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International Journal for Parasitology 29 (1999) 1987–1989

The Australian Society for Parasitology Inc.
INTERNATIONAL Journal for PARASITOLOGY

Controversies in parasitology

Human nakedness: adaptation against ectoparasites?

Markus J. Rantala *

Department of Biological and Environmental Science, University of Jyväskylä, P.O. Box 35, FIN-40351 Jyväskylä, Finland

Received 22 July 1999; accepted 22 July 1999

Abstract

Homo sapiens L. has been described as the naked ape, and this nakedness undoubtedly constitutes one of the most striking differences in appearance between man and the apes. Nakedness has been attributed at various times to sexual selection [1], aquatic stage [2], hunting [3], cooling [4], sex [5], neoteny [6] and allometry [7], most proposed explanations logically revealing some aspect of the phenomenon. However, most fail to account for the distinctiveness of man's hairlessness among mammals of the same size. Unfortunately, fossils cannot help us to explain how denudation occurred, and how it helped hominids to survive. In this paper I will present an old hypothesis with a new point of view incorporating more recent evidence. © 1999 Australian Society for Parasitology Inc. Published by Elsevier Science Ltd. All rights reserved.

Keywords: Ectoparasites; Evolution; Homo; *Homo sapiens*; Human evolution; Nakedness; Primates

Much fossil evidence indicates that hominids evolved in South and East Africa [8]. In the savannah, days are hot but at night the temperature can sometimes drop to as low as 11°C [9]. If hominids had retained their fur, they would have been better protected from cold nights and daily sunshine. Hair also protects from wounds, sores, insect bites and u.v. radiation. As hominids moved out of Africa, about two million years ago [10], to northern latitudes where the climate was cooler, a hairy coat surely would have been beneficial. However, man adapted to northern latitudes by changing the color of the skin, not by regaining hair. Why should nudity have any selective advantage?

The parasite argument was advanced by Belt in the 19th century. He claimed that a naked primate would be less liable to harbour ticks and other noxious parasites, which in the tropics may constitute a serious danger to health [9]. The weakness of Belt's hypothesis is that it does not explain why just the human species lost its hair. Ectoparasites are a problem for all primates, not only for humans.

In many animals today, grooming has evolved into a mechanism for social bonding [11]. For example, female baboons spend up to 28% of their time grooming [12]. There is considerable evidence, however, that grooming is still maintained by selection for its beneficial effect on host fitness via parasite removal. For instance, animals prevented from self-grooming suffer from increased ectoparasite loads [13] which reduce their fitness [14]. Experimental manipulation of

* Tel.: +358-14-601211; fax: +358-14-602321
E-mail address: marrant@st.jyu.fi (M. J. Rantala).

PII: S0020-7519(99)00133-2

ectoparasite load leads to changes in time spent grooming [15].

As a consequence of change in the structure of human society towards a group-hunting primate, grooming was no longer needed to maintain social hierarchy. The arduous, cooperative hunt for large prey also meant that females with babies were not able to follow hunters, so hominids had to occupy a fixed home base [16]. First proofs of the home base date to roughly 1.8 million years ago in Tanzania, where remains of *Homo habilis* were also recovered [17].

This change was beneficial to many ectoparasite species [4]. For instance, humans became the only one of the 193 species of monkeys and apes to have fleas [16]. Fleas can go through their life-cycle only if their host animal lives in a repeatedly inhabited den or lair [16]. Lairs and dens also provided greater opportunities for other parasites to thrive and breed. Increased population size would also increase opportunities for parasites. The great apes bed down in special sleeping-nests, but the group is always on the move and they make a new bed at a new site each night, so that there is little need to worry about nest hygiene [4]. An animal with a short coat or no coat has a lower ectoparasite load than one with long hair, for example bats [18]. It is also easier to remove parasites from naked skin.

Humans became able to compensate for heat loss (with subcutaneous fat), and having fewer parasites became more important than having a warming, furry coat. Natural selection started to favour more short-haired less-parasitised individuals, leading to the naked ape of today. Selection pressure was possibly enforced by the fact that blood-sucking ectoparasites are vectors for many lethal diseases, for example: fleas spread plagues, the sheep tick (*Ixodes ricinus*) spreads tick-borne encephalitis (TBE) and Lyme borreliosis, lice (*Anoplura*) spread spotted fever and plague, and mites (*Acarina*) spread European encephalitis, relapsing fever and tularaemia [19]. Because the fatty layer is not totally sufficient at low temperatures during periods of inactivity [20], which generally occur at night, heat loss in humans was retarded by the use of removable insulation. Body covering, in the form of clothing, was probably augmented by the use of controlled fire and artifical shelter, neither of which would be sufficient without personal covering. Sheltering behaviour is apparent in contemporary apes [20].

Females are less hairy than males, and hairy females are less attractive to men. Females spend more time at the home base, and are thus more exposed to ectoparasites. Therefore, we could expect 'hairless' women to have more reproductive success than hairy ones, and they would produce sons and daughters with less hair, leading eventually to nakedness.

Humans are not actually hairless. In fact the numbers and density of hair follicles are not especially different from those of their nearest primate relatives. Most of these hairs are relatively miniscule, and certainly neither protect the skin nor provide appreciable thermal insulation [20]. Human males and females have about the same number of hairs, but males have thicker body hair than females. Thicker hair on the trunk and beard of men is androgen dependent [21] and could be explained by a handicap-effect, which would explain the lesser hairiness of women and their sexual attraction towards hairy men. The beard of men also makes the chin look more massive [22]. Humans also have hair in the axillae and around the genitals which is believed to act as a trap for pheromones [22]. The major function of eyebrows is to express mood changes [23].

Besides being most vulnerable to blows, the head also needs protection against solar heating as well as prevention from excessive thermal loss, so the trade-off between parasitism and thermoregulation favoured the mop of hair. Long hair would, similarly, protect the shoulders. However, long, straight scalp hair is generally characteristic only of the caucusoid and mongoloid geographical races; negroids more often have curved or crimped hair. The wide variations in human skin and hair would seems to invaldiate any sweeping generalizations [24].

These theories are in no way mutually exclusive and they are, of course, only speculations which cannot be proved or refuted, but they generate a hypothesis to be discussed in the light of

different lines of evidence. Nevertheless, if nakedness was developed in some connection other than parasitic, it might anyway make it easier to remove troublesome skin parasites, a task which today still occupies a great deal of time for hairier primates.

References

[1] Darwin C. The descent of man, and selection in relation to sex. London: John Murray, 1871.
[2] Hardy AC. Was man more aquatic in the past? New Scientist 1960;7:642–5.
[3] Campbell BG. Human evolution. Chicago: Aldine, 1966.
[4] Morris D. The naked ape. London: Jonathan Cape, 1967.
[5] Stephensson W. The ecological development of man. Sydney: Angus and Robertson, 1972.
[6] Gould SJ. Ontogeny and phylogeny. Cambridge, MA: Harvard University Press, 1977.
[7] Schwartz GG, Roseenblum LA. Allometry of hair density and the evolution of human hairlessness. Am J Phys Anthrop 1981;55:9–12.
[8] Leakey R. The origin of humankind. New York: Basic Books, 1994.
[9] Morgan E. The scars of evolution. London: Souvenir Press, 1990.
[10] Zihlman AL, Cohn BA. Responses of hominid skin to savannah. S Afr J Sci 1986;82:89–90.
[11] Poulin R. "Adaptive" changes in the behaviour of parasitized animals: a critical review. Int J Parasitol 1995;25:1371–83.
[12] Harrison GA, Weiner JS, Tanner JM, Barnicot NA. Human biology. Oxford: Oxford University Press, 1977.
[13] Clayton DH. Coevolution of avian grooming and ectoparasite avoidance. In: Loye JE, Zukk M, editors. Bird–parasite interactions: ecology, evolution and behaviour. Oxford: Oxford University Press, 1991;258–89.
[14] Booth DT, Clayton DH, Block BA. Experimental demonstation of the energetic cost of parasitism in free-ranging hosts. Proc R Soc Lond 1993;B253:125–9.
[15] Møller AP. The preening activity of swallows, *Hirundo rustica*, in relation to experimentally manipulated loads of haematophagous mites. Anim Behav 1991;42:251–60.
[16] Morris D. The human animal. London: BBC Books, 1994.
[17] Johanson D., Blake E. From Lucy to language. Verona: Editoriale Bortolazzi-Stei, 1996.
[18] Hassanloo Z, Fenton MB, DeLaurier JD, Eger JL. Fur increases the parasite drag for flying bats. Can J Zool/Rev Can Zool 1995;73:837–42.
[19] Cook GC. Manson's tropical diseases. London: W.B. Saunders, 1996.
[20] Kushlan JA. The vestiary hypothesis of human hair reduction. J Hum Evol 1985;14:29–32.
[21] Leshin M, Wilson JD. Mechanisms of androgen-mediated hair growth. In: Orfanos CEW, Montagna W, Stuttgen W, editors. Hair research. Berlin: Springer, 1981;205–9.
[22] Gutherie RD. Body hot spots: the anatomy of human social organs and behaviour. New York: Van Nostrand Reinhold, 1976.
[23] Morris D. Bodywatching. A field guide to the human species. Oxford: Equinox and Jonathan Cape, 1986.
[24] Ebling J. The mythological evolution of nudity. J Hum Evol 1985;14:33–41.