The same pressure of selection then favored ever longer and straighter hair, eventually producing the extreme lengths we can see today. This selection pressure seems to have acted primarily on women and then secondarily spilled over onto men, perhaps because most of the genes in question are not sex-linked, like most genes.

To varying degrees, other visible infant traits (i.e., smooth, hairless, and fair skin and a more childlike face shape) have pursued this kind of evolutionary trajectory, i.e., the infant phenotype has become the adult phenotype, and more so in women than in men. In some cases, this trajectory has also gone farther in those human groups that entered northern Eurasia.

One case is face shape. Infants have a less prognathic face, and this infant trait has been retained by adults to varying degrees. A study of familial transmission has shown that reduction of prognathism displays clear signs of Mendelian inheritance and is expressed much more in women than in men (Cruz et al., 2008). As with adult head hair, adult face shape apparently became more infant-like in tandem with the spread of humans into northern Eurasia.

Another case is skin pigmentation. Humans are born pale even in very dark-skinned populations, and this infant trait is to some degree imitated by the female adult. Women are fairer than men, although this sex difference is smaller in very fair- and very dark-skinned populations, probably because of "ceiling" and "floor" effects (Frost, 2007). This sex difference is of hormonal origin and is unconsciously used for sex recognition, being a more important visual cue than face shape (Frost, 2011).

As humans spread into northern Eurasia, they became fairer-skinned, particularly in Europe. This change is usually attributed to weaker sunlight, which either decreased selection for dark skin (protection against solar UV being less necessary) or increased selection for light skin (to maintain vitamin D synthesis). Neither reason explains why this skin lightening went farther in Europe than in northern Asia. Also unexplained is its relative rapidity. If white skin is an adaptation to weaker sunlight, we need to explain why Europeans remained dark-skinned long after their ancestors had entered Europe some 40,000 years ago. Beleza et al. (2013) place the whitening of European skin between 19,000 and 11,000 years ago, and Canfield et al. (2014) between 19,200

and 7600 years ago (Frost, 2014).

2. Current Explanations

Why did long head hair evolve? Explanations are still at the level of hypotheses. To date, we have the aquatic ape hypothesis, the index of health hypothesis, the relaxation of selection hypothesis, and the sexual selection hypothesis.

2.1. Aquatic Ape Hypothesis

The aquatic ape hypothesis was first proposed by the German pathologist Max Westenhöfer in 1942 and later by the English marine biologist Alister Hardy in 1960. It is best known to the public through the writings of Elaine Morgan, who argued that head hair lengthened during an aquatic phase of human evolution that forced infants to hang on to their mother's hair while in the water "and if the hair floated around her for a yard or so on the surface [the infant] wouldn't have to make so accurate a beeline in swimming towards her" (Morgan, 1972: p. 36).

Yard-long hair did not yet exist when modern humans began to spread out of Africa. Between then and now, there is no evidence of humans going through an aquatic stage. Admittedly, this explanation of long head hair is of marginal importance in the aquatic ape hypothesis, which itself has been marginal in the scientific community.

2.2. Index of Health Hypothesis

Some evolutionary psychologists have argued that long head hair improved mating success among ancestral humans by acting as a visible marker of health and hence mate quality (Hinsz et al., 2001; Mesko & Bereczkei, 2004). Again, no mention of the non-universality of long head hair. Does health matter less in the tropics?

2.3. Relaxation of Selection Hypothesis

Some anthropologists believe that head hair lengthened in non-tropical environments through relaxation of natural selection. According to this hypothesis, natural selection intervenes to keep head hair short and frizzy in the tropics as a means to dissipate body heat and keep the brain from overheating. As humans moved into colder climates, this selection pressure would have weakened and caused head hair to become more variable in length and texture (Jablonski & Chaplin, 2014).

Yet relaxation of selection could hardly have caused head hair to lengthen so dramatically over so little evolutionary time. Modern humans entered northern Eurasia some 40,000 years ago, and the actual timeframe for this evolutionary change must have been much less. Dramatic change can occur within such a timeframe, but there must be a strong selection pressure to drive it. For example, a variant at the *EDAR* gene causes head hair to thicken in Asian populations and attests to a strong selection pressure that probably operated not long before 10,000 years ago (Fujimoto et al., 2008).

Moreover, if relaxation of selection caused head hair to lengthen in cold climates, why do we see no lengthening and thickening of body hair? Although the natives of northern latitudes in Asia and North America have very long head hair, they actually have less body hair than do Southwest Asians, who live in a much warmer climate.

2.4. Sexual Selection Hypothesis

Charles Darwin was the first to argue that human head hair lengthened through the action of sexual selection, specifically sexual selection of women: "we know that long tresses are now and were formerly much admired, as may be observed in the works of almost every poet; St. Paul says, if a woman have long hair, it is a glory to her." Darwin did not elaborate, other than to say that long head hair must be a "late acquisition" in our species. He also mentioned that some monkeys have "ornamental tufts of hair about the head," which he likewise attributed to sexual selection (Darwin, 1936 [1888]: p. 906).

Darwin explained that long head hair arose in some human groups but not in others because "each race would possess its own innate ideal standard of beauty" (Darwin, 1936 [1888]: p. 890). This explanation raises more questions than it answers. Why would humans stop preferring short frizzy hair and begin to prefer long straight hair when they left the tropics? And did such a change in preference really take place?

3. A Second Look at the Sexual Selection Hypothesis

The last two hypotheses have garnered the most support, with the most popular one probably being the third. Although the last one has Darwin's endorsement, it suffers from widespread distrust due to attempts to use sexual selection to explain almost any human characteristic. All too often, such explanations cannot be tested or falsified. Most academics with an opinion seem to think of long head hair as being somehow an adaptation to cold climates.

Nonetheless, the sexual selection hypothesis still holds promise. Head hair looks ornamental and is located where visual attention is strongest, given the key role of the eyes and the mouth in communication and identification. This hypothesis is vulnerable, however, in its premise that long head hair is absent in those regions where it has been undesirable. Such a premise actually has little supporting evidence.

First, there is much evidence that notions of human beauty vary relatively little within the human species. Children as young as 2 - 3 months old look longer at female faces that adults consider attractive, and this finding is as true when the children are white and look at the faces of black women who seem attractive to black men as it is when the children are black and look at the faces of white women who seem attractive to white men (Langlois et al., 2000; Langlois et al., 1991; Langlois et al., 1987; Langlois & Stephen, 1977). Similar findings have been found with adults of various racial/ethnic origins (Bernstein et al., 1982; Cunningham et al., 1995; Maret, 1983; Miller, 1969; Perrett et al., 1994). Our notions of beauty vary much less than our ability to use them as criteria for mate choice, this ability being constrained by situations and cultural rules that vary from one place to another.

On the specific subject of head hair, there is much ethnographic evidence that long female hair is appreciated even among people whose hair is naturally short and frizzy, such as the Mende of Sierra Leone:

> "Big hair," "plenty of hair," "much hair"—West African communities, including Mende, admire a fine head of long, thick hair on a woman. Both these elements are crucial: thickness and length. Thickness equals increase in the number of individual strands, and the length is proof of strength. Growing such luxuriant hair requires a Mende woman's patience and care. Because a man's hair is kept shaved or cut close to the scalp, people say that "men don't have hair." Beautiful hair thus is a distinctly female trait; the more of it, the more feminine the woman (Boone, 1986: p. 184).

Long female hair has been admired for so long among the Mende that this admiration appears in their myths and folk tales:

> It is known among Mende that all the "water people," angels, have marvelous hair. The mermaid *Tingoi* is known by her long, wavy hair and her glamorous habit of dressing it with a golden comb while seated on a rock. A little girl with especially long hair is feared to be in danger of drowning because she will be very attractive to the "water people,"who may think she is one of them and wish her to join them (Boone, 1986: p. 192).

Sub-Saharan Africans in general have a long history of lengthening and straightening female head hair:

> [...] probably the earliest form of hair straightening was the molding of hair into shapes using various clays and mud (e.g., indicating the station of a married woman among the Zulu's). [...] Hair was also lengthened with fibers and grasses, much as is done for braids with synthetic extensions nowadays. Although small decorative comb-like structures have been discovered with archeological finds, it is not clear whether original Africans combed their hair or if these implements were purely decorative (Khumalo, 2008).

Hairdressing appears to be ancient in many sub-Saharan African societies, as shown by artefacts that predate European contact (Sieber & Herreman, 2000). Furthermore, ethnographers and other observers report that African women traditionally lengthened their head hair with vegetable fiber, sinew, or hair from relatives to enhance their beauty (Bernolles, 1966; Sieber & Herreman, 2000). Among African Americans, women have braided and threaded their hair from an early date, whereas men have often shaved their heads, apparently because head hair is implicitly and explicitly deemed to be a female trait (White & White, 1995).

4. Sexual Selection with Geographic Differences in Intensity

To the extent that sexual selection has acted differently in different populations, the reason may simply be that it has been stronger in some than in others (Frost, 2008).

As ancestral humans spread out of the tropics, women could less easily gather food during the cold season and had to rely more on men to get food for themselves and their children (Hoffecker, 2002: p. 8; Kelly, 1995: pp. 262-270). Conversely, men could less easily afford polygyny, with the result that only the ablest hunters could support additional wives. At the same time, men had to hunt over larger areas because the density of wildlife was lower. Hunting thus took a heavier toll on the lives of young men.

For these two reasons—less polygyny and more hunting deaths—the non-tropical zone tended to have a lower ratio of men to women on the mate market. More women had to compete for fewer men, thus shifting the pressure of sexual selection from the latter to the former. Women were now selected for ornamental traits that could make them more visible and desirable on the mate market. Even small incremental improvements could help. The situation was like that of actresses lining up for a part in a movie. When all of the candidates seem perfect, even tiny details matter.

This intensification of sexual selection would have caused head hair to lengthen primarily in women and secondarily in men. Most societies consider a greater amount of head hair to be an appropriate female trait (Synnott, 1987). Even in naturally shorter-haired New Guineans, the scalp hairs of women display a higher mean diameter and hence more volume (Walsh & Chapman, 1966). Thus, even from the outset of this evolutionary trajectory, there was a tendency to associate longer head hair with femininity, and this perceptual bias would have influenced men in their choice of mates.

5. Sexual Selection in Northern Eurasia

To recapitulate, polygyny decreased and male mortality increased among early modern humans along a south-to-north gradient with an end point in northern Eurasia, where women had the fewest opportunities for food gathering and men the longest hunting distances. It is under such conditions that sexual selection of women is at a maximum.

This end point, however, did not remain unchanged during the time of early modern humans. As the climate deteriorated after 30,000 BP, much of northern Eurasia became open steppe-tundra, and the dynamics of sexual selection changed accordingly.

The pressure of sexual selection thus varied in intensity not only over space but also over time. Early northern Eurasians seem to have undergone two phases of intensity: an initial, moderate phase and a second, stronger one.

5.1. Initial Phase of Sexual Selection (after 40,000 BP)

Sexual selection of women first intensified with the entry of humans into northern Eurasia some 40,000 years ago, at a time when northern climates were colder and drier than they are today, though not as extreme as they would be later on.

It was during that time that head hair probably began to lengthen, reaching current lengths by 15,000 to 12,000 BP, when ancestral Amerindians began to penetrate North America. If we accept the argument, advanced by Rogers (1986), that western Eurasians (ancestral Europeans) and eastern Eurasians (ancestral East Asians and Amerindians) became reproductively isolated from each other during the glacial maximum c. 20,000-15,000 BP, head hair must have already reached current lengths by then, since the descendants of both groups can grow very long hair.

5.2. Second Phase of Sexual Selection (after 25,000 BP)

As the climate grew colder after 30,000 BP and especially after 25,000 BP, women would have undergone even stronger sexual selection, particularly within the steppe-tundra that formed across northern Eurasia from western France to Beringia. This environment offered almost no opportunities for food gathering and made women and children dependent on meat procured by men through hunting, thereby raising the cost of polygyny for men. Meanwhile, men had to pursue herds of game animals over long distances, thereby increasing male mortality and hence male scarcity on the mate market.

Meanwhile, the steppe-tundra became split into western and eastern halves (Rogers, 1986). This division was physical (due to ice sheets moving south and large glacial lakes forming along the Ob), climatic, demographic and, eventually, genetic. The eastern half was colder and drier, being farther north and farther from the Atlantic's moderating influence. It thus supported a smaller human population, which offered fewer mutations for

sexual selection to act upon. When such mutations did arise they could be lost, given the smallness of the population and the risk of some groups dying out, particularly at the peak of the glacial maximum (Goebel, 1999; Graf, 2009a; Graf, 2009b). This view is supported by ancient DNA from 24,000 BP and 17,000 BP in south-central Siberia, which has much more affinity with present-day Europeans and Amerindians than with present-day Siberians, who seem to be largely the product of repeopling from the south near the end of the ice age (Maanasa et al., 2013).

In the western half, essentially the plains of northern and eastern Europe, the steppe-tundra was warmer and moister and could support a relatively large human population even during the glacial maximum (Hoffecker, 2002: pp. 3, 17). Useful mutations could accumulate, including some for novel hair colors. It was this later and stronger phase of sexual selection that made head hair even more ornamental by creating a diverse palette of hues, not only black but also brown, red, and blonde (Frost, 2006; Frost, 2014).

6. Conclusion

Human head hair begs to be explained. On the one hand, it can reach extreme lengths unlike anything in other primates. On the other hand, this lengthiness is not universal even within our young species and thus seems to be recent. The selection pressure must have therefore been very strong.

The most promising explanation is sexual selection, but not as originally proposed by Darwin. Sexual selection has varied within our species not because it has been guided by different standards of beauty but rather because it has varied in intensity. In the tropical zone, it was weak and focused more on men than on women. As humans spread north, the dynamics of sexual selection changed as fewer men became available for mating, partly because men could less easily afford polygyny and partly because women began to outnumber men through sex differences in mortality.

Thus, colder climates did drive the evolution of longer head hair, but indirectly through an intensification of sexual selection of women. Long head hair seems to be an ornamental female trait that developed through a selection pressure that acted primarily on women and then secondarily spilled over onto men.

Also begging to be explained is another aspect of human head hair: its length and silkiness began as infant traits. There seems in fact to be a pattern of visible infant traits being "borrowed" by adult women under the pressure of sexual selection. Such traits attract the interest of adults while stimulating feelings of nurturance and protection. This is a useful behavioral response not only for infants but also for adult women when competing for attention from prospective mates.

Evolutionary psychologists may reply that sexual selection favors only those traits that provide information on female health and fertility. This view ignores the possibility of manipulation of one sex by the other. Sexual selection, like natural selection, will favor anything that evokes interest from the opposite sex, as long as this interest is sufficiently positive and favorable.

References

Ajose, F. O. A. (2012). Diseases That Turn African Hair Silky. *International Journal of Dermatology, 51,* 12-16. http://dx.doi.org/10.1111/j.1365-4632.2012.05556.x

Beleza, S., Murias dos Santos, A., McEvoy, B., Alves, I., Martinho, C., Cameron, E., Shriver, M. D., Parra, E. J., & Rocha, J. (2013). The Timing of Pigmentation Lightening in Europeans. *Molecular Biology and Evolution, 30,* 24-35. http://dx.doi.org/10.1093/molbev/mss207

Bernolles, J. (1966). *Permanence de la parure et du masque africains*. Paris: G.P. Maisonneuve et Larose.

Bernstein, I. H., Lin, T., & McClellan, P. (1982). Cross- vs. within-Racial Judgments of Attractiveness. *Perception & Psychophysics, 32,* Article ID: 495503. http://dx.doi.org/10.3758/BF03204202

Boone, S. A. (1986). *Radiance from the Waters: Ideals of Feminine Beauty in Mende Art*. New Haven and London: Yale University Press.

Canfield, V. A., Berg, A., Peckins, S., Wentzel, S. M., Ang, K. C., Oppenheimer, S., & Cheng, K. C. (2014). Molecular Phylogeography of a Human Autosomal Skin Color Locus under Natural Selection. *G3-Genes, Genomes, Genetics, 3,* 2059-2067.

Cruz, R. M., Krieger, H., Ferreira, R., Mah, J., Hartsfield Jr., J., & Oliveira, S. (2008). Major Gene and Multifactorial Inheritance of Mandibular Prognathism. *American Journal of Medical Genetics Part A, 146A,* 71-77. http://dx.doi.org/10.1002/ajmg.a.32062

Cunningham, M. R., Roberts, A. R., Barbee, A. P., Druen, P. B., & Wu, C. H. (1995). "Their Ideas of Beauty Are, on the Whole, the Same as Ours": Consistency and Variability in the Cross-Cultural Perception of Female Physical Attractiveness. *Journal of Personality and Social Psychology, 68,* 261-279. http://dx.doi.org/10.1037/0022-3514.68.2.261

Darwin, C. (1936) [1888]. *The Descent of Man and Selection in Relation to Sex* (2nd ed.). The Modern Library, New York: Random House.

Frost, P. (2006). European Hair and Eye Color—A Case of Frequency-Dependent Sexual Selection? *Evolution and Human Behavior, 27,* 85-103. http://dx.doi.org/10.1016/j.evolhumbehav.2005.07.002

Frost, P. (2007). Comment on Human Skin-Color Sexual Dimorphism: A Test of the Sexual Selection Hypothesis. *American Journal of Physical Anthropology, 133,* 779-781. http://dx.doi.org/10.1002/ajpa.20555

Frost, P. (2008). Sexual Selection and Human Geographic Variation. Special Issue: Proceedings of the 2nd Annual Meeting of the NorthEastern Evolutionary Psychology Society. *Journal of Social, Evolutionary, and Cultural Psychology, 2,* 169-191. http://dx.doi.org/10.1037/h0099346

Frost, P. (2011). Hue and Luminosity of Human Skin: A Visual Cue for Gender Recognition and Other Mental Tasks. *Human Ethology Bulletin, 26,* 25-34.

Frost, P. (2014). The Puzzle of European Hair, Eye, and Skin Color. *Advances in Anthropology, 4,* 78-88. http://dx.doi.org/10.4236/aa.2014.42011

Fujimoto, A., Ohashi, J., Nishida, N., Miyagawa, T., Morishita, Y., Tsunoda, T., Kimura, R., & Tokunaga, K. (2008). A Replication Study Confirmed the *EDAR* Gene to Be a Major Contributor to Population Differentiation Regarding Head Hair Thickness in Asia. *Human Genetics, 124,* 179-185. http://dx.doi.org/10.1007/s00439-008-0537-1

Goebel, T. (1999). Pleistocene Human Colonization of Siberia and Peopling of the Americas: An Ecological Approach. *Evolutionary Anthropology, 8,* 208-227. http://dx.doi.org/10.1002/(SICI)1520-6505(1999)8:6<208::AID-EVAN2>3.0.CO;2-M

Graf, K. E. (2009a). "The Good, the Bad, and the Ugly": Evaluating the Radiocarbon Chronology of the Middle and Late Upper Paleolithic in the Enisei River Valley, South-Central Siberia. *Journal of Archaeological Science, 36,* 694-707. http://dx.doi.org/10.1016/j.jas.2008.10.014

Graf, K. E. (2009b). Modern Human Colonization of the Siberian Mammoth Steppe: A View from South-Central Siberia. In M. Camps, & P. Chauhan (Eds.), *Sourcebook of Paleolithic Transitions* (pp. 479-501). New York: Springer Science & Business Media. http://dx.doi.org/10.1007/978-0-387-76487-0_32

Hinsz, V. B., Matz, D. C., & Patience, R. A. (2001). Does Women's Hair Signal Reproductive Potential? *Journal of Experimental Social Psychology, 37,* 166-172. http://dx.doi.org/10.1006/jesp.2000.1450

Hoffecker, J. F. (2002). *Desolate Landscapes. Ice-Age Settlement in Eastern Europe.* New Brunswick: Rutgers University Press.

Jablonski, N., & Chaplin, G. (2014). The Evolution of Skin Pigmentation and Hair Texture in People of African Ancestry. *Dermatologic Clinics, 32,* 113-121. http://dx.doi.org/10.1016/j.det.2013.11.003

Kelly, R. L. (1995). *The Foraging Spectrum. Diversity in Hunter-Gatherer Lifeways.* Washington DC: Smithsonian Institution Press.

Khumalo, N. P. (2005). African Hair Morphology: Macrostructure to Ultrastructure. *International Journal of Dermatology, 44,* 10-12. http://dx.doi.org/10.1111/j.1365-4632.2005.02805.x

Khumalo, N. P. (2008). On the History of African Hair Care: More Treasures Await Discovery. Letter to the Editor, *Journal of Cosmetic Dermatology, 7,* 231. http://dx.doi.org/10.1111/j.1473-2165.2008.00396.x

Kondo, S., Hozumi, Y., & Aso, K. (1990). Organ Culture of Human Scalp Hair Follicles: Effect of Testosterone and Oestrogen on Hair Growth. *Archives of Dermatological Research, 282,* 442-445. http://dx.doi.org/10.1007/BF00402619

Langlois, J. H., & Stephan, C. (1977). The Effects of Physical Attractiveness and Ethnicity on Children's Behavioral Attributions and Peer Preferences. *Child Development, 48,* 1694-1698. http://dx.doi.org/10.2307/1128538

Langlois, J. H., Kalakanis, L., Rubenstein, A. J., Larson, A., Hallam, M., & Smoot, M. (2000). Maxims or Myths of Beauty? A Meta-Analytic and Theoretical Review. *Psychological Bulletin, 126,* 390-423. http://dx.doi.org/10.1037/0033-2909.126.3.390

Langlois, J. H., Ritter, J. M., Roggman, L. A., & Vaughn, L. S. (1991). Facial Diversity and Infant Preferences for Attractive Faces. *Developmental Psychology, 27,* 79-84. http://dx.doi.org/10.1037/0012-1649.27.1.79

Langlois, J. H., Roggman, L. A., Casey, R. J., & Ritter, J. M. (1987). Infant Preferences for Attractive Faces: Rudiments of a Stereotype? *Developmental Psychology, 23,* 363-369. http://dx.doi.org/10.1037/0012-1649.23.3.363

Loussouarn, G. (2001). African Hair Growth Parameters. *British Journal of Dermatology, 145,* 294-297. http://dx.doi.org/10.1046/j.1365-2133.2001.04350.x

Loussouarn, G., El Rawadi, C., & Genain, G. (2005). Diversity of Hair Growth Profiles. *International Journal of Dermatology, 44,* 6-9. http://dx.doi.org/10.1111/j.1365-4632.2005.02800.x

Maanasa, R., Skoglund, P., Graf, K.E., Metspalu, M., Albrechtsen, A., Moltke, I., Rasmussen, S., Stafford Jr., T. W., Orlando, L., Metspalu, E., Karmin, M., Tambets, K., Roots, S., Mägi, R., Campos, P. F., Balanovska, E., Balanovsky, O., Khusnutdinova, E., Litvinov, S., Osipova, L. P., Fedorova, S. A., Voevoda, M. I., DeGiorgio, M., Sicheritz-Ponten, T., Brunak, S., Demeshchenko, S., Kivisild, T., Villems, R., Nielsen, R., Jakobsson, M., & Willerslev, E. (2013). Upper Palaeolithic Siberian Genome Reveals Dual Ancestry of Native Americans. *Nature, 505,* 87-91. http://dx.doi.org/10.1038/nature12736

Maret, S. M. (1983). Attractiveness Ratings of Photographs of Blacks by Cruzans and Americans. *The Journal of Psychology, 115,* 113-116. http://dx.doi.org/10.1080/00223980.1983.9923605

Mesko, N., & Bereczkei, T. (2004). Hairstyle as an Adaptive Means of Displaying Phenotypic Quality. *Human Nature, 15,* 251-270. http://dx.doi.org/10.1007/s12110-004-1008-6

Miller, E. L. (1969). Body Image, Physical Beauty and Colour among Jamaican Adolescents. *Social and Economic Studies, 18,* 72-89.

Morgan, E. (1972). *The Descent of Woman.* London: Souvenir Press.

Perrett, D. I., May, K. A., & Yoshikawa, S. (1994). Facial Shape and Judgements of Female Attractiveness. *Nature, 368,* 239-242. http://dx.doi.org/10.1038/368239a0

Rogers, R. A. (1986). Language, Human Subspeciation, and Ice Age Barriers in Northern Siberia. *Canadian Journal of Anthropology, 5,* 11-22.

Sieber, R., & Herreman, F. (2000). Hair in African Art and Culture. *African Arts, 33,* 54-69. http://dx.doi.org/10.2307/3337689

Sigler, R. (2011). *Our Long Hairitage.* Bloomington, IN: WestBow Press.

Synnott, A. (1987). Shame and Glory: A Sociology of Hair. *The British Journal of Sociology, 38,* 381-413. http://dx.doi.org/10.2307/590695

Walsh, R. J., & Chapman, R. E. (1966). A Study of the Quantitative Measurement of Human Head Hair Fibres. *Man (New Series), 1,* 226-232. http://dx.doi.org/10.2307/2796348

White, S., & White, G. (1995). Slave Hair and African American Culture in the Eighteenth and Nineteenth Centuries. *The Journal of Southern History, 61,* 45-76. http://dx.doi.org/10.2307/2211360