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Birth Order: Parental Manipulation Hypothesis

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Synonyms

Maternal manipulation hypothesis

Definition

The parental manipulation hypothesis explains the phenomenon of male homosexuality as the result of manipulation by the maternal organism, directing the development of the embryos of later-born sons toward a homosexual orientation. In socioeconomically stratified societies, the homosexuality of younger sons increases the reproductive success chances of older sons, thereby enhancing the inclusive fitness of the mother.

Introduction

The emergence and persistent presence of male homosexuality in virtually all populations pose an evolutionary puzzle. Biologically, male homosexuality is disadvantageous for its carriers as it significantly reduces fertility and thus biological fitness (Apostolou, 2022; Ciani et al., 2015; Coome et al., 2020; Fořt et al., 2024). Human sexual orientation is influenced by genetic factors (Bailey et al., 1999; Pillard & Bailey, 1998); thus, genes contributing to homosexual orientation would be expected to diminish in prevalence within the population over time. Given the absence of evidence for such a decrease, various hypotheses have been proposed to explain the persistence of male homosexuality in the human population.

The pleiotropy hypothesis suggests that genes (meaning alleles) for homosexuality affect not only the likelihood of developing male homosexuality but also other traits, such as social intelligence, which may conversely increase fitness (Ciani et al., 2004; Miller, 2000; Zietsch et al., 2021). The related *sexually antagonistic genes hypothesis* argues that genes responsible for male homosexuality have sexually antagonistic effects; specifically, genes that increase biological fitness in females, for example, by preferring more masculine male sexual partners, are disadvantageous in males as they increase the probability of developing a homosexual orientation (Ciani et al., 2008). The *bisexuality byproduct hypothesis*

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suggests that homosexuality is an unintended and, from a fitness perspective, undesirable byproduct of the existence of bisexuality. Bisexuality can be advantageous for its carrier as it may, for instance, facilitate access to potential mating partners who prefer traits more commonly found in bisexual men (Dewar, 2003). When bisexuality is influenced by a larger number of genes with small additive effects, and alleles for bisexuality spread in a population, it is likely that alongside bisexual individuals, those with biologically disadvantageous genotypes conditioning the development of strictly homosexual orientation will also genetically segregate. The *kin selection hypothesis* proposes that the evolution of male homosexuality results from kin selection—male homosexuals reproduce less or not at all but provide resources to their relatives, thereby increasing the quantity of their offspring and thus enhancing their inclusive fitness (Wilson, 1975). The same-sex affiliation hypothesis proposes that homosexuality serves a function directly unrelated to reproduction, primarily fostering long-term alliances and mutual support among men (Kirkpatrick, 2000). In such a case, male homosexuality could persist in the population due to the action of group selection (see the chapter ► Evolution by Non-individual Selection Pressures).

Parental Manipulation Hypothesis of the Origin of Homosexuality

The parental manipulation hypothesis (Ruse, 1988; Trivers, 1974) posits that male homosexuality is not an evolutionary adaptation—that is, a trait enhancing the biological fitness of its carrier—but rather a *xenoadaptation*. This term refers to a trait shaped by the activity of genes in the genome of another individual, which boosts the fitness of this other individual, frequently at the cost of significantly diminishing the fitness of the trait carrier (refer to the chapter ► "Xenoadaptations"). The parental manipulation hypothesis posits that the relevant alleles are part of the mother's genotype. By influencing the ontogeny of younger sons and directing their sexual orientation towards homosexuality, it eliminates competition for family resources and sexual partners for older brothers. In many societies, only the wealthiest men have a decent chance of acquiring a quality partner and reproducing. Thus, by enabling homosexuality in younger brothers to concentrate resources in the hands of the eldest brother, the chances are increased that the eldest son will be among the men who reproduce.

Fraternal Birth Order Effect

The main and, unfortunately, perhaps the only evidence for the *parental manipulation hypothesis* is the old observation by (Slater, 1962), which has been repeatedly confirmed (Blanchard et al., 2021), that male homosexual orientation is much more common among younger brothers than among first-borns or only children. This so-called *fraternal birth order effect* applies only to biological brothers; stepbrothers with whom an individual does not share a common mother do not exhibit this effect (Bogaert, 2006). The effect seems to be quite strong—with each additional older brother, the probability that a son will be homosexual increases by about 33% (Blanchard & Bogaert, 1996). It is irrelevant whether brothers grow up in the same family or each in a different one (Bogaert, 2006). The question of whether older sisters exert a similar influence remains partially unresolved, as some prior studies have underscored the significance of birth order in male homosexuality but did not identify variations in the proportions of brothers (Blanchard & Zucker, 1994). Although some studies have suggested that they do (Blanchard & Lippa, 2021), it has not been ruled out that this was merely a statistical artifact caused by the fact that the number of older brothers and the number of older sisters in a family necessarily correlate positively. Similarly, consensus is lacking on the relationship between parental age and male homosexuality. Although some research indicates that homosexual men often have older fathers, other studies have not corroborated these findings, suggesting that homosexuality is likely not

attributable to an increase in mutations in germ cells (Blanchard & Bogaert, 1996).

The Mechanisms of the Fraternal Birth Order Effect

The molecular mechanism responsible for the *fraternal birth order effect* is not yet known. It is commonly assumed to involve the maternal immune system's response to male-specific antigens present on the cells of male embryos. A study from 2018 suggested that the molecule responsible for this immunization could be the Y-chromosome-linked protein *neuroligin* 4 (NLGN4Y), an *adhesin* that plays a significant role in specific cell-cell interactions during brain development. Higher levels of antibodies against this protein were measured in the serum of mothers of homosexual men compared to the serum of mothers of heterosexual sons (Bogaert et al., 2018).

However, this traditional model, based on maternal immunization, is not the only one proposed. More recently, the phenomenon of *microchimerism* has been suggested as a possible explanation for the fraternal birth order effect (Flegr, 2022; Haig, 2014). It is known that during pregnancy, some cells from the embryo settle in the maternal organism and persist there long-term (O'Donoghue, 2008). Similarly, some somatic cells from the mother settle in the developing embryo (Schepanski et al., 2022), even in its brain (Fujimoto et al., 2022). It is even probable that the embryo is colonized by cells originating from an embryo that previously developed in the same womb (Johnson et al., 2021; Yan et al., 2005). One can thus imagine that the *fraternal birth order effect* is caused by cells from the embryos of older brothers, which first colonize the mother's organism and, during a subsequent pregnancy, enter the organism of the younger brother's embryo, move into its brain, and direct the ontogeny of the younger brother's sexual orientation towards homosexuality. In this scenario, the manipulator would be the older brother, not the parent-mother, and the goal of the manipulation would be to increase the direct fitness of the older brother, not the inclusive fitness of the mother—see chapter ▶ "Birth order: Sibling manipulation hypothesis".

Challenges of the Parental Manipulation Hypothesis

A core assumption of the *parental manipulation hypothesis* is that redistributing resources to favor older brothers over younger ones leads, on average, to an increase in the total number of children—the mother's grandchildren—that the sons of a given mother will produce over their lifetimes. However, this outcome is probable only under specific conditions. It particularly requires a scenario where intense competition among men for access to sexual partners, and thus opportunities to reproduce, exists, with a man's chances of acquiring a partner primarily determined by his material resources, rather than his physical or psychological attributes. This scenario became plausible with the advent of agricultural societies, where family material resources began to play a crucial role. Moreover, this scenario is unlikely in strictly monogamous societies where most men have a chance to reproduce. At the same time, the spread of weapons that enable even a weaker individual to kill a stronger one, such as bows, has made it difficult for stronger individuals to maintain a monopoly on reproduction, likely leading most communities to transition to monogamy.

For a significant portion of our species' history, before the advent of agriculture, the accumulation of material resources that could be passed from one generation to the next, such as agricultural land, was not feasible. Consequently, these long-term accumulative resources could not have significantly impacted competition for partners, making it unjustifiable for mothers to redistribute family assets in a way that would diminish the reproductive potential of younger sons. It is also important to note that male homosexuality occurs in many animal species where, although polygamy is often present, agriculture and thus material resources that could be redistributed through induced homosexuality of younger brothers do not exist. The resource being redistributed could

indeed be the sexual partners themselves, over whom intense competition can occur locally, i.e., among brothers. However, unlike material resources, sexual partners are not family resources; competition for them also occurs among members of different families, and thus their redistribution in favor of older brothers through the induced homosexuality of younger brothers could decrease, not increase, the mother's inclusive fitness. Therefore, while the parental manipulation hypothesis may explain the evolutionary emergence of male homosexuality and its persistent presence in some populations, it cannot explain its existence in animals or in human societies with most types of socio-economic arrangements. Most likely, the *parental manipulation hypothesis* cannot serve as a universal explanation for the existence of male homosexuality and the fraternal birth order effect. In this context, alternative theories, such as the *sibling manipulation hypothesis*, may offer more promising directions for understanding these phenomena.

Testing the Parental Manipulation Hypothesis

According to the *parental manipulation hypothesis*, the inclusive biological fitness of women whose younger sons exhibit homosexuality should, on average, be higher—meaning they should have a greater number of grandchildren—than women whose younger sons are not homosexual. The challenge is that the outcome of such a test would depend on the socio-economic organization of the society in which the study is conducted. If the study were conducted in a polygamous community where only a small percentage of the wealthiest men had the chance to acquire a sexual partner and reproduce, then the predictions of the parental manipulation hypothesis would probably be confirmed. In all other cases, the study's outcome would likely be the opposite: women with homosexual sons would probably have lower inclusive fitness than women without homosexual sons. Indeed, the higher inclusive fitness of mothers of homosexual sons could also be observed if, for instance, genes with sexually antagonistic effects come into play. Specifically, this scenario could occur if the decreased fertility of homosexual sons is compensated by the increased fertility of daughters when the relevant gene is located on the X chromosome (Ciani et al., 2008).

A fundamental problem with such studies is that we do not know under what conditions and at what time the trait in question, here male homosexuality, developed. Especially for humans, there have been several drastic changes in living conditions, both natural and particularly social, in the past. A trait that might have been adaptive for its carrier (adaptation) or for another member of the population, such as the carrier's mother (*xenoadaptation*), in the past could have lost any adaptive value under changed conditions and thus could be considered a *postadaptation* (see the chapters ▶ "Xenoadaptations" and ▶ "Post-adaptations"). Traits that have lost their adaptive value gradually disappear from the population as the relevant genes are inactivated through the accumulation of mutations; however, this process can be significantly slower than the accumulation of changes in the living and especially the social environment of our species.

Conclusions

The *parental manipulation hypothesis* presents a compelling, if controversial, explanation for the persistence of male homosexuality in human populations. It suggests that male homosexuality may not represent an evolutionarily adaptive trait for the individual but rather a xenoadaptation—a characteristic influenced by genes in another individual's genome that benefits this other individual (in this case, the mother). The key evidence for the *parental manipulation hypothesis* is the *fraternal birth order effect*, where younger biological brothers are significantly more likely to be homosexual.

While the hypothesis remains unproven, some mechanisms have been suggested. Traditional models emphasize maternal immunization against male-specific antigens. In contrast, newer

hypotheses propose microchimerism, where cells from the embryos of older brothers might initially colonize the mother's body and either immunize the mother or subsequently enter the embryo of a younger brother, including the developing brain, potentially influencing his sexual orientation.

The *parental manipulation hypothesis* faces challenges. It assumes a socio-economic structure where material resources heavily influence a man's reproductive chances, and such conditions may not have been common throughout human evolution. Further, the hypothesis likely does not explain the existence of male homosexuality in other animal species where material resources are less relevant or irrelevant. It's possible the *sibling manipulation hypothesis*, where the older brother is the manipulator, provides a stronger evolutionary framework.

To definitively test the *parental manipulation hypothesis*, research must demonstrate that mothers of younger homosexual sons experience an increase in inclusive fitness (measured by the number of grandchildren). However, such outcomes would likely be confined to societies with particular socioeconomic frameworks. The issue arises from the fact that societies meeting these criteria may no longer exist, and, more critically, it is improbable that such societies predominated during the period when human species traits were being established.

The *parental manipulation hypothesis* offers a provocative lens through which to view the enduring puzzle of male homosexuality. Whether it proves a key piece of that puzzle or an interesting but incorrect evolutionary scenario, its exploration can advance our understanding of both human sexuality and the complex forces behind familial competition and cooperation.

Cross-References

- ▶ Birth Order: Sibling Manipulation Hypothesis of Homosexuality
- ▶ Evolution by Non-individual Selection Pressures
- ▶ Postadaptation
- ▶ Xenoadaptation

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