

A Family that Climbed Out of Inbreeding Depression

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ABSTRACT

Whenever biologically unrelated mates become scarce, consanguineous marriages become a potential option for procreation. Despite the genetic harms caused by inbreeding, kin unions still produce more viable offspring than the alternative: remaining single. We present a family that, due to loss of its high social status, was unable to find unrelated mates for their children. The solution was a marriage arranged between first cousins, which produced five children with genetic disorders. By the time these defective children became adults, the social status of the family improved. Thus, for their four unfit daughters, the parents could arrange marriages with healthy and biologically unrelated men. These unions produced four healthy children. We analyze the interaction of mate choice, sexuality, inbreeding avoidance, altruism and parental investment to establish that close-kin marriages are an adaptive response to a shortage of unrelated mates.

Keywords: Kin marriage, mate choice, parental investment, altruism, congenital diseases

Introduction

In spite of being associated with multiple genetic problems, consanguineous marriages continue to remain extremely prevalent worldwide.^{1,2} To elucidate this apparent sociobiological paradox, various explanations have been offered: tradition, socioeconomic status, ignorance about offspring abnormalities, safeguarding of family members, protecting family wealth, enhanced altruism and hidden genetic benefits.¹⁻⁴ Previously, we have criticized these explanations and we have proposed a more parsimonious explanation for human consanguinity,⁵ i.e., when a biologically unrelated mate is unavailable, a kin is a good alternative. Though the genetic harms of inbreeding are well known, kin marriages produce (on an average) more viable offspring than the (non-inbreeding) alternative of no marriage.^{1,2,6} We have explained the interaction of the

ecology and sociobiological principles involved (mate choice, inbreeding avoidance, parental investment and altruism) and why scarcity of an unrelated mate is an important factor responsible for human consanguinity. This case report provides evidence for the theory that close-kin marriages are an adaptive response to a shortage of unrelated mates.

Case Report

In 2008, a family was fortuitously found in Northeast China. Before the 1948 Revolution, this family was wealthy and owned vast amount of land. After nationalization, the family was given a tiny house with a small plot of land. Subsequently, during the Cultural Revolution (1966-1976), all landowning families in the country were severely prosecuted and socially ostracized. The social stigma on the members of former land owning families was so persuasive that any form of association with them was deemed as dangerous.⁷ At that time, there were two children of marriageable age. As their parents were unable to find unrelated mates from the society, they arranged an intra-family marriage between available first cousins. The union produced five offspring: three mentally retarded girls, one deaf-mute girl, and one mentally retarded boy who did not survive (Figure 1). The consanguineous (first cousin) parents supported their four disabled daughters throughout their childhood. By the time these daughters were of marriageable age, the Cultural Revolution in China was over and the social stigma of land-owning families was lifted. Thus, the consanguineous parents were able to arrange marriages of their four unfit daughters with four biologically unrelated men. The deaf and mute girl was married to a deaf and mute man from the same village. The three mentally retarded daughters were married to healthy men, of low socioeconomic status, and they resided in their husbands' homes in the same village. The most severely retarded daughter was married to a poor man who came to their family looking for food; he was offered this daughter and accommodation within the family household. After marriages of their daughters, the consanguineous parents continued to support all four families, and each of the four daughters produced one healthy child (maximally allowed number of children in China at the time). The most severely retarded daughter accidentally lost one child at birth. Today, the consanguineous couple has four grandchildren who are attending regular school and are expected to marry to biologically unrelated mates (Figure 1).

Discussion

The history of this family supports the theory that close-kin marriage is an adaptive response to an environment with a paucity of unrelated mates. We deliberate the role of several sociobiological principles involved in the arrangement of unions in consanguineous families. In this family, the *unavailability of biologically unrelated mates* was the main reason for arranging marriage among first cousins; this ecological factor is often mentioned as one of the many reason for such unions.^{1,2} In this family, the loss of their socioeconomic status placed them on the lowest rung in the social ladder.⁷ The family was ostracized from the remaining population; thereby, the only way to procreate was through a consanguineous marriage. In general, scarcity of mates is of two types: physical and virtual. Physical scarcity is physical absence of any potential mate from an area in which an individual can find a spouse, e.g., small island

population. Virtual scarcity is in the mind created through social learning, i.e., it is cultural. Cultural constraints may segregate potential mates into smaller groups, e.g., casts, tribes, and ancestral groups. Our family was isolated from the rest of society with short-lived sociopolitical constraints. It experienced a relative scarcity of biologically unrelated mates since no member of their society wanted to marry into this family.

Mate choice: Humans carefully choose mates in order to maximize their chances to reproduce and to beget the fittest offspring. There are many universal cues that human beings consider in their mate choice. Socioeconomic status is one of these elements.^{8,9} In general, consanguineous marriages are more common among lower socioeconomic strata as seen with our family.^{1,2} A lower socioeconomic status is associated with a lower level of education; however, this was not true in the family presented. This may imply that poor 'don't know' whom to marry. Such a view ignores the importance of mate choice, a powerful determinant of behavior in humans. Generally, women prefer and marry men of the same or higher status; men are less status conscious in their mate choice.^{8,9} Consequently, in a small human groups (with relatively fewer potential mates), men of lowest status are often left without any mate: some women from these lower strata are picked up by higher status men. In addition, in some societies men of higher status have more than one wife. Thus, men at the bottom (and women at the top) of social ladder are most likely to remain unmarried. To avoid being unmarried (and failing to procreate) poor individuals marry their kin; hence, the association of low socioeconomic status with consanguinity. Furthermore, in some societies, marrying into another social group (e.g., nearby caste) is often abhorred and may result in divorce, excommunication and, in some extreme cases – the death penalty. Therefore, kin marriage remains a better option to a potentially difficult marriage or to no marriage at all. Indeed, inbred unions produce, on an average, more healthy than genetically morbid and unfit offspring.^{1,2} Incidentally, in the family presented, all five children were afflicted with congenital diseases; this inbreeding depression was overcome due to the extensive support within consanguineous family.

Altruism: Parents help their children more than distant relatives and strangers.¹⁰ In the presented family, the consanguineous parents supported their descendants to an extraordinary degree, as shown by: i) four (of their five) children with congenital disorders survived in rural China during the notoriously difficult period of the Cultural Revolution; ii) finding healthy men to marry their four unfit daughters; iii) the economic and physical support to their married children and their grandchildren (thereby, compensating for the lack of support from defective mothers and economically poor fathers). In the literature, better social and economic support within consanguineous families is stated as a reason for such unions.^{1,2} The theory of altruism envisages enhanced help amongst consanguineous families. In fact, an analysis of first cousin families has shown that this support equals a 'third parent'.³ The history of the family presented backs this hypothesis; however, the enhanced altruism appears to be the result and not the cause for human consanguinity.

Sexuality: The instinct to procreate is one of the most compelling behaviors in humans, and is exemplified in the family presented. In some parts of China, a man's marriage to father's sister's daughter is considered 'incestuous'.³ Since it was present in this family (Figure 1), it suggests that a high desire to procreate can overcome social taboo. Also, the instinct to procreate motivated three poor men to marry handicapped women. In general, desire for children is implied in any marriage, non-consanguineous or consanguineous. A strong sexual drive may be

directed towards a kin, especially when a biologically unrelated mate is unavailable. Inbreeding avoidance (inhibition of libido toward close kin) is an epigenetic adaptation that prevents excessive genetic harms from inbreeding. It has a biological basis (i.e., it is universally induced by physical proximity during childhood), and is further modified by social learning (incest taboo).¹¹⁻¹³ In the family presented, as seen in consanguineous marriages the world over, the majority of intra family unions, are first cousin unions. A higher step of consanguinity, i.e., double-first-cousin, uncle-niece unions, is less common. The social line that separates permitted consanguinity from banned incest varies among different consanguineous societies.^{1,2} In short, sexuality is essential for both non-kin and kin unions and inbreeding avoidance (with incest taboo) is its integral part. In all societies, incest taboo defines the closest marriageable kin.

Parental investment: Parents invest into their children despite the extensive cost to themselves.^{14,15} Parents arrange many non-consanguineous and nearly all consanguineous marriages. Arranging marriages is a form of parental investment. It may enhance fitness of the offspring in two ways: i) parents may choose a better mate and ii) arranged marriages (being earlier) result in more children. In addition, an analysis of preferred choice of kin for a spouse, in different consanguineous societies, is related to the type of ecological threat to the specific society.³ All these observations attest to the importance of parental investment in arranging consanguineous marriages.

Conclusion

The history of the family presented supports a novel explanation for human consanguinity: kin marriages are arranged whenever biologically unrelated individuals are not available. In geographic isolates, physical unavailability of mates is an obvious reason for such unions. In densely populated societies, however, the reasons are less obvious. Mate (un)availability is not physical but mental since mates from other groups are considered a poor choice and such unions are often socially banned. In such societies, young men and women may find themselves in a predicament because, their innate desire to mate and procreate is hampered by a lack of suitable mates. In such an environment, the selection of a kin for a spouse is a good compromise. Kin unions produce more fit offspring, despite cost of inbreeding, than the alternative of staying unmarried and childless or marrying against social norms and being ostracized by the community. Therefore, human consanguinity can be explained by principles of behavior that drive all human unions (sexuality, inbreeding avoidance, parental investment) and selecting the best possible mate under the circumstances (mate choice). The validity of this explanation is supported by the fitness calculus of inbreeding, i.e., harms of inbreeding are less than generally perceived. However, the question that still remains unanswered is: what causes such a rigorous restriction of mate selection in some societies?

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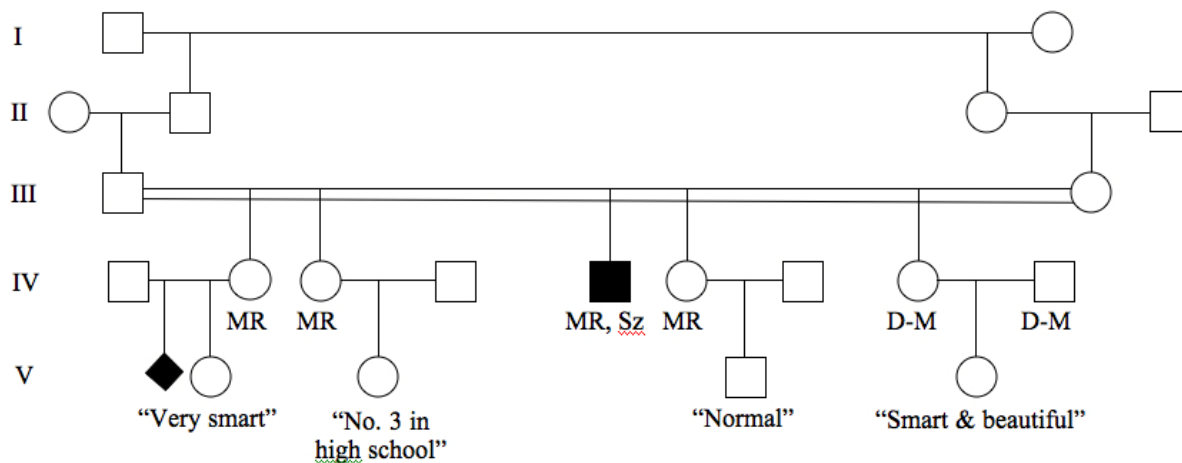


Figure 1. Five generations of the family. Double lines indicate first cousin marriage. In quotes are descriptions of children by their neighbors. Abbreviations: MR, mental retardation; Sz, seizure disorder; D-M, deaf-mute.