Fur or Fire: Was the use of fire the initial selection pressure for fur loss in ancestral hominins?

A variety of reasons have been advanced to explain the loss of fur in humans and why they differ in this way from all other primates. None of these reasons has become generally accepted as the explanation for the absence of functionally effective thermally insulating fur. The hypotheses previously advanced have not satisfactorily explained why humans are the unique naked ape. This paper proposes a new hypothesis; that *Homo sapiens* ancestors use of fire created the initial selection pressure leading to fur loss in humans.
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Introduction

A variety of reasons have been advanced to explain the loss of fur in humans and why they differ in this way from all other primates. None of these reasons has become generally accepted as an explanation for the absence of functionally effective thermally insulating fur. An aid to body cooling on the savannah was first proposed by Raymond Dart (P. Wheeler, 1992) and remained the conventional explanation for some time although the controversial aquatic ape theory has drawn particular attention to the anomaly of naked humans (Hardy, 1960; Morgan, 1997). Sexual selection was tentatively proposed by Darwin in the Decent of Man (Darwin, 1871) and more recently some other explanations have been proposed including neotony (Gould 1977), use of clothing (Kushlan, 1985), enhancing social communication (Simmons, 2001), parental selection (Harris, 2006), bipedality (P. E. Wheeler, 1984), allometry (Schwartz & Rosenblum, 1981), cooling (Morris, 1967), hunting (Brace, 1966), carrion eating (Stephensson, 1972). A defensive response to ecto-parasites is another (Pagel & Bodmer, 2003)(Rantala, 1999) that has gained recent attention. Even the pleasure of skin-to-skin contact between mother, partner and infant has been postulated as enhancing relationships thus increasing survival in hairless individuals (Giles, 2011). A review paper by (Rantala, 2007) provides a discussion of the hypotheses and any empirical evidence for them. This paper proposes a new hypothesis; Homo sapiens ancestors use of fire created the initial selection pressure leading to fur loss in humans.

A Fur Reduction Selection Pressure Proposed

One driver that has not received attention as a selection pressure is the human adoption of the use of fire. It seems likely that fur would be selected against in a fire using, pleistocene lifestyle. While the insulating properties of fur assist in keeping the body warm, and protecting it from strong sunlight, the same insulating property is likely to prevent the skin beneath the fur from feeling the heat until, at least on some occasions, it is too late and the hot fur ignites. Even small burns are serious injuries and would have been particularly debilitating in a Pleistocene life. Infections from burns, even small burns on feet from walking barefoot on cinders, or hot cinders settling on sleeping people, would have been more likely to incapacitate or become life threatening when compared to burns treated with modern medical procedures within contemporary hygiene standards. Even today infections from burns are the most important and potentially serious complications that occur in the acute period following the burn (Rafla & Tredget, 2011).

Pyjama fires and beard fires are modern day examples of this proposed selection pressure. There are government standards dedicated to ensuring the safety of children’s pyjamas with respect to their flame retardant properties and child’s clothing fires are associated with nearly 300 emergency-room-treated burn injuries to children each year in the United States (U.S. Consumer Product Safety Commission, 2000).

Humans are messy eaters and one can easily imagine more serious conflagrations arising from time to time from the accumulation of cooked meat juices, including fats and oils dripping and coalescing
in the fur after cooking prey species that had fattened up over the summer. Men who wear beards tend to dribble into them (Stephensson, 1972) and it is likely that food generally, and fats and oils in particular, dribbled well down the body of our less genteel ancestors. Given that the face is particularly hairy in men, and beards accumulate much of spillage beard fires would be particularly dangerous, even if less likely. There are examples of people dying from beard fires in historical (“Certain accursed ones of no significance,” 2011) and in modern times (Koljonen, 2008) (Unknown, 1949)(Unknown, 1973). The naked part of the face and the eyes are however, particularly sensitive to radiant heat (Tannam, 2012) and this could partially explain the continuation of facial hair despite almost complete loss of body hair.

The Mechanism of Selection

The actual mechanism for differential selection is that those with lesser insulating fur (thinner, shorter or finer) would more quickly detect dangerously elevated temperatures from radiation and are therefore more likely to move or otherwise reduce the risk of fur catching on fire. Selection for less fur, allowing individuals to be more sensitive to dangerously high temperatures, would have started when fire was first being used. Fire selection against hirsuteness would have initiated a positive feedback loop, with less fur for warmth resulting in increased dependence on fire, in turn increasing selection pressure against hirsuteness.

Timing of Fur Loss and Fire Use

Exactly when the first widespread use of fire in early Hominin communities occurred is not settled although most archaeologists accept the idea that Homo erectus was using fire about 0.5mya (James, 1989). This is up to 700000 years after the appearance of the MC1R gene, a gene associated with dark skin pigmentation (Rogers, Iltis, & Wooding, 2004). Rogers et al (2004) suggest early man must have lost fur thus increasing exposure to sunlight, in turn selecting for MC1R gene. Even a small area of significant fur loss, for example the face for improved social communication, could have selected for the benefit of the skin pigmentation protection afforded by the arising of the MC1R gene so this does not necessarily imply body hair loss. So the earlier arrival of MC1R gene the change in pigmentation is not strong evidence for or against this fur or fire theory.

The use of animal hides as protection is believed to have started around 300,000 years ago as indicated by the earliest records of hide scraping (Toth and Schick 1993:161). This means there was some time between use of fire and clothing. Molecular phylogenetic data suggesting that clothing arrived after the use of fire supports this idea. Head and clothing lice diverged between 83000 and 170000 years ago, (Toups, Kitchen, Light, & Reed, 2011).

Head Hair and Body Hair

In general, the consideration of facial hair as distinct from body hair, or fur, probably serves as a distraction from focussing on the important question of human fur loss. The range of diversity of facial hair in modern humans suggest it is a result of cultural or other selection pressures in more recent times, rather than being a notable or important difference during the Pleistocene. Indeed all head hair, not just facial hair has variation in its qualities and extent in different ethnicities (Hrdy, 1973), but there is no direct evidence regarding the quantum or extent of facial hair in our Pleistocene ancestors. There is some evidence to support the hypothesis that the human beard
evolved primarily via intrasexual selection between males and as part of complex facial communication signalling status and aggressiveness (Dixson & Vasey, 2012).

Incomplete Nakedness

Others have described the partial nakedness of humans compared with the absolute nakedness of some terrestrial and aquatic mammals (Hardy, 1960). The proposed fur or fire hypothesis could explain this incomplete absence. An optimal balance would exist between the reduction of burns risk by increased sensitivity against the benefits of insulation and physical protection of the skin. The net result would be an optimal amount of body hair rather than a runaway loss of fur leading to absolute nakedness as seen in other species where the loss was driven by other imperatives and not influenced by the proximity to intense radiation with a risk of fire.

Multiple Drivers

It may be that increasing use of fire, and the attendant risks associated with proximity to fire might have merely initiated selection for fur reduction in Hominins. If so, this does not preclude contributions of some other potential selection pressures that have been proposed. Sexual selection could have proceeded after initial selection created some variation. Indeed one of the objections to sexual selection for hair loss, as first proposed by Charles Darwin in the Decent of Man, is that it does not explain the initial selective advantage that may have caused one gender to prefer less fur covering on the other gender (Darwin, 1871). It is worth noting that there is evidence that sexual selection for hairlessness continues given the effort and expense dedicated to hair control in modern society. (Labre, 2002)

Further Evidence Required

Evidence to support or detract from this theory would likely come from a variety of disciplines. Physiological investigation of the insulating properties of fur near open fire, flammability and insulating properties of fur and proximity to fire, comparisons of human body hair with that of other primates, mortality and infection in mammals suffering burns, and perhaps molecular evidence from body hair genes or burn related properties of the Human skin biome are potential sources of data that could be explored in an effort to resolve this important question.

Conclusion

Fur loss in Hominins is likely a result of multiple selection pressures, but Hominin’s developing association with fire is proposed as a first step starting them on the path to reduced fur covering. Perhaps, in addition to the better known benefits of fire – improving digestion of food, providing warmth and extending hours available for social interaction, human nakedness can be added.

Bibliography


