Odor in Human Mate Choice

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Abstract

A person chooses a mate with advantageous genes through odor and facial symmetry. Dustin J. Penn and Wayne K. Potts discovered that mice are capable of smelling the potential mates' major histocompatibility complex (MHC) through the scent of urine. Penn and Potts found that the mice preferred the scent of mates with a dissimilar MHC genotype to their own. Claus Wedekind investigated an odor mediated mating system in the human species through his "sweaty t-shirt study." He found, similarly to the results of Penn and Potts, that women rated males' scent as more pleasant and sexy when their MHC was dissimilar to their own. Contrastingly, women on contraceptives preferred the scent of MHC similar males. To address contraception as a confounding factor, S. Craig Roberts completed a similar study, finding a trend of decreasing preference for dissimilar MHC among the pill-using group, and an increasing preference for dissimilar MHC among the non-pill-using group. If women can smell and prefer facial symmetry (FA), are MHC and FA preference correlated? Randy Thornhill investigated this study. He found neither FA or facial attractiveness predicted MHC dissimilarity, MHC heterozygosity, or commonness of MHC alleles to the opposite sex. Since Roberts contradicted Wedekind, and Thornhill partially supported both Roberts and Wedekind, it is important to count on future studies to support or reject claims relating to preference for similar or dissimilar MHC and FA.

Introduction

How do we choose our mate? What factors do we take into consideration when choosing a mate? Is every decision conscious? In today's society appearance has been a significant way in which we communicate in sexual selection, but this is not the only way. Humans may have adapted in order to prefer the scent of a potential mate's good genes. These good genes can put offspring ahead in the parasite-host arms race, enabling those genes to be passed on to later generations. A person chooses advantageous genes, whether it be consciously or not, through odor and facial symmetry.

The olfactory system aids humans in odor mediated mating (Thornhill, *et al*., 2003). The olfactory system works through nasal neurons that transduce physical scents into quantitative data in the brain, enabling a person to perceive a scent. Odor mediated mating preferences have been demonstrated in several vertebrate taxa, including mice (Olsen *et al*., 1998). Dustin J. Penn and Wayne K. Potts discovered that mice determine their preference in a mate partially through the smell of the mates' urine, which has chemical properties. They found that mice are capable to smell the potential mates' major histocompatibility complex (MHC) found in urine. Furthermore, they preferred the scent of mates with a dissimilar MHC genotype, rather than a MHC genotype like their own (Penn, 2002; Penn and Potts 1999).

What is MHC and why is it advantageous to be able to smell it? MHC is a polymorphic gene complex, meaning it has multiple alleles at multiple loci in a single population. MHC also encodes cell surface receptors that play a key role in the initiation of most immune responses (Thornhill *et al*., 2003). Smelling if a MHC is similar or dissimilar to one's own genotype is beneficial for two key reasons. Firstly, family members, who have a similar MHC genotype will not be attractive, therefore decreasing the likelihood of inbreeding (Wedekind *et al*., 1995). Secondly, reproducing with a MHC dissimilar individual can produce MHC heterozygous offspring that have sound immunocompetence against several parasite types. A heterozygous MHC gene combination has more capability to identify rapidly evolving parasites, which can escape recognition by immune systems containing common alleles (Thornhill *et al*. 2003).

One of the first studies done on humans relating to odor mediated mating system was completed by Claus Wedekind in a study that became commonly known as "the sweaty t-shirt study." In this study, Wekekind hypothesized that MHC influences body odor and body odor preferences, and that women's partiality depended on their hormonal status (Wedekind *et al*., 1995). For the study, 49 females and 44 males were typed based upon their Human Leukocyte Antigen (HLA), the term for MHC in human beings (Roberts *et al*., 2008). Wedekind recorded whether or not women were using birth control, as this can change their hormonal status. Each man was asked to wear a cotton t-shirt for two consecutive nights, and keep it in a plastic bag for the time not worn. Men were discouraged from eating odor causing foods, smoking, drinking alcohol, wearing scented deodorant, using perfumed soaps or shampoos, having intercourse, or sleeping in the same bed with another person. They also were required to wash clothing worn with the t-shirt, as well as their bedding with unscented detergent.

Women were asked to rate the t-shirts for pleasantness and sex appeal during menstruation, which is their most odor-sensitive time (Wedekind *et al*., 1995). The women were given six shirts total, three by MHC similar men and three worn by men with MHC dissimilar to the woman rater. Scores for sex appeal strongly correlated with pleasantness. On average, women scored males' scents as more pleasant and sexy when their MHC was dissimilar to the rater. On the other hand, women reportedly on contraceptives preferred the scent of males who had similar MHC to their own, unlike women not on contraception (Wedekind *et al*., 1995). These results suggested that contraception may be disruptive to the adaptive preference for dissimilar MHC.

Contraceptives change many normal functions of the body. They cause hormonal shifts due to the pregnancy-mimicking effect of the pill, leading to increased preference for similar MHC (Wedekind, *et al*., 1995). Pregnant women who have a preference for similar MHC is a modification which reflects pregnant women's desire to be close to a relative who may provide aid and care for her and her newborn. A disadvantage of taking contraceptives is that a preference for MHC similarity arises. Two MHC similar parents will produce children with more similar MHC alleles, leaving the children with little ability to defend themselves against rapidly evolving parasites (Roberts *et al*., 2008).

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To address the issue of contraception as a confounding factor, S. Craig Roberts completed a study similar to the sweaty t-shirt study; men and women were typed, and males wore t-shirts for two nights that would later be used for female rating. The difference between Wedekind's and Roberts's study was that females were tested twice, meaning they had to smell sets of t-shirts on two occasions. Session one tested the entire group of women during menstruation, and session two tested only half the women after they initiated contraception, The other half continued their cycles as normal.

From this study, Roberts found no significant effect of MHC dissimilarity on odor pleasantness or desirability scores. There was no correlation found between allele sharing and odor pleasantness, desirability, or intensity. Finally, women using oral contraceptives had no significant preference for MHC similarity (Roberts *et al*., 2008). These findings contradicted the findings of Wedekind's study. This finding may be due to Roberts's study having a larger sample size than Wedekind's study. Wedekind's study tested approximately forty individuals of each sex, whereas Roberts tested approximately two-hundred females and hundred males. Since Roberts found no generally associated preferences, he found looked to potential shifts in preferences across the two sessions. He did this by calculating the difference between MHC dissimilar and MHC similar ratings for each female rater within a single session. When using the sample as a whole, he found a trend of decreasing preference for dissimilar MHC among the pill-using group, and an increasing preference for dissimilar MHC among the non-pill-using group (Roberts *et al*., 2008).

Just as preference for MHC scent may be indicative of advantageous MHC genes, bilateral symmetry of morphological is thought to be a phenotypic marker for underlying high genetic quality. Fluctuating asymmetry (FA) refers to any deviation form perfect bilateral symmetry of morphological traits (Palmer *et al*., 1997). Symmetry is also seen as the ability to deal with genetic and environmental stresses throughout a person's ontogeny (Thornhill *et al*., 2003). Therefore, it is reasonable to hypothesize that the preference for FA has evolved due to its association with genetic quality and capability to deal with stress. Other studies found that the scent of symmetric men is attractive to women who are cycling normally, not using oral contraceptives, and those who are in fertile phases of menstrual cycle (Thornhill *et al*., 2003). If women can smell and prefer FA, are the two correlated?

To find if the relationship between MHC of low FA is attractive to men and women, Randy Thornhill tested the relationship between preference for MHC dissimilarity and facial attractiveness. Each participant's ear, elbow, ankle, wrist, and foot were measured twice. Each person had to participate in the sweaty t-shirt methods and have their photographs taken. An additional fourteen women and fifteen men, unfamiliar to the study, were recruited to rate participants' facial attractiveness based on the photographs, and smell the shirts worn by the other participants. Like Roberts *et al*. (2008), Thornhill *et al*. (1995) found no evidence that women prefer a male's scent with dissimilar MHC genotypes to their own. Yet, Thornhill *et al*. (1995) found women's preferences for symmetry could be predicted by their fertility status, which supported Wedekind *et al*. (1995). This conclusion has been solidified by four studies completed in the late 1990s.

Dissimilar to Wedekind's and Roberts's studies, only Thornhill observed MHC heterozygosity was preferred over other MHC combinations. He did this by correlating the number of heterozygous MHC loci with the mean attractiveness of their scents, this is significant in males, but not females. Thornhill *et al*., (1995) found neither FA nor facial attractiveness predicted MHC dissimilarity, MHC heterozygosity, or commonness of MHC alleles to the opposite sex. He concluded women in their fertile stage prefer scent of symmetrical men, which is independent from women's preference for dissimilar MHC. The preference for symmetry increased as a function of their conception risk. Women's preferences for symmetry, rather than MHC dissimilarity, was predicted by their fertility status (Thornhill *et al*., 1995). Yet, FA did not predict men or women's facial attractiveness. This contracted Wedekind *et al*. (1995) who concluded women's preferences for dissimilar MHC could be predicted solely by fertility status; FA was not observed.

Since Roberts contradicted Wedekind, and Thornhill partially supported both Roberts and Wedekind, it is important to count on future studies to support or reject claims relating to preference for similar or dissimilar MHC and FA. When reading these studies it is critical to look for confounding factors. In these studies, sample size was a large confounding factor, and possibly an explanation for varying results between studies. Also, men were not watched to be sure they did not break rules given to them that could skew a woman's preference. Only Wedekind's study provided nasal spray to maximize scent reception, and only Thornhill's study tested men and women. There can be many confounding factors when rating the attractiveness of someone in a picture, including prejudices and differences in preferences, which was not stated as a control.

Humans are evolving, just as every other species, particularly when it comes to sexual selection. As humans, we put material goods and societal importances before genetic quality or fecundity. This seems to be very much like other species that put time and effort into choosing a mate who appears increasingly fit and capable to take care of them and their offspring. Humans have supported evolved adaptations due to the beneficial qualities accompanying them. Unknowingly having physical adaptations, such as the capability to smell dissimilar MHC or the ability to see and prefer low FA, both of which we may or may not have been programmed to prefer, could enable us to pass down genetically fit offspring.

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