

# Is there a homosexuality gene?

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Although biologists are still far from answering this question, scattered evidence for a possible gene influencing sexual orientation has recently encouraged scientists to map out a guide to future research. Because many possibilities for such a gene exist, scientists Sergey Gavrilets and William Rice have recently developed some theoretical guidelines and testable predictions for explaining the evolutionary causes of homosexuality.

“During the 1990s there was a short surge of interest by a small number of labs in finding major genes that might mediate homosexuality,” Rice told *PhysOrg.com*. “However, for a variety of reasons, this effort waned by the turn of the century. I think that—when studying humans—many people shy away from studying sexual phenotypes in general and homosexuality in particular. Much of Sergey's and my motivation in writing our paper was to rekindle an interest in studying the genetic basis of homosexuality. I personally think that if a firm genetic foundation for homosexuality in humans were established, then many people would view this fascinating human phenotype more objectively.”

During the past several decades, scientists have discovered some interesting patterns that may point toward genetic causes of homosexuality. Among the findings is that male homosexuality appears to be inherited more often from the mother than the father (Pillard). Also, natural selection might maintain a gene that may decrease the fecundity of one sex because the same gene also increases the fecundity of the other sex. In fact, recent data shows that female maternal relatives of gay men have higher than average reproduction capacity (Camperio-

Ciani).

Another interesting result from previous research is that a male's chance of homosexuality increases with the number of biological older brothers he has—even when he grows up away from his older male siblings (Blanchard and Bogaert). Scientists explain that, with each male fetus, a mother develops an increased immunization to an antigen produced by the male fetuses, and this antigen likely plays a role in masculinizing the brain.

These studies and others—while unable to point to a specific gene—do point to the idea that homosexuality may be inherited through a polymorphic gene, which is a gene that has more than one different form, and can exhibit either form. Studies have shown that this gene inheritance must be more complex than for common Mendelian traits.

To take the next step, Gavrilets and Rice have developed several mathematical models that make contrasting predictions for the possible factors responsible for the polymorphism of genes influencing homosexuality. Hopefully, the predictions generated by these models will guide future tests and help zone in on the correct genetic characteristics involved in sexual orientation. As Rice explains, past research has shown the complexity inherent in determining the cause(s) of homosexuality.

“We know that homosexuality (gay or lesbian) can be caused by simple genetic changes in fruit flies, and since so many reproductive and neurological genes are shared by flies and humans, it seems highly likely that there are major genes influencing homosexuality in humans,” said Rice. “However, we also have firm evidence for a birth-order effect on male homosexuality, and discordance in the expression of homosexuality of identical twins, so clearly there is also an environmental influence on the trait.”

Gavrilets and Rice identify two main factors that may explain the polymorphism of a gene (and how the gene spreads): overdominance and sexual antagonism. Overdominance refers to phenotypes that come from heterozygous genes, and the advantages promoting genetic variation. Sexual antagonistic traits are those that are advantageous in one sex, but may cause homosexuality in the other sex. For a variety of different gene inheritance patterns, the scientists provide mathematical models that require, in essence, that the benefits for one sex must outweigh the costs for the other sex.

In their study, Gavrilets and Rice make predictions for the likelihood of certain types of genes (e.g. autosomal or sex-linked, recessive or dominant, with small or large effects) favoring either overdominance or sexual antagonism under different conditions. However, many possibilities remain, and research into each one will determine how well they satisfy the requirements provided in this study.

“The research so far that I think is most illuminating on this topic are the studies showing that homosexuality can have a simple genetic foundation in fruit flies,” said Rice. “I think that it is too early to decide which of our models (or one yet to be formulated) is most feasible. However, based on the abundance of sexually antagonistic variation found in fruit flies, the sexually antagonistic variation seems like a probable candidate process leading to polymorphism for homosexuality.”

Citation: Gavrilets, Sergey and Rice, William R. “Genetic models of homosexuality: generating testable predictions.” *Proceedings of the Royal Society B* (2006) 273, 3031-3038.

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