

EVOLUTIONARY MODELS FOR MALE ANDROPHILIA

DEANNA L. FORRESTER

Bachelor of Arts (Honours), Grant MacEwan University, 2009

A Thesis

Submitted to the School of Graduate Studies  
of the University of Lethbridge  
in Partial Fulfillment of the  
Requirements for the Degree

MASTER OF SCIENCE  
(Psychology)

Department of Psychology  
University of Lethbridge  
LETHBRIDGE, ALBERTA, CANADA

© Deanna L. Forrester, 2011

## ABSTRACT

### Evolutionary Models for Male Androphilia

*Androphilia* refers to sexual attraction and arousal to adult males, whereas *gynephilia* refers to sexual attraction and arousal to adult females. Prehistoric artifacts such as art and pottery indicate that male-male same sex behaviour has existed for millennia. Bearing this in mind, and considering that male androphilia has a genetic component yet androphilic males reproduce at a fraction of the rate than do gynephilic males, how the genes for male androphilia have been maintained in the population presents an evolutionary puzzle. This thesis tests two hypotheses that attempt to address this Darwinian paradox. Chapter one reviews the current literature on the kin selection hypothesis and the sexually antagonistic gene hypothesis. In addition, rationales for testing these hypotheses in Canada are provided. Chapter two tests the kin selection hypothesis for male androphilia within a Canadian population. Results and implications are discussed. Chapter three tests the sexually antagonistic gene hypothesis within a Canadian population. Results and implications are discussed. Chapter four summarizes the results of the two studies and discusses how these findings may be interpreted from an evolutionary perspective. The impacts of gene-environment interaction on the functional behavioral expression of traits are emphasized.

## ACKNOWLEDGEMENTS

When I first returned to university as a mature student I was unsure if I would even be able to pass a first year university level course. To be at the point where I am now defending a Masters thesis is somewhat surreal to me. I can state without hesitation that I would not have been able to reach this goal had I not been fortunate enough to have the friends and mentors that I have presently and along the way.

To Dr. Paul Vasey, words cannot express how grateful I am for your untiring guidance, support, investment, and supervision. I feel privileged to be a member of your lab and to have such an accomplished yet humble mentor who is so generous with his time, direction, and encouragement. I am eternally grateful for the opportunities that you have provided me and for your unwavering confidence in my abilities. You have not only been an exceptional mentor but you have also been an extraordinary friend. Your enthusiasm for research is contagious and you make coming to work every day something that I look forward to. I only hope that someday I can pay it forward and be as inspiring to one of my own students as you have been for me.

To my other committee members, Dr. Louise Barrett, and Dr. Shawn Bubel, thank you both for your ongoing encouragement, your belief in me, and your advice. I feel fortunate to have had two excellent mentors as role models throughout my Master of Science degree. Shawn, thank you for always welcoming my updates and for making time to meet with me during your maternity leave. I appreciate how understanding you were when my project changed and as well for our unconventional committee meetings. I really took to heart the advice you gave me last summer and although I managed to get both studies completed; you made me realize that it would be okay if I didn't. Louise,

thank you for all the laughter, the introduction to fountain pens, and the many therapeutic cups of tea. Your insight to my project has been invaluable and you have impressed upon me alternative ways of seeing things. Every conversation I have with you I feel as though I learn something new. Speaking with you makes me a better thinker and more importantly a better academic. On top of all of that, you remind me that sometimes it is okay to take a weekend off and go on a spontaneous road trip.

I may not ever have been in the position I am today had I not taken a Biopsychology class in the spring of 2005 taught by Dr. Lynne Honey. Lynne, before I took that class I had no idea that psychology was a science, and after that class I became obsessed. You gave me the opportunity to get my feet wet with an independent study and then mentored me through my Honours project with just the right balance of encouragement, expectation, and enthusiasm. Through your unwavering support you made it possible for me to realize my aspirations of graduate school. I am forever grateful for your guidance and just as importantly, your friendship.

I would also like to extend my appreciation to Doug VanderLaan, my lab-mate, graduate student role model, advice giver, and above and beyond all else, my friend. Doug your support, your advice, and your feedback on this project have been priceless. I deeply appreciate all the time that you have spent listening to me gripe, or work my way through an idea, and all of the time you spent working with me. I am sometimes in awe of the way your mind works, you are so insightful, and I am not sure that I can express my gratitude for how generous you have been with your time and your ideas. In addition, you have been a great friend and have made the last two years that I have spent in Lethbridge

significantly more enjoyable. Every day I look forward to the familiar sound of your feet walking down the hallway.

To Jessica Parker (girl detective), you have been my saving grace this past year. I appreciate all of the data entry, data management, and marking that you took responsibility for throughout this project. I am forever thankful for your help. In addition, you have been a great support emotionally for me and I may not have finished on time without fountain pop breaks and delicious treats. Although I am very happy for you that you are going away to Africa, I will miss you terribly when you are gone.

To Brandon Yardy, Laura Rodman, Desi McEwan, and Trish Slade the four of you have been extraordinarily supportive of me from the very beginning. You have been nothing but positive, and demonstrated unwavering confidence in my ability to complete this project. I want to thank each one of you for your unconditional friendship, your encouragement, and for providing just the right distractions at just the right times. You are all 'keepers' and I will never forget the love and support that you gave to me.

To my Mum, for as far back as I can remember you have pushed me to think independently, think critically, and above all else not to be scared to try something new. You have always emphasized the importance of following your passion and to not settle for anything less. You have never doubted my ability and you consistently tell me how proud you are of me. You make me want to be the person that you believe that I can be. I want to thank you for more than I can possibly articulate in this paragraph. But this will have to suffice. Thank you.

For my Dad, who would have loved to read this thesis, I miss you every day.

## TABLE OF CONTENTS

Title Page.....	i
Signature Page.....	ii
Abstract.....	iii
Acknowledgements.....	iv
Table of Contents.....	vii
List of Tables.....	viii
<b>Chapter 1.</b> Evolutionary Models for Male Androphilia.....	p. 1
<b>Chapter 2.</b> Male Sexual Orientation and Avuncularity in Canada: Implications for the Kin Selection Hypothesis.....	p. 11
<b>Chapter 3.</b> Testing the Sexually Antagonistic Gene Hypothesis for Male Androphilia in Canada.....	p. 30
<b>Chapter 4.</b> Conclusion.....	p. 51
<b>References</b> .....	p. 60
<b>Appendix A.</b> Questionnaire Package for Kin Selection Study.....	p. 68
<b>Appendix B.</b> Questionnaire Package for Sexually Antagonistic Gene Study.....	p. 75
<b>Appendix C.</b> Consent Form for Kin Selection Study.....	p. 110
<b>Appendix D.</b> Consent Form for Sexually Antagonistic Gene Study.....	p. 112

## LIST OF TABLES

Table 2.1	Subscale scores and standardized internal consistency reliabilities (alphas) by group.....p. 27
Table 2.2	Descriptive statistics for biographic variables by group.....p. 28
Table 2.3	Two-tailed Pearson's <i>r</i> correlations between subscale scores and number of children parented, whether the participant had children, and age.....p. 29
<b>Table 3.1</b>	Descriptive statistics for biographic variables by group.....p. 45
<b>Table 3.2</b>	Means, standard deviation, and n for maternal and paternal line homosexual relatives by group.....p. 48
<b>Table 3.3</b>	Reported maternal and paternal line reproductive success.....p. 49
<b>Table 3.4</b>	Sibling sex comparisons and total family size by group.....p. 50

## **CHAPTER ONE**

### **Evolutionary models for Male Androphilia**

#### **ABSTRACT**

Male androphilia is paradox when viewed from an evolutionary perspective. It has a genetic basis (e.g., Bailey, Dunne, & Martin, 2000; Kendler, Thornton, Gilman, & Kessler, 2000; Långström, Rahman, Carlström, & Lichtenstein, 2008), yet male androphiles do not reproduce or, if they do, they tend to do so much less than male gynephiles. Nonetheless, judging from prehistoric rock art and pottery (e.g., Mathieu, 2003; Nash, 2001; Yates, 1993), male-male sexual activity has existed for millennia. The maintenance of genes for a behaviour that reduces reproductive success appears counter-intuitive to Darwinian theory and, therefore, requires an explanation.

There are two hypotheses that have been put forth in an attempt to address this paradox and for which there is some empirical support. These are the kin selection hypothesis, and the sexually antagonistic gene hypothesis (SAGH). The Kin Selection Hypothesis (KSH) posits that genes for male androphilia can persist over evolutionary time if androphilic males offset the fitness costs of not reproducing directly by enhancing indirect fitness. In theory, by directing altruistic behavior toward kin, androphilic males can increase the reproduction of kin, thereby enhancing indirect fitness. The SAGH suggests that the reproductive costs of genes for male androphilia are offset by the reproductive benefits that occur if the same genes result in an increased reproductive success in the female relatives of male androphiles. The studies presented in this thesis tested both of these hypotheses in Canada; a culture with relatively low homophobia and in which neither of these hypotheses has been previously examined.



## CHAPTER ONE

### Introduction

*Androphilia* refers to sexual attraction and arousal to adult males, whereas *gynephilia* refers to sexual attraction and arousal to adult females. Research in behavioral genetics indicates that there is a genetic component to male androphilia, although research in the area of molecular genetics has yet to identify the specific genes in question (Bailey et al., 1999; Bailey & Bell, 1993; Bailey, Dunne, & Martin, 2000; LeVay, 2010; Långström, Rahman, Carlström, & Lichtenstein, 2008). For example, sibling studies demonstrate that the male siblings of androphilic male probands are 2-5 times more likely to be androphilic themselves, compared to the male siblings of gynephilic probands (Bailey & Pillard, 1991). Beyond sibling dyads, male androphilia has also been shown to cluster in families and over several generations, suggesting that specific parenting styles cannot account for multigenerational familial clustering (LeVay, 2010). Twin studies demonstrate that monozygotic male twins are approximately two and a half to three times more likely to be concordant for homosexuality than dizygotic twin (Bailey & Pillard, 1991; Whitam et al., 1993). These results are also unlikely to be accounted for by socialization as research demonstrates that monozygotic twins recall being treated less alike by their parents than their dizygotic counterparts (Evans & Martin, 2008). All of these effects appear to be stronger for same-sex siblings as opposed to opposite-sex ones (LeVay, 2010).

Research demonstrates that sexual orientation in human males tends to be categorical. The vast majority of males exhibit exclusive genital arousal to adult females, whereas a small percentage (approximately 2-3%) exhibits exclusive genital arousal to

adult males (Chivers et al., 2004). Few human males (< 1%) exhibit genital arousal to both males and females (Rieger et al., 2005). Not surprisingly then, androphilic males reproduce at a fraction of the rate of gynephilic males (Saghir & Robins, 1973; van de Ven, Rodden, Crawford & Kippax, 1997; Yankelovich, 1994). Given gynephilic males' disproportionate reproductive success, the genes associated with male androphilia should have been long since replaced by the genes associated with male gynephilia.

Nevertheless, prehistoric rock art and pottery suggests that male-male sexual activity has existed for millennia (Mathieu, 2003; Nash, 2001; Yates, 1993). For example, prehistoric petroglyphs in the Gothenburg regions of Sweden depict male genital-genital contact (Yates, 1993) and ceramic water containers from the prehistoric Moche culture of Peru depict male-male anal intercourse (Mathieu, 2003). In addition, archeological evidence from early medieval Britain in the form of male skeletal remains buried with feminine artifacts is suggestive of male androphilia (Knüsel & Ripley, 2000). Taken together, this evidence points to the conclusion that male androphilia represents something of an evolutionary puzzle.

### **The Kin Selection Hypothesis for Male Androphilia**

The Kin Selection Hypothesis (KSH; Wilson, 1975) suggests that the genes for male androphilia can be maintained in a population if enhancing one's indirect fitness offsets the cost of not reproducing directly. *Indirect fitness* is a measure of an individual's impact on the fitness of collateral kin (who share some identical genes by virtue of descent), weighted by the degree of relatedness (Hamilton, 1963). Accordingly, androphilic males could theoretically increase their indirect fitness by directing altruistic behaviour toward closely related kin, thereby allowing those kin to increase their own reproductive success. Thus, the KSH predicts that androphilic males will be more likely

to exhibit kin-directed altruism compared individuals whose life histories are, or will likely be, characterized by direct reproduction (i.e., gynephilic males and androphilic females). As of yet, no support has been found for the KSH for male androphilia in Western cultures (USA: Bobrow & Bailey, 2001; UK: Rahman & Hull, 2005) or in Japan (Vasey & VanderLaan, 2011).

However, repeated evidence supporting the KSH for male androphilia has come from the Polynesian island nation of Samoa. In Samoa, androphilic males are referred to as *fa'afafine*, an “alternative” gender role category that is distinct from the gender categories of “man” and “woman” (Bartlett & Vasey, 2006; Schmidt, 2003; Vasey & Bartlett, 2007). *Fa'afafine* translates to mean “in the manner of a woman.” Most *fa'afafine* self-identify, and are identified by other Samoans as *fa'afafine* and not as “men” or “women.” As a group, *fa'afafine* tend to be effeminate both as children and as adults, and some are so feminine that they could easily pass as women to the naïve observer. Only a very small number are unremarkably masculine. In adulthood, *fa'afafine* are, with very few exceptions, exclusively androphilic.

Research in Samoa has repeatedly demonstrated that, *fa'afafine* show evidence of significantly higher altruistic tendencies towards their siblings' offspring (i.e. nieces and nephews) relative to Samoan gynephilic men with children (Vasey, Pocock & VanderLaan, 2007). This sexual orientation difference was subsequently replicated twice in Samoa using independent samples (VanderLaan & Vasey, in press; Vasey & VanderLaan, 2010a). *Fa'afafine* had significantly higher avuncular tendencies even when compared to childless gynephilic men who, like *fa'afafine*, had no direct childcare responsibilities (Vasey & VanderLaan, 2010a). In addition, *fa'afafine* exhibited significantly higher avuncular tendencies compared to the maternal (i.e., aunt-like)

tendencies of Samoan mothers and childless women (Vasey & VanderLaan, 2009).

*Fa'afafine* are as likely to form, and invest in, sexual/romantic relationships as men and women and, as such, their elevated avuncular tendencies are not simply a by-product of affordances created by lack of investment in such relationships (VanderLaan & Vasey, in press). Behaviorally, *fa'afafine*'s elevated altruistic tendencies are expressed, at least in part, in terms of more money given toward nieces, relative to comparable monetary contributions by Samoan women and gynephilic men (Vasey & VanderLaan, 2010b).

In addition, it has been shown that, compared to women and gynephilic men, the avuncular cognition of *fa'afafine* appears to be more adaptively designed. First, compared to Samoan women and gynephilic men, *fa'afafine* appear to be more attuned on maximizing resources directed toward nieces and nephews while at the same time minimizing resources directed toward non-kin children (Vasey & VanderLaan, 2010c). Second, whereas Samoan men and women show a tendency to decrease their willingness to investment in nieces and nephews when they have sexual or romantic relationship partners, the cognition of *fa'afafine* appears to protect against this tendency by maintaining a high level of willingness to invest in nieces and nephews regardless of relationship status (VanderLaan & Vasey, in press). These cognitive tendencies in *fa'afafine* may have early developmental precursors in the form of elevated attachment to the family during childhood. For example, pre-androphilic boys' elevated traits of separation anxiety stem, in part, from concern over the wellbeing of their parents (VanderLaan, Gothreau, Bartlett, & Vasey, 2011; Vasey, VanderLaan, Gothreau, & Bartlett, 2009).

The question arises then as to why the avuncular cognition of the Samoan *fa'afafine* appears to be in line with the predictions of the KSH, while the avuncular cognition of

androphilic (i.e. “gay”) males from other cultures (e.g. USA, UK, Japan) is not. One possibility is that an avuncular androphilic male phenotype exists, but the functional expression of this phenotype is dependent on key environmental variables that mediate its development. The key environmental variables that mediate the development of an avuncular androphilic male phenotype may be present in Samoa, but absent in the USA, the UK and Japan. In the absence of environmental variables similar to those that characterized the environment of evolutionary adaptedness, the functional behavioral expression of such genotypes may not be expressed (for a more general discussion of this point, see Tooby & Cosmides, 2005).

Multiple environmental variables may explain the cross-cultural differences in avuncularity among androphilic males (Bobrow & Bailey, 2001; Vasey et al., 2007; Vasey & VanderLaan, in press). For example, the high levels of social and familial acceptance experienced by Samoan androphilic males (*fa’afafine*) may be a key social factor promoting the expression of elevated avuncularity in this group (Vasey et al., 2007; Vasey & VanderLaan, 2009, 2010a, b, c). Conversely, national probability samples collected in the USA, the UK, and Japan indicate that individuals from those cultures are relatively intolerant of homosexuality. Indeed, in the USA and Japan homophobic attitudes are well above the average for 24 countries (Widmer, Treas, & Newcombe, 1998; Halman, Inglehart, Díez-Menrano, Luijkx, Moreo, & Basáñez, 2008). Thus, cross-cultural differences in the expression of elevated avuncularity by androphilic males may be related to cross-cultural variations in social acceptance toward such males.

### **The Sexually Antagonistic Gene Hypothesis for Male Androphilia**

The sexually antagonistic gene hypothesis (SAGH; sometimes referred to as the “female fecundity hypothesis” or the “fertile female hypothesis”) offers another possible

explanation for the evolution of male androphilia. This hypothesis posits that the genes for androphilia have pleiotropic and sexually antagonistic effects (for a more general discussion see, Zeh & Zeh, 2005). Specifically, these particular genes for androphilia are expressed phenotypically as same sex attraction and arousal when inherited by males, ultimately resulting in fitness costs. Conversely, the same genes for androphilia are expressed phenotypically as elevated fecundity when inherited by females, ultimately resulting in fitness benefits. The fitness benefits associated with elevated fecundity in females are thought to offset the associated costs in males and, therefore, be sufficient to maintain the sexually antagonistic genes for androphilia within a population. As such, the most basic version of SAGH predicts that all of the female relatives of androphilic males will exhibit an elevated fecundity (i.e., mothers, as well as, maternal and paternal grandmothers, aunts, sisters, and female cousins).

Support for the SAGH for male androphilia comes from research conducted in Western and non-Western nations. Using low-fertility Italian populations, Camperio-Ciani, Corna, and Capiluppi (2004) demonstrated that the female maternal relatives of androphilic males had a significantly higher fecundity than did the female maternal relatives of gynephilic males. Female maternal relatives of androphilic males produced approximately 33% more offspring than the female maternal relatives of gynephilic males. Comparable rates of fecundity were not found in the paternal relatives of androphilic or gynephilic males. In addition, Camperio-Ciani et al. (2004), found that androphilic males had more androphilic male relatives in the maternal line, than they did in the paternal line. Iemmola & Camperio-Ciani (2008) replicated these results using an independent Italian sample.

Further, albeit more limited, support for the SAGH comes from a UK population. Rahman et al. (2008) found that, compared to gynephilic males, androphilic males had significantly more maternal-line androphilic male relatives than paternal-line ones. In addition, Rahman et al. (2008) demonstrated that the maternal aunts of white androphilic males exhibited elevated fecundity relative to the maternal aunts of gynephilic males.

Several other studies have furnished support for the SAGH by demonstrating that androphilic males have a greater number of maternal aunts than gynephilic males (Bailey, Pillard, Dawood, Miller, Farrer, Trivedi et al., 1999; McKnight & Malcolm, 2000; Turner, 1995). Additionally, research conducted in the Polynesian island nation of Samoa has repeatedly demonstrated that the mothers of androphilic males (*fa'afafine*), are more fecund than those of gynephilic males (Vasey & VanderLaan, 2007; VanderLaan & Vasey, 2011). Taken together, existing tests of the sexually antagonistic gene are ostensibly consistent with the conclusion that gene(s) for male androphilia are found on the X chromosome and, as such, inheritance of these genes occurs through maternal-line relatives. To date, no studies have been conducted to identify the psychological or physiological mechanisms that might produce fertility differences between the female kin of male androphiles and those of male gynephiles. In sum, the existing evidence supports a modified version of the SAGH, which predicts that the maternal female relatives of androphilic males will exhibit elevated fecundity compared to: (1) the female partner relatives of androphilic males, and (2) the female maternal and paternal relatives of gynephilic males.

### **Concluding Introductory Remarks**

The KSH and the SAGH both provide plausible explanations as to how the genes for androphilia are maintained in the population despite a marked reproductive

disadvantage. Moreover, it deserves to be stressed that these two explanations are complimentary, not mutually exclusive and, therefore, may work in tandem to maintain genes for male androphilia in a population over evolutionary time. Although other evolutionary hypotheses for male androphilia have been forwarded in the literature (for examples, see Kirkpatrick, 2000), the KSH and the SAGH are the only evolutionary hypotheses for male androphilia that have any quantitative support. Still, both hypotheses require further testing in different cultural settings. As previously mentioned, if an avuncular male androphilic behavioral phenotype exists, its adaptive expression is likely mediated by a particular environmental context, namely, one that shares key features which the ancestral environment in which the genes for male androphilia evolved.

Given that support of the KSH has been gleaned from research conducted in Samoa but not from research that has been conducted in the USA, the UK or Japan, several authors have proposed that social tolerance toward androphilic males may have been a key prerequisite in the ancestral human environment for the origin and evolution of elevated avuncularity in androphilic males (Bobrow & Bailey, 2001; VanderLaan et al., 2011; Vasey et al., 2007). Likewise, these authors have argued that the development and expression of elevated avuncularity in androphilic males in contemporary environments is contingent on a social environment that is characterized by social tolerance toward androphilic males.

Although Canada shares many characteristics with other so-called Western populations, comparatively speaking, it falls toward a more liberal end of the spectrum with respect to the social acceptance experienced by homosexual citizens (Anderson & Fetner, 2008; Widmer et al., 1998; Halman et al., 2008). This is especially true relative to



other populations (i.e., USA, UK, Japan) in which the KSH has been tested (Widmer et al., 1998; Halman et al., 2008). Consequently, if the phenotypic expression of elevated avuncularity is contingent on relatively high levels of social acceptance of male androphiles, then Canada is an appropriate environment in which to test the KSH.

It seems reasonable to suggest that in ancestral human environments, most gynephilic women were likely reproducing at, or near, their reproductive limit given that lack of modern contraceptives. As such, researchers have suggested that it is more appropriate to test the SAGH hypothesis in populations that are characterized by higher fertility rates (Camperio-Ciani et al., 2004; Iemmola & Camperio-Ciani, 2008; VanderLaan & Vasey, in press; Vasey & VanderLaan, 2007). Elevated fecundity may be more easily detected in high fertility populations. Canadian born women give birth to more children on average than do European born women (Belanger & Okiawa, 1999). Consequently, compared to the UK, Canada provides a reasonable environment in which to test the SAGH. In the subsequent chapters, I test the KSH and the SAGH using a sample drawn from a Canadian population.

## CHAPTER TWO

### Male Sexual Orientation and Avuncularity in Canada: Implications for the Kin Selection Hypothesis

#### ABSTRACT

*Androphilia* refers to sexual attraction and arousal to adult males, whereas *gynephilia* refers to sexual attraction and arousal to adult females. The Kin Selection Hypothesis (KSH) posits that genes for male androphilia can persist if androphilic males offset the fitness costs of not reproducing directly by enhancing indirect fitness. In theory, by directing altruistic behavior toward kin, androphilic males can increase the reproduction of kin, thereby enhancing indirect fitness. Evidence supporting the KSH has been documented in Samoa. Samoan transgendered, androphilic males, known locally as *fa'afafine*, are socially accepted by the majority of Samoans. In contrast, no supportive evidence has been garnered from other cultures (i.e., USA, UK, Japan) that are characterized by less social tolerance toward male androphiles. Tests of the KSH in Canada might be more likely to yield findings consistent with Samoa because Canadian social and political attitudes toward male androphiles are markedly more tolerant and accepting. Here, I compared the willingness of Canadian androphilic men, gynephilic men, and androphilic women to invest in nieces and nephews as well as nonkin children. Consistent with the KSH and findings from Samoa, androphilic men exhibited a significantly greater cognitive dissociation between altruistic tendencies directed toward kin versus nonkin children relative to gynephilic men and androphilic women. The present study, therefore, provides some tentative support for the KSH from a culture other than Samoa. Findings and future directions for research are considered within the context of the existing cross-cultural literature.

*Androphilia* refers to sexual attraction and arousal to adult males, whereas *gynephilia* refers to sexual attraction and arousal to adult females. Research suggests that there is some genetic influence on male androphilia (e.g., Bailey, Dunne, & Martin, 2000; Kendler, Thornton, Gilman, & Kessler, 2000; Långström, Rahman, Carlström, & Lichtenstein, 2008), and that androphilic males reproduce at about one-fifth to one-tenth the rate of gynephilic males (e.g., Saghir & Robins, 1973; van de Ven, Rodden, Crawford & Kippax, 1997; Yankelovich, 1994). Consequently, one would expect genes for male gynephilia to have long replaced those for male androphilia given the reproductive benefits associated with the former. Nevertheless, prehistoric rock art and pottery suggests that male-male sexual activity has existed for millennia (e.g., Mathieu, 2003; Nash, 2001; Yates, 1993). A trait that lowers direct reproduction and persists over evolutionary time requires explanation when viewed within the context of natural selection, a process that favors the evolution of reproductively viable traits.

The Kin Selection Hypothesis (KSH; Wilson, 1975) postulates that genes for male androphilia could be maintained in a population if enhancing one's indirect fitness offset the cost of not reproducing directly. *Indirect fitness* is a measure of an individual's impact on the fitness of kin (who share some identical genes by virtue of descent), weighted by the degree of relatedness (Hamilton, 1963). Theoretically speaking, androphilic males could increase their indirect fitness by directing altruistic behavior toward close kin, which, in principle, would allow kin to increase their reproductive success. This hypothesis is unique in that it predicts male androphiles will exhibit more kin-directed altruism than men and women whose life-histories are (or will likely be) characterized by direct reproduction. To date, no support for this hypothesis has been garnered from

studies conducted in Western cultures (USA: Bobrow & Bailey, 2001; UK: Rahman & Hull, 2005) and Japan (Vasey & VanderLaan, in press).

In contrast, repeated support for the KSH for male androphilia has come from the Polynesian island nation of Samoa. In Samoa, androphilic males are referred to as *fa'afafine*, an “alternative” gender role category that is distinct from the gender categories of “man” and “woman” (Bartlett & Vasey, 2006; Schmidt, 2003; Vasey & Bartlett, 2007). *Fa'afafine* translates to mean “in the manner of a woman.” Most *fa'afafine* self-identify, and are identified by other Samoans, as *fa'afafine* and not as “men” or “women.” As a group, *fa'afafine* tend to be effeminate both as children and as adults, and some are so feminine that they could easily pass as women to the naïve observer. Only a very small number are unremarkably masculine. In adulthood, *fa'afafine* are, with very few exceptions, exclusively androphilic.

Multiple studies using independent samples have shown that *fa'afafine* exhibit significantly higher altruistic tendencies toward nieces and nephews compared to Samoan gynephilic men with children (Vasey, Pocock & VanderLaan, 2007), childless gynephilic men (Vasey & VanderLaan, 2010a), and mothers and women without children (Vasey & VanderLaan, 2009). Behaviorally, the *fa'afafine*'s elevated avuncularity is manifested, at least in part, in terms of more money given to nieces, compared to women and gynephilic men (Vasey & VanderLaan, 2010b). In addition, it has been shown that, compared to women and gynephilic men, the avuncular cognition of androphilic males appears to be adaptively designed, in that, *fa'afafine* appear to be more focused on maximizing resources directed to nieces/nephews while minimizing resources directed to non-kin children (Vasey & VanderLaan, 2010c).

The question arises as to why the avuncular cognition of *fa'afafine* in Samoa is consistent with the KSH, while that of androphilic (i.e., *gay*) men from the other cultures (e.g., UK, USA, Japan) is not. If an altruistic androphilic male phenotype indeed exists, its functional expression may be dependent on key environmental factors that mediate its development. In the absence of a social context that approximates the environment of evolutionary adaptedness for genetic factors underlying male androphilia, the theorized functional behavioral expression of such genetic factors is simply not manifested (for a more general discussion of this point, see Tooby & Cosmides, 2005). As such, environmental factors that may mediate the development of an altruistic androphilic male phenotype may not be present in cultures such as the USA, the UK, and Japan (Bobrow & Bailey, 2001; Rahman & Hull, 2005; Vasey & VanderLaan, in press).

A number of factors might account for the observed cross-cultural differences in avuncularity among androphilic males (Bobrow & Bailey, 2001; Vasey et al., 2007; Vasey & VanderLaan, in press). In Samoa, social and familial acceptance of androphilic males (*fa'afafine*) is widespread. For example, *fa'afafine* are able to hold *matai* (family chief) titles, which constitute the central socio-political positions in Samoan society (Mageo, 1998). It has been suggested that the social acceptance that *fa'afafine* enjoy may be a key social factor promoting elevated avuncularity in this group (Vasey et al., 2007; Vasey & VanderLaan, 2009, 2010a, b, c). In contrast, national probability samples collected in the USA, the UK, and Japan indicate that individuals from those cultures are relatively intolerant of homosexuality; indeed, in the USA and Japan homophobic attitudes are well above the average for 24 countries (Widmer, Treas, & Newcombe, 1998). Thus, cross-cultural differences in the presence of distinctive avuncular cognition

among androphilic males may be related to cross-cultural variations in social acceptance toward them.

With this logic in mind, I examined whether androphilic men would exhibit relatively higher avuncular tendencies in Canada. Despite Canada's cultural similarity to the USA and the UK, previous authors have cautioned against characterizing all Western populations on the basis only a few, and have encouraged systematic research on differences and similarities among Western nations (Henrich, Heine, & Norenzayan, 2010). Indeed, in contrast to the USA and the UK, as well as Japan, Canadian social and political attitudes are markedly more tolerant and accepting toward homosexuality (Anderson & Fetner, 2008; Widmer et al., 1998). Since 1981, Canada has experienced a dramatic decrease in the stigmatization of homosexuality (Anderson & Fetner, 2008), and conversely, there has been a dramatic increase in support for gay men and lesbians. For example, a 1994 poll found that 46% of Canadians felt that homosexuality was "not wrong at all," compared to 19% of US citizens, 26% of UK citizens, or 2% of Japanese citizens (Widmer et al., 1998). In 2005, Canada became the fourth nation in the world to legalize same-sex marriage. Part of this process involved the amendment of 68 federal statutes to recognize same-sex couples (e.g., old age pension, income tax, bankruptcy protection). A survey by Environics (2007) found that 75 per cent of Canadians "agree or strongly agree" that gays and lesbians should be permitted to run for public office; this was the highest approval level of all countries in the Western Hemisphere. Taken together, this information suggests that same-sex couples in Canada enjoy more legal rights and social acceptance than almost any other nation. Hence, if the development of elevated avuncular tendencies among androphilic males is contingent on a cultural environment that is more accepting of them, then Canadian androphilic men should be

more likely to exhibit such tendencies. In the current study, I examined this possibility by comparing willingness of Canadian androphilic men, gynephilic men, and androphilic women to invest in nieces and nephews.

We carried out an additional test of the KSH by examining participants' willingness to invest in nonkin children. Humans have evolved via kin selection to preferentially allocate altruistic tendencies towards closely related family members (Daly, Salmon, & Wilson, 1997). As a result, this preferential altruism should be evident in all individuals regardless of sex or sexual orientation. More importantly, however, a potential by-product of elevated avuncularity might be elevated willingness to help non-kin children, and available data suggests this is, indeed, the case (Vasey & VanderLaan, 2010c; Vasey & VanderLaan, in press). Based on the KSH, to alleviate the potential fitness costs associated with such a by-product, androphilic males should be optimally designed to maximize kin-directed altruism, while minimizing the altruistic behaviour diverted toward nonkin children. Thus, I also tested the prediction that Canadian androphilic men's willingness to invest in kin versus nonkin children should be more dissociated (i.e., co-vary less with one another) compared to gynephilic men and androphilic women.

## **Methods**

### *Participants*

All participants (N = 325) were recruited via a combination of Canadian mailing lists, (N = 543) through the University of Lethbridge student participant pool, and through online advertisements placed on Facebook - a well-known social networking website. Facebook ads were displayed only to Canadian facebook members.

Kinsey ratings (Kinsey, Pomeroy, & Martin, 1948) of sexual feelings over the previous year were obtained for all participants. In order to assess sexual feelings, participants were asked “Which of the following statements best describes your sexual feelings during the last year?” Subsequently, participants were asked to select one of the following six options: “Sexual feelings only toward females” (Kinsey rating = 0), “Most sexual feelings toward females, but an occasional fantasy about males” (Kinsey rating = 1), “Most sexual feelings toward females, but some definite sexual feeling toward males” (Kinsey rating = 2), “Sexual feelings equally divided between males and females with no strong preference for one or the other” (Kinsey rating = 3), “Most sexual feelings toward males, but some definite sexual feelings toward females” (Kinsey rating = 4), “Most sexual feelings toward males, but an occasional fantasy about females” (Kinsey rating = 5), “Sexual feelings only toward males” (Kinsey rating = 6). (Note: Kinsey ratings were reverse scored for women). Kinsey ratings were obtained for 122 androphilic males. Of these, 103 (84.4%) had a rating of 6, and 19 (15.6%) had a rating of 5. For 107 gynephilic males, 84 (78.5%) had a rating of 0, and 23 (21.5%) had a rating of 1. For 96 androphilic females, 60 (62.5%) had a rating of 0, and 36 (37.5%) had a rating of 1.

#### *Procedure and Measures*

All data were collected via an online questionnaire. The questionnaire was a modified version of a previously used Kin Selection and Altruistic Tendencies Toward Nonkin Children Questionnaire (Bobrow & Bailey, 2001; Rahman & Hull, 2005; Vasey et al., 2007; Vasey & VanderLaan, 2010c), and was made up of three sections. The first section contained standard biographical questions pertaining to participant sex, gender identity, age, sexual orientation, socio-economic status, highest level of education, religious affiliation, level of religiosity, and number and ages of children parented.



The second section was comprised of the Avuncular/Maternal Tendencies subscale. This 9-item subscale was designed to measure willingness to allocate resources to nieces and nephews (Bobrow & Bailey, 2001; Rahman & Hull, 2005; Vasey et al., 2007). For this subscale, participants were asked to imagine that a sibling who lived nearby requested assistance with various childcare activities. Participants were then asked to rate their willingness to help care for their nieces and nephews via a 7-point Likert-type scale that ranged from 1 = *very unwilling*, to 7 = *very willing*. Items included: babysitting for an evening, babysitting on a regular basis, taking care of the children for a week while the parents are away, buying toys for the children, tutoring one of the children in a subject they knew well, helping to expose the children to art and music, contributing money for daycare, contributing money for children's medical expenses, and contributing money for the children's education.

The third section of the questionnaire was made up of the same items and the same response scale as in the previous section. However, in contrast, for this section participants were asked about their willingness to imagine that an individual in their neighborhood who they were not related to asked for assistance taking care of their children, and thus comprised the Altruistic Tendencies Toward Nonkin Children subscale (Vasey & VanderLaan, 2010c). For each subscale, participants' ratings were averaged to create Avuncular/Maternal Tendencies and Altruistic Tendencies Toward Nonkin Children scores.

## **Results**

Table 2.1 shows the descriptive statistics and standardized internal consistency reliabilities for androphilic men, gynephilic men, and androphilic women for the

Avuncular/Maternal Tendencies subscale as well as the Altruistic Tendencies Toward Nonkin Children subscale. Reliabilities were appreciable for each group.

Descriptive statistics for all biographic variables were calculated and are presented in Table 2.2 according to group. Analysis of Variance (ANOVA) indicated a main effect of group for age ( $F[2, 318] = 26.12, p < .001, \eta^2 = .14$ ). However, ANOVAs indicated no main effects of group for religiosity ( $F[2, 322] = 2.27, p = .11, \eta^2 = .01$ ), or number of children parent ( $F[2, 322] = .62, p = .54, \eta^2 = .003$ ). Chi-square tests of independence demonstrated no group differences with respect to: socioeconomic status (SES) during childhood ( $\chi^2 [4, 325] = 3.25, p = .49, \text{Cramer's } \phi = .07$ ); level of education ( $\chi^2 [2, 325] = .64, p = .73, \text{Cramer's } \phi = .04$ ); religious affiliation ( $\chi^2 [6, 325] = 3.16, p = .79, \text{Cramer's } \phi = .07$ ); ethnicity ( $\chi^2 [2, 325] = 1.78, p = .41, \text{Cramer's } \phi = .07$ ); region of residence ( $\chi^2 [4, 325] = 4.98, p = .29, \text{Cramer's } \phi = .08$ ); or whether the participant was a parent ( $\chi^2 [2, 325] = 5.03, p = .08, \text{Cramer's } \phi = .13$ ).

Although no statistically significant differences were found between-groups in regards to number of children parented or whether the participant was a parent, the lack of group difference appeared to result from the significant group differences in regards to age. An analysis of covariance (ANCOVA) was conducted using age as a covariate. When controlling for group differences in age in this manner, there was a significant main effect of group with respect to number of children parented ( $F[2, 317] = 11.72, p < .001$ ). Likewise, a general linear model showed that when controlling for age, there was a significant main effect of group with respect to the presence or absence of children ( $G^2[2] = 22.19, p < .001$ ). That said, number of children parented and whether the participant was a parent were not significantly correlated with scores on either subscale, whereas age

was significantly correlated with Avuncular Tendencies scores for androphilic and gynephilic men (Table 2.3). Participant age was, therefore, controlled for in all subsequent analyses.

A two-way mixed model (group x subscale) ANCOVA was conducted, including age as a covariate. There was a main between-subjects effect of group ( $F[2, 317] = 5.31$ ,  $p = .005$ ,  $\eta^2 = .03$ ), as well as a main within-subjects effect of subscale, ( $F[2, 317] = 157.54$ ,  $p < .001$ ,  $\eta^2 = .33$ ). There was no statistically significant interaction between group and subscale ( $F[2, 317] = .587$ ,  $p = .56$ ,  $\eta^2 = .04$ ). The absence of any statistically significant interaction between the two factors would seem to suggest that avuncular tendencies and altruistic tendencies toward nonkin children are not relatively dissociated among Canadian androphilic men. However, it may be erroneous to make this assumption based on this particular ANCOVA model alone. Tests of interaction effects, by nature, are associated with weakened statistical power, particularly when strong main effects are evident (Wahlsten, 1999), as is the case here. In the present study, then, it is reasonable to assume that the test for interaction provided by the ANCOVA model is weak, and that the absence of an interaction effect is a case of Type II error. Consequently, I approached data analysis in the manner suggested by Saville (1990), who argued that when predictions are made *a priori*, the most appropriate means of testing them while balancing the likelihood of Type I and Type II errors is to perform direct inferential tests.

Two-tailed paired *t*-tests were conducted on the two subscales. Avuncular/Maternal Tendencies scores tended to be significantly greater than Altruistic Tendencies Toward Nonkin Children scores for androphilic men ( $t[121] = 14.11$ ,  $p <$

.001, Cohen's  $d = 1.22$ ), gynephilic men, ( $t[106] = 18.28, p < .001$ , Cohen's  $d = 1.39$ ), and androphilic women ( $t[95] = 17.72, p < .001$ , Cohen's  $d = 1.50$ ).

One-way ANCOVAs with age as a covariate showed main effects of group on Avuncular/Materteral Tendencies scores ( $F[2, 317] = 3.55, p = .03, \eta^2 = .02$ ), and Altruistic Tendencies Toward Nonkin Children ( $F[2, 317] = 5.09, p = .007, \eta^2 = .03$ ). With respect to Avuncular/Materteral Tendencies scores, *post hoc* pair-wise comparisons using Fisher's Least Significant Difference showed that androphilic women scored significantly higher than androphilic men ( $p = .05$ ). With respect to Altruistic Tendencies Toward Nonkin Children scores, *post hoc* pair-wise comparisons showed that women scored significantly higher than androphilic men ( $p = .009$ ) and gynephilic men ( $p = .04$ ).

Finally, the correlation between Avuncular/Materteral Tendencies scores and Altruistic Tendencies Toward Nonkin Children scores was calculated for each group while controlling for age. There were significant positive correlations for androphilic men ( $n = 122, r = .55, p < .001$ ), gynephilic men ( $n = 107, r = .71, p < .001$ ), and androphilic women ( $n = 96, r = .66, p < .001$ ). Subsequently, using Fisher's *r*-to-*Z* transformation, the magnitudes of these correlations were compared. The correlation between these variables was significantly weaker among androphilic men than among gynephilic men ( $z = 3.98, p < .001$ ), and androphilic women ( $z = 2.67, p = .003$ ). However, there was no statistically significant difference between gynephilic men and androphilic women ( $z = 1.17, p = .12$ ).

## **Discussion**

Previous research has shown that transgendered androphilic males from Samoa (*fa'afafine*) exhibit elevated avuncular tendencies, whereas non-transgendered

androphilic men (gays) from Western nations such as the USA and the UK, as well as those from non-Western nations such as Japan do not (Bobrow & Bailey, 2001; Rahman & Hull, 2005; Vasey et al., 2007; Vasey & VanderLaan, in press). These differences might be due to the fact that Samoan androphilic males enjoy widespread social acceptance, whereas the same is not true for androphilic men from the other cultures that have been studied thus far. Consequently, I hypothesized that elevated societal homophobia in the USA, UK, and Japan might mitigate the expression of elevated kin-directed altruism in androphilic men from these nations.

Androphilic men in Canada enjoy more legal rights and social acceptance than most other nations. Hence, I predicted that if homophobia is a key factor influencing the expression of avuncularity in non-transgendered androphilic (gay) men, then those living in Canada should be more likely to exhibit increased avuncular tendencies. Contrary to this prediction, Canadian androphilic men did not exhibit increased avuncular tendencies compared to gynephilic men and androphilic women. These findings, then, do not support the hypothesis that societal differences in acceptance of androphilic males are responsible for the observed cross-cultural differences in avuncular tendencies. In addition, these findings suggest that decreased societal homophobia, in and of itself, is not sufficient for the development of elevated willingness to invest in nieces and nephews in male androphiles relative to male gynephiles and female androphiles. However, experiencing homophobia might still be an important factor to consider for understanding individual differences in kin-directed altruism among androphilic men. Future research, therefore, may wish to consider how individual experiences with homophobia relate to kin-directed altruism among androphilic men.

Given the present findings, the question remains as to why cross-cultural differences in elevated avuncular tendencies among androphilic males exist. A number of potentially inter-related cultural factors might account for these cross-cultural differences, including the degree of individualism versus collectivism, geographic disconnect from kin, and relative lack of transgenderism found in the USA, UK, Japan, and Canada relative to Samoa (Bobrow & Bailey, 2001; Vasey et al., 2007; Vasey & VanderLaan, in press). In addition, the relative lack of homophobia in Samoa might interact with these other cultural factors to produce a social environment that is conducive to the development of elevated avuncular tendencies in male androphiles. Further studies aimed at isolating these factors, as well as differing combinations thereof, would help elucidate the developmental bases of elevated avuncular tendencies in male androphiles as documented in Samoa.

In addition to assessing the potential role of societal homophobia in the expression of elevated avuncular tendencies in androphilic males, I also tested further predictions derived from the KSH concerning the avuncular cognition of androphilic males. Vasey and VanderLaan (2010c) predicted that, relative to gynephilic men and androphilic women, the relationship between willingness to invest in kin versus nonkin children would be more dissociated in androphilic males. Indeed, Vasey and VanderLaan (2010c) showed that such was the case in Samoa. Furthermore, they speculated that examining the relationship between these two cognitive domains in other populations might be more effective at revealing unique aspects of the avuncular cognition of androphilic males relative to simply comparing their willingness to invest in nieces and nephews to that of gynephilic men and androphilic women. Here, I carried out such an assessment by examining how willingness to invest in kin versus nonkin children related

to one another in our sample of Canadian androphilic men, gynephilic men, and androphilic women.

Consistent with the idea that all humans evolved via kin selection to preferentially direct altruism toward kin (Daly et al., 1997), all three participant groups exhibited elevated willingness to invest in kin (i.e., nieces and nephews) over nonkin children. All three participant groups showed a positive correlation between willingness to invest in kin versus nonkin children, which is consistent with the conclusion that a by-product of elevated avuncular/materteral tendencies is an increased willingness to behave altruistically toward nonkin children. More importantly, given the focus of the present study, the magnitude of the correlation between willingness to invest in kin versus nonkin children was significantly weaker for androphilic men compared to gynephilic men and androphilic women. In line with the KSH, this latter finding indicates that these two cognitive domains (i.e., willingness to invest in kin versus nonkin children) are relatively more dissociated (i.e., co-vary less with one another) in Canadian androphilic (*gay*) men. Similar findings have been reported for Samoan androphilic males, and it was argued that such a cognitive dissociation would allow for allocation of resources to nieces and nephews in a more economical, efficient, reliable, and precise (i.e., adaptive) manner (Vasey & VanderLaan, 2010c). As such, the present findings concerning Canadian androphilic men are the first data from a population other than Samoa to indicate that the avuncular cognition of androphilic males has undergone selection for enhancing indirect fitness, as posited by the KSH.

Given these findings, it seems pertinent to recommend that future studies examine whether this cognitive dissociation characterizes the avuncular cognition of androphilic males in other populations as well. For example, androphilic men in the USA and the UK

might be similar to those in Canada in that although they do not exhibit elevated avuncular tendencies, they may still show a greater dissociation between willingness to invest in kin versus nonkin children. That said, in Japan, androphilic men do not show elevated avuncular tendencies or a relatively greater dissociation between these domains (Vasey & VanderLaan, in press). At present, it is unclear why the findings from Japan differ from those obtained in Samoa and Canada. Null findings, like those observed in Japan, can be difficult to interpret, and raise the question of whether these differences in findings are owing to differences in some of the aspects of the methodologies employed (e.g., sampling method, cultural differences in questionnaire response patterns).

Alternatively, these conflicting findings might be reflective of true cultural differences. If this latter scenario is the case, then potentially relevant factors include those that systematically differ between Samoa and Canada versus Japan and also bear relevance to the development of kin-directed altruism (e.g., societal acceptance of androphilic males). Any speculations concerning these possibilities would be equivocal at this point. Hence, future replications of this study in novel samples from varying populations that examine factors of potential relevance to the development of kin-directed altruism in androphilic males will be the most informative.

Nevertheless, the present findings concerning Canadian androphilic men are the first data from a population other than Samoa to indicate that the avuncular cognition of androphilic males has undergone selection for enhancing indirect fitness, as posited by the KSH. VanderLaan, Gothreau, Bartlett, and Vasey (2011) have argued that developmental precursors of elevated avuncularity (i.e., elevated childhood attachment to kin) characterize pre-androphilic boys across diverse cultures, citing quantitative evidence from Canada (VanderLaan, Gothreau, Bartlett & Vasey, in press) and Samoa



(Vasey, VanderLaan, Gothreau & Bartlett, in press). The fact that Canadian androphilic men exhibit the cognitive dissociation found here contributes further to the evidence base suggesting cross-cultural continuity in the kin-related cognition of males who are androphilic in adulthood. Still, the question remains as to why Samoan *fa'afafine* and Canadian androphilic men would be similar in these respects, but differ for elevated avuncular tendencies, and this question should continue to be the focus of future research.

**Table 2.1** Subscale scores and standardized internal consistency reliabilities (alphas) by group.

	Androphilic men ( <i>n</i> = 122)	Gynephilic men ( <i>n</i> = 107)	Androphilic women ( <i>n</i> = 96)
Avuncular/ Materteral Tendencies subscale: <i>M</i> (SD)	4.89 (.83)	5.08 (.77)	5.50 (.68)
Reliability ( $\alpha$ )	.89	.87	.85
Altruistic Tendencies Toward Nonkin Children subscale: <i>M</i> (SD)	3.27 (1.06)	3.38 (1.06)	3.89 (1.60)
Reliability ( $\alpha$ )	.90	.91	.86

**Table 2.2.** Descriptive statistics for biographic variables by group.

Biographic Variable	Androphilic men ( <i>n</i> = 122)	Gynephilic men ( <i>n</i> = 107)	Androphilic women ( <i>n</i> = 96)
Age (in years) <i>M</i> (SD)	39.14 (15.85)	30.12 (11.82)	26.60 (14.30)
Socioeconomic status childhood			
Upper/upper middle class (%)	27.0	29.0	27.1
Middle class (%)	56.6	46.7	49.0
Lower/lower class (%)	16.4	24.3	24.0
Education			
Secondary or less (%)	14.8	18.7	16.8
Post secondary (%)	85.2	81.3	83.4
Religious affiliation			
Protestant/Catholic (%)	31.1	36.4	37.5
Jewish/Muslim/Buddhist (%)	4.1	1.9	2.1
None (%)	53.3	47.7	45.8
Other (%)	11.5	14.0	14.6
Religiosity <i>M</i> (SD)	2.52 (1.70)	2.76 (1.87)	3.03 (1.74)
Ethnicity			
Caucasian (%)	86.9	80.4	83.3
Non-Caucasian (%)	13.1	19.6	16.7
Region			
Western Canada (%)	71.3	66.0	75.8
Central Canada (Ont. & Que.) (%)	20.5	29.2	17.9
Eastern Canada (%)	8.2	4.7	6.3
Do you have children			
Yes (%)	12.3	22.4	22.1
No (%)	87.7	77.6	77.4
Number of children <i>M</i> (SD)	.25 (.72)	.36 (.87)	.36 (.77)

**Table 2.3** Two-tailed Pearson's *r* correlations between subscale scores and number of children parented, whether the participant had children, and age.

Item	Androphilic men ( <i>n</i> = 122)		Gynephilic men ( <i>n</i> = 107)		Androphilic women ( <i>n</i> = 96)	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Number of children parented						
Avuncular/ Materteral Tendencies	-.09	.29	-.00	.98	-.01	.93
Altruistic Tendencies Toward Nonkin Children	-.08	.40	-.03	.77	.07	.52
Presence or absence of children						
Avuncular/ Materteral Tendencies	.11	.22	.06	.51	.04	.70
Altruistic Tendencies Toward Nonkin Children	.13	.17	-.04	.71	-.03	.78
Age (in years)						
Avuncular/ Materteral Tendencies	-.14	.05	-.19	.05	-.14	.17
Altruistic Tendencies Toward Nonkin Children	-.02	.87	-.09	.37	-.09	.39

## CHAPTER THREE

### Testing the Sexually Antagonistic Gene Hypothesis for Male Androphilia in Canada

#### ABSTRACT

*Androphilia* refers to sexual attraction and arousal to adult males whereas, *gynephilia* refers to sexual attraction and arousal to adult females. Male androphilia has a genetic component however, male androphiles reproduce far less often than male gynephiles. Therefore the persistence of male androphilia in populations over evolutionary time represents an evolutionary puzzle. The Sexually Antagonistic Gene Hypothesis (SAGH) suggests that the reproductive costs of genes for male androphilia are offset by the reproductive benefits that occur if the same genes result in an increased reproductive success in the female relatives of male androphiles. Preliminary support for the SAGH comes from various Western and non-Western populations (e.g., Camperio-Ciani et al., 2004; Iemmola & Camperio-Ciani, 2008; Vasey & VanderLaan, 2007), in which certain categories of androphilic males' maternal relatives have been shown to exhibit higher reproductive success than those of gynephilic males. The current study, tested the SAGH in Canada by comparing androphilic and gynephilic males in terms of the number of paternal-line and maternal-line female relatives they had. Results were inconsistent with the SAGH and the possibility of sampling bias is discussed.

*Androphilia* refers to sexual attraction and arousal to adult males. In contrast, *gynephilia* refers to sexual attraction and arousal to adult females. Research in behavioral genetics indicates that there is some genetic influence on male androphilia (e.g., Bailey, Dunne, & Martin, 2000; Kendler, Thornton, Gilman, & Kessler, 2000; Långström, Rahman, Carlström, & Lichtenstein, 2008). Moreover, demographic research indicates that androphilic males reproduce at a fraction of the rate of gynephilic males (e.g., Saghir & Robins, 1973; van de Ven, Rodden, Crawford & Kippax, 1997; Yankelovich, 1994). Given gynephilic males' reproductive advantage, one would expect the genes for male gynephilia to have long replaced those for male androphilia. Nevertheless, prehistoric rock art and pottery suggest that male-male sexual activity has existed for millennia (e.g., Mathieu, 2003; Nash, 2001; Yates, 1993). Traits that lower reproductive success, such as male androphilia, represent an evolutionary puzzle when viewed within the context of natural selection, a process that favors the evolution of reproductively viable traits. As such, the existence of such fitness-compromising traits raises the question as to why the genes responsible for such traits do not go extinct.

The sexually antagonistic gene hypothesis (SAGH; sometimes referred to as the “female fecundity hypothesis” or the “fertile female hypothesis”) offers one possible explanation for the evolution of male androphilia. This hypothesis holds that genes for androphilia have, pleiotropic and sexually antagonistic effects (for a more general discussion see, Zeh and Zeh, 2005). Specifically, these genes for androphilia result in fitness costs for males in the form of same-sex sexual attraction and arousal. Conversely, these same genes result in fitness benefits for females in the form of increased fecundity, compared to other females in the population. The fitness benefits associated with elevated fecundity in females are thought to offset the associated costs in males and

therefore, be sufficient to maintain sexually antagonistic genes for androphilia within a population. As such, the most basic version of SAGH predicts that all of the female relatives of androphilic males will exhibit an elevated fecundity (i.e., mothers, as well as, maternal and paternal grandmothers, aunts, sisters, and female cousins).

Repeated support for the SAGH has been derived using Italian populations. Camperio-Ciani, Corna, and Capiluppi (2004) demonstrated that the female maternal relatives of androphilic males had a significantly higher fecundity than did the female maternal relatives of gynephilic males, with the later producing approximately 33% more offspring than the former. The same elevated fecundity was not found in the paternal relatives of androphilic or gynephilic males. In addition, Camperio-Ciani et al. (2004), found that androphilic males had more androphilic male relatives in the maternal line, than they did in paternal line. Iemmola & Camperio-Ciani (2008) replicated these results using an independent Italian sample.

Rahman et al., (2008) found that, compared to gynephilic males, androphilic males had significantly more matrilineal androphilic male relatives than patrilineal ones. In addition, the maternal aunts of white androphilic males exhibited elevated fecundity relative to those of gynephilic males. Contrary to the predictions of the SAGH, Rahman et al. (2008) also reported that the kin of non-white gynephilic males exhibited elevated fecundity overall, when compared to those of non-white androphilic males. LeVay (2010) suggested that this latter finding might have resulted from a recruitment bias because non-white immigrants who are not yet fully acculturated tend to belong to larger-than-average families (Coleman & Salt, 1992), use more inclusive definitions of relationship terms like “cousins,” and be less accepting and open about homosexuality. Further, LeVay (2010) speculated that the gynephilic male non-White participants in Rahman et

al. (2008) sample were representative of the non-White population, but the androphilic male non-Whites came from more acculturated families, leading to a smaller estimate of family size for gay men. Indeed, Rahmen et al. (2008) state that a reporting bias may account for why non-White heterosexual participants in his study reported more relatives. Furthermore, Rahmen et al.'s (2008) failure to replicate the well-established fraternal birth-order effect (e.g., Bogaert & Skorska, 2011) for male androphiles suggests that their sample was anomalous.

A number of other studies demonstrate that androphilic males have more maternal-line aunts compared to gynephilic males, thus lending further support the SAGH (Bailey, Pillard, Dawood, Miller, Farrer, Trivedi et al., 1999; McKnight and Malcolm, 2000; Turner, 1995). Finally, research conducted in the Polynesian island nation of Samoa has repeatedly demonstrated that the mothers of androphilic males are more fecund than those of gynephilic males (Vasey & VanderLaan, 2007; VanderLaan & Vasey, 2011).

Taken together, this body of research indicates that genes influencing male androphilia are shared by maternal-line relatives. This is consistent with the conclusion that genes for male androphilia are inherited maternally via the X chromosome. In line with this conclusion, research on fruit flies (*Drosophila melanogaster*) demonstrates that the X chromosome harbors 97% of genome-wide sexually antagonistic variation (Gibson, Chippindale, & Rice, 2002). Detailed mathematical modeling by Camperio-Ciani, Cermelli, & Zanzotto (2008) demonstrated that a two-locus genetic model with at least one locus on the X chromosome, and in which gene expression is sexually antagonistic, can account for why male androphilia persists at a constant, low frequency in populations without disappearing or increasing in frequency.



In the current study, I examine whether Canadian androphilic males and gynephilic males differed in the number of children produced by their female relatives (i.e., mothers, grandmothers, aunts, sisters, and female cousins) and their male relatives (i.e., fathers, grandfathers, uncles, brothers, and male cousins) in order to ascertain whether elevated reproductive success is specific to female relatives of androphilic males. On the basis of previous research outlined above, I predicted that the maternal line female relatives of androphilic males would demonstrate greater reproductive success relative to: (1) the paternal line of female relatives of androphilic males and (2) the maternal line of female relatives of gynephilic males. In addition, I predicted that androphilic males will have a greater number of maternal androphilic male relatives, compared to paternal ones. These effects may be more easily detected in higher fertility populations. In this regard, it is noteworthy that Canadian-born women give birth to more children, on average, than do European ones (Belanger & Okiawa, 1999).

## **Methods**

### *Participants*

All participants (N = 206) were recruited via a combination of Canadian mailing lists, through the University of Lethbridge student participant pool, and through online advertisements placed on Facebook. Facebook is a well-known social networking website. Facebook ads were displayed only to Canadian Facebook members.

Kinsey ratings (Kinsey, Pomeroy, & Martin, 1948) of sexual feelings over the previous year were obtained for all participants. In order to assess sexual feelings, participants were asked, “Which of the following statements best describes your sexual feelings during the last year?” Kinsey ratings were obtained for 109 self-identified

androphilic males. Of these, 93 (85.3%) had a rating of 6 (Sexual feelings only toward males), and 16 (14.7%) had a rating of 5 (Most sexual feelings toward males, but an occasional fantasy about females). For 97 self-identified gynephilic males, 87 (89.7%) had a rating of 0 (“Sexual feelings only toward females”), and 10 (10.3%) had a rating of 1 (Most sexual feelings toward females, but an occasional fantasy about males).

### *Procedure and Measures*

All data were collected via an online questionnaire. Biographic information was collected pertaining to gender identity (i.e. woman, man, other), age, highest level of education (i.e. none, less than elementary, elementary, less than high school, high school, some post secondary, post secondary, post graduate), religious affiliation (Christian, Jewish, Muslim, Buddhist, other, none), level of religiosity (7-point Likert-type scale that ranged from 1 = *not at all religious*, to 7 = *extremely religious*), socio-economic status (i.e. upper class, upper-middle class, middle class, lower-middle class, lower class), area of residence (i.e., urban, rural suburban), birth order of participants’ siblings, and sexual orientation of participants. The same information was collected for the participants’ siblings and parents, as well as, their maternal and paternal first cousins, aunts, uncles, and grandparents. Total numbers of offspring were calculated for each category. Participants were also asked to identify each relative as heterosexual, homosexual, or bisexual.

### **Results**

Descriptive statistics for all biographic and demographic variables were calculated and are presented in Table 3.1 according to group. Analysis of Variance (ANOVA) indicated a main effect of group for age ( $F[1, 205] = 6.64, p = .01, \eta^2 = .03$ ), and for

religiosity ( $F[1, 205] = 5.98, p = .02, \eta^2 = .03$ ). Participant age and religiosity was, therefore, controlled for in all subsequent analyses.

Chi-square tests of independence demonstrated no group differences with respect to: level of education ( $\chi^2 [1, 204] = .08, p = .77, \text{Cramer's } \varphi = .02$ ); religious affiliation ( $\chi^2 [5, 205] = 4.26, p = .51, \text{Cramer's } \varphi = .14$ ); current socioeconomic status ( $\chi^2 [2, 206] = 4.66, p = .10, \text{Cramer's } \varphi = .15$ ); parents socioeconomic status ( $\chi^2 [2, 204] = .896, p = .64, \text{Cramer's } \varphi = .07$ ); maternal grandparents socioeconomic status ( $\chi^2 [2, 205] = 2.66, p = .27, \text{Cramer's } \varphi = .11$ ); maternal aunts and uncles (mother's siblings) socioeconomic status ( $\chi^2 [2, 202] = .15, p = .93, \text{Cramer's } \varphi = .03$ ); paternal grandparents socioeconomic status ( $\chi^2 [2, 204] = 2.05, p = .36, \text{Cramer's } \varphi = .10$ ); paternal aunts and uncles (father's siblings) socioeconomic status ( $\chi^2 [2, 200] = 5.33, p = .07, \text{Cramer's } \varphi = .16$ ); childhood living area ( $\chi^2 [2, 206] = 3.25, p = .20, \text{Cramer's } \varphi = .13$ ); maternal grandparents living area ( $\chi^2 [2, 203] = 2.13, p = .35, \text{Cramer's } \varphi = .10$ ); paternal grandparents living area ( $\chi^2 [2, 202] = .64, p = .73, \text{Cramer's } \varphi = .06$ ).

#### *Rates of Homosexuality in the Relatives of Androphilic and Gynephilic Participants*

The sum of relatives reported to be homosexual was calculated for matrilineal male relatives (i.e., maternal uncles and male cousins) and patrilineal male relatives (i.e., paternal uncles and male cousins). An analysis of covariance (ANCOVA) was conducted using age and religiosity as a covariates. This analysis indicated that compared to gynephilic males, androphilic males had a greater number of maternal male homosexual relatives ( $F[3, 190] = 5.68, p = .001, \eta^2 = .08$ ), paternal male homosexual relatives ( $F[3, 185] = 11.24, p < .000, \eta^2 = .15$ ; Table 3.2).

### *Reproductive Success of the Relatives of Androphilic and Gynephilic Men*

Reproductive outputs (i.e., number of children produced) were calculated for the following categories of relatives: mothers, maternal aunts, maternal uncles, maternal grandparents, paternal aunts, paternal uncles, and paternal grandparents (Table 3.3). In addition, family size (i.e., cumulative reproductive output of maternal-line relative or paternal-line relatives) and family composition (i.e., number of older and younger brothers, number of older and younger sisters) was also examined.

An analysis of covariance (ANCOVA) was conducted using age and religiosity as a covariates. I found no evidence for increased reproductive success in the maternal versus the paternal-line of androphilic males ( $F[1, 185] = 2.50, p = .12, \eta^2 = .01$ ). Conversely, I found significantly elevated reproductive success in the mothers ( $F[3, 197] = 5.01, p = .002, \eta^2 = .07$ ), maternal aunts ( $F[3, 152] = 5.03, p = .002, \eta^2 = .09$ ), maternal uncles ( $F[3, 159] = 8.52, p < .000, \eta^2 = .14$ ), paternal aunts ( $F[3, 151] = 3.97, p = .009, \eta^2 = .07$ ) and paternal uncles ( $F[3, 150] = 4.90, p = .003, \eta^2 = .02$ ) of gynephilic males, relative to those of androphilic males. No significant between group differences were found in terms of the reproductive success of the maternal ( $F[3, 152] = 2.35, p = .07, \eta^2 = .34$ ) and paternal ( $F[3, 189] = 1.48, p = .22, \eta^2 = .02$ ) grandparents of androphilic and gynephilic males.

### *Sibling Sex Composition*

Family composition with respect to sibling sex found significant group differences with respect to total family size in that gynephilic men had larger families on average  $F[3, 195] = 8.12, p < .000, \eta^2 = .11$ ). More specifically, compared to androphilic

men, gynephilic males had more older sisters ( $F[3, 196] = 3.57, p = .01, \eta^2 = .05$ ), and younger brothers ( $F[3, 196] = 2.62, p = .05, \eta^2 = .04$ ). No significant between group differences were found in terms of number of older brothers and younger sisters (Table 3.4).

## **Discussion**

Previous research suggests that male androphilia clusters within families across multiple generations (LeVay, 2010). This pattern suggests that male androphilia has a heritable component and is not the result of particular parenting styles. On the basis of this evidence, I predicted that familial clustering of male androphilia would be observed in the current study, which employed a Canadian sample. Familial clustering of male androphilia was indeed observed. The number of androphilic male relatives was significantly higher in the families of androphilic males compared to those of gynephilic males.

The SAGH holds that the female kin of male androphiles will exhibit elevated reproductive success compared to the female kin of male gynephiles. Previous research conducted on Italian populations (Camperio-Ciani et al., 2004; Iemmola & Camperio-Ciani, 2008) has furnished support for this hypothesis demonstrating that the maternal female kin of male androphiles exhibit elevated reproductive success compared to those of gynephilic males (see also Rahman, 2008 for more limited supporting evidence from a UK population). On the basis of this research, I predicted that the maternal-line female relatives of androphilic males would demonstrate elevated reproductive success compared to their paternal-line female relatives. In addition, I predicted that the maternal-line female relatives of androphilic males would demonstrate elevated reproductive

success compared to the maternal line female relatives of their gynephilic counterparts. Contrary to my prediction, I found no support for the SAGH using this Canadian sample. More specifically, no significant difference in reproductive success was found in the maternal-line versus the paternal-line relatives of androphilic males. Moreover, I found elevated rates of reproductive success for both the maternal-line relatives (i.e. mothers, aunts, uncles) and the paternal-line relatives (i.e. aunts, uncles) of gynephilic males.

The fraternal birth order (older brother) effect refers to the phenomenon whereby men have an increased probability of being homosexual with every older biological brother that they have (Bogaert, 2006). Evidence in support of the fraternal birth order effect is overwhelming. This effect has been documented in subjects examined in recent years and in subjects examined decades ago; in psychiatric patients and in non-patient volunteers; in subjects examined in childhood and adulthood; in transsexual subjects and in subjects who experience no dysphoria with their sexed bodies; in men sexually attracted to adults and in those sexually attracted to prepubescent or pubescent children; in non-White (i.e., Black, Hispanic, East Indian, Asian) citizens of the United States; in samples collected in different Western nations including England, Italy, the Netherlands, Canada, and the United States (reviewed in Blanchard, 2004); in samples collected in non-Western locations (Vasey & VanderLaan, 2007; VanderLaan & Vasey, 2011); by independent researchers (Camperio-Ciani, Corna & Capiluppi, 2004; Green, 2000; King, Green, Osborn, Arkell, Heterton, Pereira, 2005; Robinson & Manning, 2000; Williams, Pepitone, Cristensen, Cooke, Huberman, Breedlove et al., 2000); and in men reared with and without their biological older brothers (Bogaert, 2006). In addition, research demonstrates that although the number of biological older brothers is correlated with an

increased probability of androphilia in men, the number of non-biological older brothers has no effect (Bogaert, 2006).

The current study found no significant differences between androphilic and gynephilic males with respect to number of older brothers. The absence of a fraternal birth order effect is strikingly inconsistent with most other research and, in and of itself, suggests that the samples employed in this study are not typical. Although androphilic and gynephilic participants were recruited using identical methodology, there were variables on which the groups differed. For example, significant group differences in religiosity existed. Religiosity clusters within families (Cornwall, 1987). Research indicates that religiosity is positively correlated with reproductive success (Krishnan, 1993). Consequently, it is conceivable that the relatives of our gynephilic male participants also exhibited elevated religiosity compared to the relatives of our androphilic male participants. This elevated religiosity may, in turn, help explain, at least in part, why the relatives of the gynephilic male participants exhibited elevated reproductive success compared to those of the less religious androphilic males. While it is true that participants' religiosity was controlled for during the analyses, it may have been more optimal to control for the religiosity of the extended family members as well. Not doing so may have affected our results.

Hartley (1978) suggested that the critical factor when considering the influence of religion is religious practice and not belief. Indeed, a Canadian study found that attendance at church services is positively correlated with the likelihood of whether individuals decided to have children (Krishnan, 1993). Similarly, a study of The Church of Jesus Christ of Latter-day Saints (LDS; aka, Mormons), found a positive correlation between attendance at religious services and the number of children parented (Wilkinson

& Tanner, 1980). The same study found that religiosity is causally related to family size and that family size is in turn a measure of religious commitment (Wilkinson & Tanner, 1980). Our questionnaire asked participants how religious they were, not how often they attended church services. As such, our attempt to control for the religiosity may have been confounded.

A further limitation of this study may have involved the manner in which religious affiliation was defined. In Lethbridge, Canada, where the majority of the gynephilic male participants were recruited, there is a higher than normal representation of LDS (Mormons) (Brinkerhoff & Grandin, 1991). Members of this religious group have been demonstrated to have larger than average families (Binkerhoof & Grandin, 1991; Wilkinson & Tanner, 1980). On our questionnaire, all Christian religious affiliations including Mormonism were simply collapsed under the umbrella category “Christian” and did not provide participants the opportunity to identify with a particular subset of Christianity. Given that much of the gynephilic male sample was collected in Lethbridge, Canada, the possibility exists LDS Mormons were over-represented and this may have biased the sample such that gynephilic male participants had larger than average family sizes.

Furthermore, if LDS Mormons were over-represented in our gynephilic male sample, then it stands to reason that these participants may have under-reported the existence of homosexual relatives, either because they sought to suppress such information or were unaware that they even had homosexual relatives. The LDS Church has a rich history of prohibiting homosexual behaviour (Byrd & Chamberlain, 1993). As such, it is possible that gynephilic participants who are members of the LDS church may have had ‘closeted’ family members that they may not want to acknowledge as



homosexual or that they were completely unaware of. If future tests of the SAGH were to be conducted using a Canadian sample, then attempts should be made to obtain a more representative sample of Canadian gynephilic males.

When testing evolutionary hypotheses, such as the sexually antagonist gene hypothesis, it is important to consider the role that environmental factors, such as culture, play in the development of heritable traits. Genes interact with the environment to produce behavioral output (i.e., phenotypes). It is possible that the SAGH for male androphilia is correct, but that the genes in question are not functionally expressed in Canadian cultures because the social environment is not representative of the context in which male androphilia evolved. In the absence of a social context that approximates the gene's environment of evolutionary adaptiveness, a functional behavioral expression of the gene is simply not manifested.

Analyses conducted by VanderLaan, Ren & Vasey (submitted) have shown that the ancestral form that male androphilia likely took was transgendered, and not the sex/gender-congruent form ("gay") that is typical in Western cultures. In the societies in which they occur, transgendered androphilic males occupy alternative gender role categories distinct from the categories of "men" and "women," and they exhibit gender role presentation that is markedly similar to that of members of the opposite sex within their given cultural context. In contrast, sex-gender congruent androphilic males occupy the gender role typical of their sex and identify as "men". In light of VanderLaan et al.'s (submitted) findings, it seems reasonable to caution that tests of models for the evolution of male androphilia may be more valid if they are conducted in certain non-Western populations, in which transgender male androphiles exist.

All this being said, genes that influence male androphilia might be expressed in Western cultural contexts in ways that are not necessarily adaptive, but which reflect the ancestrally-atypical contingencies afforded by Western cultures. For example, using a previously employed scale, Forrester, VanderLaan, Parker & Vasey (submitted) found no differences in avuncular tendencies between Canadian gynephilic and androphilic males. In contrast, when a new avuncular tendencies scale was developed with the goal of taking in to account the affordances of modern Western culture (e.g., internet communication), Abild, VanderLaan & Vasey (in prep.) found that androphilic males exhibit elevated avuncular tendency compared to their gynephilic counterparts. Although Abild et al.'s (in prep.) findings are consistent with predictions derived from the Kin Selection Hypothesis for male androphilia, it is unlikely that avuncularity when expressed in terms of communicating with one's nieces and nephews via the internet has any fitness enhancing payoff for the individuals involved.

Similar logic might be employed when interpreting tests of the SAGH within Western cultures. Imagine, for example, that this hypothesis is correct. Imagine further that fecundity differences are mediated by differences in libido between the female kin of male androphiles versus those of male gynephiles. In keeping with this logic, I would predict that, ancestrally, the female kin of male androphiles engaged in sexual interactions more frequently compared to the female kin of male gynephiles. In the current environment, elevated sexual activity might also be expressed by the female kin of male androphiles but a functional pay-off, in the form of elevated reproductive success, might not be expressed given the use of contraceptives in the modern world. In other words, in contemporary Western environments, genes for elevated fecundity may express themselves in non-adaptive ways in the female kin of male androphiles (i.e.,

elevated copulation rates with contraceptives) due to ancestrally-atypical contingencies of that environment (i.e., availability of contraceptives).

**Table 3.1.** Descriptive statistics for biographic variables by group.

Biographic Variable	Androphilic men ( <i>n</i> =109)	Gynephilic men ( <i>n</i> = 97)
Age (in years) <i>M</i> (SD)	29.26 (10.08)	25.86 (8.67)
Socioeconomic status (SES) childhood		
Upper/upper middle class (%)	26.6	26.8
Middle class (%)	45.9	58.8
Lower/lower class (%)	27.5	12.4
SES status currently		
Upper/upper middle class (%)	31.2	18.6
Middle class (%)	53.2	59.8
Lower/lower class (%)	15.6	21.6
Parents SES		
Upper/upper middle class (%)	11.9	11.3
Middle class (%)	51.4	58.8
Lower/lower class (%)	34.9	29.9
Maternal grandparents SES		
Upper/upper middle class (%)	7.3	9.4
Middle class (%)	47.7	36.5
Lower/lower class (%)	45	54.1
Paternal grandparents SES		
Upper/upper middle class (%)	12.1	9.3
Middle class (%)	30.8	40.2
Lower/lower class (%)	57.1	50.5

---

Maternal Aunts and Uncles SES		
Upper/upper middle class (%)	18.7	16.8
Middle class (%)	59.8	62.1
Lower/lower class (%)	21.5	21.1
Paternal Aunts and Uncles SES		
Upper/upper middle class (%)	20.0	14.7
Middle class (%)	44.8	61.1
Lower/lower class (%)	35.2	24.2
Childhood living area		
Rural (%)	27.5	19.6
Urban (%)	24.8	35.0
Suburban (%)	47.7	45.4
Current living area		
Rural (%)	11.9	4.1
Urban (%)	66.1	55.7
Suburban (%)	22.0	39.2
Parents living area		
Rural (%)	34.6	28.9
Urban (%)	21.5	43.3
Suburban (%)	43.9	26.9
Maternal grandparents living area		
Rural (%)	46.7	51.0
Urban (%)	27.1	31.3
Suburban (%)	26.2	17.7

---

---

Paternal grandparents living area		
Rural (%)	44.8	48.4
Urban (%)	33.3	34.1
Suburban (%)	21.9	17.5
Education		
Secondary or less (%)	7.3	8.4
Post secondary (%)	92.7	91.6
Religious affiliation		
Christian (%)	25.7	33.3
Jewish/Muslim/Buddhist (%)	5.5	2.1
None (%)	57.8	49.0
Other (%)	11.0	15.6
Religiosity <i>M</i> (SD)	2.19 (2.05)	2.80 (1.52)

---

**Table 3.2** Means, standard deviation, and n for maternal and paternal line homosexual relatives by group

Variable	Androphilic males			Gynephilic males			<i>p</i>
	M	SD	<i>N</i>	M	SD	<i>N</i>	
Maternal male homosexual relatives	.18	.43	99	.10	.40	95	<i>p</i> = .001
Paternal male homosexual relatives	.33	.69	97	.04	.33	92	<i>p</i> = .000

**Table 3.3** Reported maternal and paternal line reproductive success

Relative category	Androphilic males			Gynephilic males			F	<i>p</i>	$\eta^2$
	M	SD	<i>N</i>	M	SD	<i>N</i>			
Mothers	2.82	1.69	104	3.09	1.44	97	5.01	.002	.07
Maternal aunts	1.84	1.13	82	2.38	1.74	74	5.03	.002	.09
Maternal uncles	1.38	1.40	86	2.17	1.26	77	8.53	.000	.14
Maternal grandparents	3.91	1.89	105	4.14	1.95	97	2.35	.07	.34
Paternal aunts	1.91	1.15	87	2.19	1.53	68	3.97	.009	.07
Paternal uncles	1.85	1.55	81	2.28	1.57	73	4.90	.003	.09
Paternal grandparents	4.59	2.49	99	4.03	1.82	94	1.48	.22	.02



**Table 3.4** Sibling Sex comparisons and total family size by group.

Relative category	Androphilic males			Gynephilic males			F	<i>p</i>	$\eta^2$
	M	SD	<i>N</i>	M	SD	<i>N</i>			
Older brothers	.42	.74	106	.50	.744	94	.60	.61	.01
Older sisters	.39	.64	105	.41	.68	95	3.57	.01	.05
Younger brothers	.41	.73	106	.59	.71	94	2.62	.05	.04
Younger sisters	.42	.63	105	.49	.63	95	.80	.50	.01
Total family size	1.64	1.08	105	1.98	1.34	94	8.12	.000	.11

## CHAPTER FOUR

### Conclusion

Male androphilia is paradox when viewed from an evolutionary perspective. It has a genetic basis (e.g., Bailey, Dunne, & Martin, 2000; Kendler, Thornton, Gilman, & Kessler, 2000; Långström, Rahman, Carlström, & Lichtenstein, 2008), yet male androphiles do not reproduce or, if they do, they tend to do so much less than male gynephiles (e.g., Saghir & Robins, 1973; van de Ven, Rodden, Crawford & Kippax, 1997; Yankelovich, 1994). Nonetheless, judging from prehistoric rock art and pottery (e.g., Mathieu, 2003; Nash, 2001; Yates, 1993), male-male sexual activity has existed for millennia. The maintenance of genes for a behaviour that reduces reproductive success appears counter-intuitive to Darwinian theory and therefore, requires an explanation. There are two hypotheses that have been put forth in an attempt to address this paradox and for which there is empirical support. These are, the kin selection hypothesis (KSH), and the Sexually Antagonistic Gene Hypothesis (SAGH). The studies presented in this thesis tested both of these hypotheses using a sample of Canadian participants.

#### **Kin Selection Hypothesis as a possible explanation for male androphilia.**

The Kin Selection Hypothesis (KSH; Wilson, 1975) posits that the genes for male androphilia can be maintained in a population by enhancing one's indirect fitness. *Indirect fitness* is a measure of an individual's impact on the fitness of kin (who share some identical genes by virtue of descent), weighted by the degree of relatedness (Hamilton, 1963). Theoretically, androphilic males could potentially increase their indirect fitness by behaving altruistically toward closely related kin, thereby allowing those kin to increase their own reproductive success. The basic prediction derived from this hypothesis is that androphilic males should exhibit elevated kin-directed altruistic

behaviour compared to individuals whose life histories will likely be characterized by direct reproduction (i.e., gynephilic males or androphilic females). To date, no support has been found for the KSH for male androphilia in Western cultures (USA: Bobrow & Bailey, 2001; UK: Rahman & Hull, 2005) or Japan (Vasey & VanderLaan, in press). Conversely, repeated support has been found for the KSH for male androphilia in the Polynesian island nation of Samoa.

The question then arises as to why such support for the KSH for male androphilia has been found in Samoa, but has not been found in any of the other cultures (e.g., UK, USA, Japan) in which it has been tested. If an altruistic androphilic male phenotype indeed exists, its functional expression may be dependent on key environmental factors that mediate its development. In the absence of a cultural context that resembles the environment of evolutionary adaptedness, the functional expression of genetic factors associated with male androphilia will simply not be manifested. The environmental factors that mediate the development of an altruistic androphilic male phenotype may be present in Samoa, but absent in cultures such as the USA, the UK, and Japan.

Several authors have proposed that social tolerance toward androphilic males may have been a key prerequisite in the ancestral human environment for the origin and evolution of elevated avuncularity in androphilic males (Bobrow & Bailey, 2001; VanderLaan et al., 2011; Vasey et al., 2007). Likewise, these authors have argued that the development and expression of elevated avuncularity in androphilic males in contemporary environments is contingent on a social environment that is characterized by social tolerance toward androphilic males. Consequently, I hypothesized that elevated societal homophobia in the USA, UK, and Japan (Widmer, Treas, & Newcombe, 1998;

Halman et al., 2008), might mitigate the expression of elevated kin-directed altruism in androphilic men from these nations.

### **Why test the KSH with a Canadian population?**

In contrast to the USA and the UK, and Japan, research indicates that Canadian social and political attitudes are markedly more tolerant and accepting toward homosexuality (Anderson & Fetner, 2008; Widmer et al., 1998). As such, androphilic men in Canada enjoy more legal rights and broader social acceptance than most other nations. Consequently, if tolerance is a key factor influencing the expression of avuncularity in sex-gender congruent androphilic (“gay”) men, then those living in Canada should be more likely to exhibit increased avuncular tendencies.

However, as demonstrated in Chapter 2, Canadian androphilic men did not exhibit increased avuncular tendencies relative to gynephilic men and androphilic women despite the increased social acceptance enjoyed by male androphilia in Canada. This suggests that societal differences in tolerance and acceptance of androphilic males *in and of itself*, is not sufficient for the development of an elevated willingness to invest in nieces and nephews in male androphiles and, in turn, is not solely responsible for the observed cross-cultural differences in avuncular tendencies. That being said, social acceptance might be one important facet of a suite of social factors that promote elevated avuncularity in androphilic males. The simultaneous absence of key social factors or the presence of others could theoretically mitigate the trait’s expression even when factors thought to promote its development are present. More cross-cultural research will be required to identify the precise social parameters required for the development of enhanced avuncularity in androphilic males.

As demonstrated in Chapter 2, gynephilic men, androphilic women and androphilic men all demonstrated an elevated willingness to invest in nieces and nephews over nonkin children. This is not surprising given that humans evolved via kin selection to preferentially direct altruism toward kin (Daly et al., 1997). All three participant groups showed a positive correlation between willingness to invest in kin and nonkin children. This finding is consistent with the conclusion that a by-product of elevated avuncular/maternal tendencies is an elevated willingness to behave altruistically toward nonkin children (Vasey & VanderLaan, 2010c).

Importantly, and consistent with the KSH, the magnitude of the correlation between willingness to invest in kin versus nonkin children was significantly weaker for androphilic men compared to gynephilic men and androphilic women. This suggests that similar to the findings that have been reported for Samoan androphilic males, these two cognitive domains (i.e., willingness to invest in kin versus nonkin children) are relatively more dissociated (i.e., co-vary less with one another) in Canadian androphilic (“gay”) men. Such a cognitive dissociation should, theoretically, allow for allocation of resources to nieces and nephews in a more economical, efficient, reliable, and precise (i.e., adaptive) manner (Vasey & VanderLaan, 2010c). As such, the present findings concerning Canadian androphilic men are the first data from a population other than Samoa to indicate that the avuncular cognition of androphilic males may have undergone selection for enhancing indirect fitness, as posited by the KSH.

That being said, it is possible to interpret these results from a social, not an evolutionary, perspective. For example, if androphilic males feel that they must over-compensate to prove their worth to their families, then they may be highly motivated to direct altruism towards their families members and, at the same time, have little

motivation to help non-kin individuals whose approval they do not seek. In line with this possibility, Williams (1992) pointed out that transgendered androphilic males in many non-Western cultures excel at various labor practices, especially feminine ones, as a way of striving for prestige within their families and communities. For example, historical reports from various native North American cultures (e.g., Winnebagos, Hopi, Lakota, Mohave, Assiniboine, Crow) all indicate that transgendered androphilic males were considered “better” than women when performing feminine tasks. Informants interviewed by Williams (1992:58) described a Lakota *winkte* (i.e., transgendered androphilic male) as being able to do “anything and everything better than women do: cooking, crocheting, everything women do.” In Western cultures, it has been suggested that many gay teens go into “over-achiever” mode in an attempt to compensate for the fact that they are gay, and thus, different from their peers (LeVay, Baldwin & Balwin, 2009).

Qualitative evidence suggests that in some cultures, the execution of feminine labour practices by transgendered androphilic males is underscored by a competitive element (Williams 1992). As one *fa'afafine* from the island of Upolu stated “If you cook with a *fa'afafine*, I think a *fa'afafine* will be better than you. If you're cleaning or doing all those kind of stuff that a woman should do, a *fa'afafine* is better than a woman for doing that” (Poe 2004). Williams (1992) speculated that this sort of competitiveness can be traced back to male-typical socialization in early childhood, which emphasizes competition for prestige. In line with this thinking, competition for prestige by over-excelling at labor practices, particularly those deemed feminine, may translate into increased willingness on the part of androphilic males to direct avuncular behavior towards nieces and nephews compared to women and men. Future research should focus

on testing whether androphilic males are more prone to over-achieving as a way of compensating for feelings of inferiority.

### **The Sexually Antagonistic Gene Hypothesis as a possible explanation for male androphilia**

The sexually antagonistic gene hypothesis (SAGH; sometimes referred to as the “female fecundity hypothesis” or the “fertile female hypothesis”) posits that the genes for androphilia have pleiotropic and sexually antagonistic effects (Zeh & Zeh, 2005).

Specifically, the genes for androphilia are expressed phenotypically as same sex attraction and arousal when inherited by males, ultimately resulting in fitness costs. On the other hand, the same genes for androphilia are expressed phenotypically as elevated fecundity when inherited by females, ultimately resulting in fitness benefits. The fitness benefits associated with elevated fecundity in females are thought to offset the associated costs in males and therefore, be sufficient to maintain the sexually antagonistic genes for androphilia within a population. The basic prediction derived from the SAGH is that the female relatives of androphilic males will exhibit elevated fecundity (i.e., mothers, grandmothers, aunts, sisters, and female cousins).

The strongest support for the SAGH has been derived from studies conducted in Italy where it has been demonstrated repeatedly that the female kin of male androphiles (e.g., mothers, maternal aunts and maternal grandmothers) are more fecund than those of gynephilic males (Camperio-Ciani, Corna, & Capiluppi, 2004; Iemmola & Camperio-Ciani 2008). Other studies have found elevated fecundity in the mothers or maternal aunts of male androphiles (Bailey, Pillard, Dawood, Miller, Farrer, Trivedi et al., 1999; McKnight and Malcolm, 2000; Rahman et al., 2008; Turner, 1995; VanderLaan & Vasey, 2011; 1995Vasey & VanderLaan, 2007). This evidence suggests that genes influencing

male androphilia are inherited maternally, which, in turn, is consistent with the conclusion that the genes in question exist on the X-chromosome.

Based on this body of research, I predicted that the maternal-line female relatives of androphilic males would demonstrate greater reproductive success compared to the paternal-line female relatives of androphilic males. In addition, I predicted that the maternal-line female relatives of androphilic males would demonstrate greater reproductive success compared to the maternal line of female relatives of gynephilic males. Finally, I predicted that androphilic males would have a greater number of maternal androphilic male relatives, compared to paternal ones.

#### **Why test the sexually antagonistic gene hypothesis in Canada?**

The sexually antagonistic effects gene hypothesis may be more easily tested in higher fertility populations where women are reproducing at, or near, their peak reproductive capacity (Camperio-Ciani et al., 2004; Iemmola & Camperio-Ciani 2008; VanderLaan & Vasey, 2011; Vasey & VanderLaan, 2007) . Research demonstrates that Canadian-born women give birth to more children, on average, than do European ones (Belanger & Okiawa, 1999). This is due, in part, to the fact that Canada experienced a decline in fertility at a later date than did Europe. As such, Canada may represent one of the better Western cultures in which to test the SAGH.

Despite the relatively high birth rate exhibited by Canadian women, the current study found no support for elevated maternal fecundity in the female relatives of androphilic males. In fact, the opposite was observed, with gynephilic males demonstrating an elevated maternal fecundity for many of categories of female relatives. Nevertheless, family clustering of male androphilia across several generations was observed in the androphilic male participants. This latter finding is consistent with



previous research and suggests that there is a genetic component to male androphilia. Importantly, the androphilic males in this Canadian sample did not report a significant number of older brothers relative to the gynephilic males. The noticeable absence of the well documented ‘older brother effect’ is cause for concern, suggesting that all of the results of the study presented in Chapter 3 may be due to sampling bias. These results underscore the importance of considering sample composition when testing evolutionary models for male androphile. These results also underscore the importance of considering the environmental context in which one tests evolutionary models. Although the possibility always exists that the evolutionary hypothesis one seeks to test is incorrect, weak hypotheses can only be disconfirmed with strong tests and strong test can only be conducted in environments that approximate features of the ancestral environment that are consider salient.

### **Concluding Remarks**

Although the KSH and the SAGH are often discussed separately, it is important to note that they are not mutually exclusive hypotheses. Both hypotheses may function to maintain genes for male androphilia in a population over evolutionary time and both may function in tandem. For example, one could imagine that the female relatives of male androphiles are genetically predisposed toward elevated fecundity as per the sexually antagonistic gene hypothesis. One could also imagine that elevated avuncularity in androphilic males is contingent on the existence of particular social factors (e.g., tolerance toward male androphiles, the expression of transgendered male androphilia) which characterized the Samoan culture, among others. If the sister of a male androphile was a member of such a culture, then she would enjoy increased childcare support from her androphilic brother and this would, in turn, boost her reproductive success even

further. Thus, elevated avuncularity by androphilic males might contribute, in part, to the fitness of genes influencing male androphilia as part of a gene-culture interaction.

In conclusion, given the evidence in support of both the KSH and the SAGH, it is plausible that both are reasonable explanations for male androphilia. That being said, the environmental factors necessary for the behavioral expression (e.g. elevated avuncularity, and elevated maternal line fecundity) of the associated genes may not be present in a contemporary Western culture such as Canada. Modern day Canadian society is unlikely to be very representative of the environment in which the genes for male androphilia evolved. As such, if the genes in question are expressed, they may manifest behaviorally in ways that reflect the constraints and contingencies of the modern Canadian social environment (e.g., elevated contact between uncles and their nieces/nephews over the internet or increased rates of copulation but with contraception), even if the putative adaptive psychological mechanisms are present (e.g., dissociation between avuncular tendencies versus altruistic tendencies towards non-kin children).

## REFERENCES

- Abild, M. L., VanderLaan, D. P., & Vasey, P. L. (submitted).
- Anderson, R. & Fetner, T. (2008). Cohort differences in tolerance of homosexuality: Attitudinal changes in Canada and the United States 1981-2000. *Public Opinion Quarterly*, 72, 311-330.
- Bartlett, N. H., & Vasey, P. L. (2006). A retrospective study of childhood gender-atypical behavior in Samoan *fa'afafine*. *Archives of Sexual Behavior*, 35, 559-566.
- Bailey, J. M. & Bell, A. P. (1993). Familiality of male and female homosexuality. *Behavior Genetics*, 23, 313-322.
- Bailey, J. M., Dunne, M. P., & Martin, N. G. (2000). Genetics and environmental influences on sexual orientation and its correlates in an Australian twin sample. *Journal of Personality and Social Psychology*, 78, 524-536.
- Bailey, J. M. & Pillard, R. C. (1991). A genetic study of male sexual orientation. *Archives of General Psychiatry*, 48, 1089-1096.
- Bailey, J. M., Pillard, R. C., Dawood, K., Miller, M., Farrer, L. A., Trivedi, S., & Murphy R. L. (1999). A family history study of male sexual orientation using three independent samples. *Behavior Genetics*, 29, 79-86.
- Belanger, A., Oikawa, C. (1999). Who has a third child? *Canadian Social Trends – Statistics Canada*, 11, 23-26.
- Blanchard, R. (1997). Birth order and sibling sex ratio in homosexual versus heterosexual males and females. *Annual Review of Sex Research*, 8, 27-67.
- Blanchard, R. (2004). Quantitative and theoretical analyses of the relation between older brothers and homosexuality in men. *Journal of Theoretical Biology*, 230, 173-187.

- Bobrow, D., & Bailey, J. M. (2001). Is male homosexuality maintained via kin selection? *Evolution and Human Behavior* 22, 61-368.
- Bogaert, A. F. (2006). Biological versus nonbiological older brothers and men's sexual orientation. *Proc. Natl Acad. Sci. USA*, 103, 10 771–10 774.  
doi:10.1073/pnas.0511152103
- Bogaert, A. F. & Skorska, M. (2011). Sexual orientation, fraternal birth order, and the maternal immune hypothesis: A review. *Frontiers in Neuroendocrinology*,  
doi:10.1016/j.yfrne.2011.02.004.
- Brinkerhoff, M. B. & Grandin, E. (1991). Contemporary reactions to Mormonism: A case study from rural Alberta. *Canadian Journal of Sociology*, 16, 165-186.
- Byrd, A. D. & Chamberlain, M. D. (1993). Dealing with issues of homosexuality: A qualitative study of six Mormons. *Issues in Religion and Psychotherapy*, 19, 47-89.
- Camperio Ciani, A., Cermelli, P., & Zanzotto, G. (2008). Sexually antagonistic selection in human male homosexuality. *PLoS ONE*, 3, e2282.  
doi:10.1371/journal.pone.0002282.
- Camperio Ciani, A., Corna, F., & Capiluppi, C. (2004). Evidence for maternally inherited factors favouring male homosexuality and promoting female fecundity. *Proceedings of the Royal Society of London, Series B*, 271, 2217-2221.
- Chivers, M. L., Rieger, G., Latty, E., & Bailey, J. M. (2004). A sex difference in the specificity of sexual arousal. *Psychological Science*, 15, 736-744.
- Coleman, D. and Salt, J. (1992), *The British Population: Patterns, Trends and Processes*, Oxford University Press: Oxford.
- Cornwall, M. (1987). The social basis of religion: A study of factors influencing religious

- belief and commitment. *Review of Religious Research*, 29, 44-56.
- Daly M., Salmon C., & Wilson M. (1997). Kinship: the conceptual hole in psychological studies of social cognition and close relationships. P. 265-296 in J. A. Simpson & D. Kenrick, eds., *Evolutionary social psychology*. Mahwah NJ: Erlbaum.
- Evans, D. M. & Martin, N. G. (2008). The validity of twin studies. *GeneScreen*, 1, 77-79. doi: 10.1046/j.1466-9218.2000.00027
- Forrester, D. L., VanderLaan, D. P., Parker, J. L., & Vasey, P. L. (in press). Male sexual orientation and avuncularity in Canada: Implications for the kin selection hypothesis. *Journal of Cognition and Culture*.
- Gibson, J. R., Chippindale, A. K., & Rice, W. R. (2002). The X chromosome is a hot spot for sexually antagonistic fitness variation. *Proceedings of the Royal Society of London, Series B*, 269, 499-505. doi: 10.1098/rspb.2001.1863.
- Green, R. (2000). Birth order and ratio of brothers to sisters in transsexuals. *Psychological Medicine*, 30, 789-795. doi:10.1017/S0033291799001932.
- Halman, L., Inglehart, R., Díez-Medrano, J., Luijkx, R., Moreno, A., & Basáñez, M. (2008). *Changing values and beliefs in 85 countries: Trends from the Values Surveys from 1981 to 2004*. Leiden: Brill.
- Hamilton, W. D. (1963). The evolution of altruistic behavior. *American Naturalist*, 97, 354-356.
- Hartley, S. F. (1978). Marital satisfaction among clergy wives. *Review of Religious Research*, 19, 178-191.
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, 33, 61-135.

- Iemmola, F., & Camperio Ciani, A. (2008) New evidences of genetic factors influencing sexual orientation in men: female fecundity increase in the maternal line. *Archives of Sexual Behavior*. doi: 10.1007/s10508-008-9381-6.
- Kendler, K. S., Thornton, L. M., Gilman, S. E., & Kessler, R. C. (2000). Sexual orientation in a US national sample of twin and non-twin sibling pairs. *American Journal of Psychiatry*, 157, 1843–1846.
- King, M.D., Green, J., Osborn, D. P. J., Arkell, J., Hetherington, J. & Pereira, E. (2005). Family size in white gay and heterosexual men. *Archives of Sexual Behavior*, 34, 117–122. doi:10.1007/s10508-005-1006-8.
- Kinsey, A. C., Pomeroy, W. B., & Martin, C. E. (1948). *Sexual behavior in the human male*. Philadelphia, PA and London, UK: Saunders.
- Kirkpatrick, R. C. (2000). The evolution of human homosexual behavior. *Current Anthropology*, 41, 385-413.
- Krishnan, V. (1993). Gender of children and contraceptive use. *Journal of Biological Science*, 25, 213-221. doi: 10.1017/S0021932000020502,
- Knüsel, C. J., & K. M. Ripley (2000). The man-woman or ‘berdache’ in Anglo-Saxon England and Post-Roman Europe. In W. Frazer & A. Tyrrel (Eds.), *Social identity in early medieval Britain* (pp. 157-191). Leicester: Leicester University Press.
- Långström, N., Rahman, Q., Carlström, E., & Lichtenstein, P. (2010). Genetic and environmental effects on same-sex sexual behavior: A population study of twins in Sweden. *Archives of Sexual Behavior*, 39, 75-80. doi: 10.1007/s10508-008-9386-1.
- LeVay, S. (2010). *Gay straight and the reason why*. New York: Oxford University Press
- LeVay, S., Baldwin & Baldwin,

- Mageo, J. M. (1998). *Theorizing self in Samoa: Emotions, genders and sexualities*. Ann Arbor: University of Michigan Press.
- Mathieu, P. (2003). *Sex Pots: Eroticism in Ceramics*. London: A & C Black.
- McKnight, J., & Malcolm, J. (2000). Is male homosexuality maternally linked? *Psychology, Evolution & Gender*, 2, 229–252.
- McLelland, M.J. (2000). *Male homosexuality in Modern Japan: Cultural Myths and Social Realities*. London: RoutledgeCurzon.
- Nash, G. (2001). The subversive male: Homosexual and bestial images on European mesolithic rock art. In: L. Bevan (Ed.), *Indecent exposure: Sexuality, society and the archaeological record* (pp. 43-55). Glasgow: Cruithne Press.
- Rahman, Q. & Hull, M. S. (2005). An empirical test of the kin selection hypothesis for male homosexuality. *Archives of Sexual Behavior*, 34, 461-467.
- Rahman, Q., Collins, A., Morrison, M., Orrels, J. C., Cadinouche, K., Greenfield, S., & Begum, S. (2008). Maternal inheritance and familial fecundity factors in male homosexuality. *Archives of Sexual Behavior*. doi: 10.1007/s10508-007-9191-2
- Rieger, G., Chivers, M. L., & Bailey, J. M. (2005). Sexual arousal patterns of bisexual men. *Psychological Science*, 16, 579-584.
- Robinson, S. J. & Manning, J. T. (2000). The ratio of 2<sup>nd</sup> to 4<sup>th</sup> digit length and male homosexuality. *Evolution and Human Behavior*, 21, 333–345.  
doi:10.1016/S1090-5138(00)00052-0.
- Saghir, M. T., & Robins, E. (1973). *Male and female homosexuality: a comprehensive investigation*. Baltimore: Williams & Wilkins.

- Saville, D. J. (1990). Multiple comparison procedures: The practical solution. *The American Statistician*, 44, 174-180.
- Schmidt, J. (2003). Paradise lost? Social change and *fa'afafine* in Samoa. *Current Sociology*, 51, 417-432.
- Tooby, J. & Cosmides, L. (2005). Conceptual foundations of evolutionary psychology. In: D. M. Buss (ed.). *The Handbook of Evolutionary Psychology*, Hoboken NJ: Wiley.
- Turner, W. J. (1995). Homosexuality, type 1: An Xq28 phenomenon. *Archives of Sexual Behavior*, 24, 109–134.
- van de Ven, P., Rodden, P., Crawford, J., & Kippax, S. (1997). A comparative demographic and sexual profile of older homosexually active men. *Journal of Sex Research*, 34, 349-360.
- VanderLaan, D. P., Gothreau, L., Bartlett, N. H., & Vasey, P. L. (2011). Separation anxiety in feminine boys: Pathological or prosocial? *Journal of Gay and Lesbian Mental Health*, 15, 1-16.
- VanderLaan, D. P., Gothreau, L., Bartlett, N. H., & Vasey, P. L. (in press). Recalled separation anxiety and gender-atypicality in childhood: A study of Canadian heterosexual and homosexual men and women. *Archives of Sexual Behavior*.
- VanderLaan, D. P., Ren, Z., & Vasey, P. L. (submitted).
- Vasey, P. L., & Bartlett, N. H. (2007). What can the Samoan *fa'afafine* teach us about the Western concept of “Gender Identity Disorder in Childhood”? *Perspectives in Biology and Medicine*, 50, 481-490.



- Vasey, P. L., Pocock, D. S., & VanderLaan, D. P. (2007). Kin selection and male androphilia in Samoan *fa'afafine*. *Evolution and Human Behavior*, 28, 159-167
- Vasey, P. L., & VanderLaan, D. P. (2008). Avuncular tendencies and the evolution of male androphilia in Samoan *fa'afafine*. *Archives of Sexual Behavior*. doi: 10.1007/s10508-008-9443-9.
- Vasey, P. L., & VanderLaan, D. P. (2009). Materteral and avuncular tendencies in Samoa: A comparative study of women, men and *fa'afafine*. *Human Nature*, 20, 269-281.
- Vasey, P. L., & VanderLaan, D. P. (2010a). Avuncular tendencies in Samoan *fa'afafine* and the evolution of male androphilia, *Archives of Sexual Behavior*, 39, 821-830.
- Vasey, P. L., & VanderLaan, D. P. (2010b). Monetary exchanges with nieces and nephews: A comparison of Samoan men, women, and *fa'afafine*. *Evolution and Human Behavior*, doi:10.1016/j.evolhumbehav.2010.04.001
- Vasey, P. L., & VanderLaan, D. P. (2010c). An adaptive cognitive dissociation between willingness to help kin and nonkin in Samoan *fa'afafine*. *Psychological Science*, 21, 292-297.
- Vasey, P. L., VanderLaan, D. P., Gothreau, L., & Bartlett, N. H. (2009). Traits of separation anxiety in childhood: A retrospective study in Samoan men, women, and *fa'afafine*. *Archives of Sexual Behavior*. doi: 10.1007/s10508-009-9589-0.
- Wahlsten, D. (1990). Insensitivity of the analysis of variance to heredity-environment interaction. *Behavioral and Brain Sciences*, 13, 109-161.
- Whitam, F. L., Diamond, M., and Martin, J. (1993). Homosexual orientation in twins: A report on 61 pairs and 3 triplet sets. *Archives of Sexual Behavior*, 22: 187-206.

- Widmer, E. D., Treas, J., & Newcombe, R. (1998). Attitudes toward nonmarital sex in 24 countries. *Journal of Sex Research, 35*, 349-358.
- Wilkinson, M. L. & Tanner, W. C. (1980). The influence of family size, interaction, and religiosity on family affection in a Mormon sample. *Journal of Marriage and Family, 42*, 297-304.
- Williams, W. (1992). *The spirit and the flesh: Sexual diversity in American Indian culture*. Boston: Beacon
- Williams, T. J., Pepitone, M. E., Christensen, S. E., Cooke, B. M., Huberman, A. D., Breedlove, N. J., Breedlove, T. J., Jordan, C. L. & Breedlove, S. M. (2000). Finger-length ratios and sexual orientation. *Nature, 404*, 455–456.  
doi:10.1038/35006555.
- Wilson, E. O. (1975). *Sociobiology: The New Synthesis*. Cambridge, MA: Belknap Press.
- Yankelovich Partners. (1994). *A Yankelovich MONITOR perspective on gays/lesbians*. Norwalk, CT: Yankelovich Partners.
- Yates, T. (1993). Frameworks for archaeology of the body. In C. Tilley (ed.), *Interpretive Archaeology* (pp. 31-72). Providence, RI: Berg Publishers.
- Zeh, J. A., & Zeh, D. W. (2005). Maternal inheritance, sexual conflict and the maladapted male. *Trends in Genetics, 21*, 281–286.

## APPENDIX A:

### Questionnaire Package: Kin Selection Study

Please answer the following questions to the best of your ability. Most of the questions require you to use your mouse to highlight the appropriate answer. Some others require you to type in your responses. You do not have to answer any questions you find upsetting or objectionable. Once you have completed the survey, please click the "Submit" button at the bottom of the page to submit your responses. Thank you.

#### BIOGRAPHIC INFORMATION:

1. a) Are you biologically a Male or a Female?

Female  
Male

1. b) Which of the following gender identities do you prefer to identify with?

Woman  
Man  
Other

If "other," please indicate which gender you prefer to identify with, if any (optional)

2. What is your age in years?

3. Sexual Orientation (choose one):

Heterosexual  
Homosexual  
Bisexual  
Asexual

Other If "other," please indicate which sexual orientation you prefer to identify with, if any (optional)

4. What is your current socio-economic bracket (choose one):

Upper Class  
Upper Middle Class  
Middle Class  
Lower Middle Class  
Lower Class

5. What is the highest level of education you received (choose one):

- Primary or less
- High school or less
- Post Secondary
- Post Graduate
- None

6. What is your current religious affiliation (choose one):

- Christian
- Jewish
- Muslim
- Buddhist
- None
- Other

7. Are you religious? (Choose one):

- |                         |   |   |   |   |   |   |                        |
|-------------------------|---|---|---|---|---|---|------------------------|
| Not at all<br>religious |   |   |   |   |   |   | Extremely<br>religious |
| 1                       | 2 | 3 | 4 | 5 | 6 | 7 |                        |

8. How would you describe your ethnic background (choose one):

- African Canadian
- Asian Canadian
- European Canadian
- Hispanic Canadian
- Native Canadian
- Other

9. Do you currently live in Canada (choose one)?:

- Yes
- No

10. Please indicate how you heard about this study (choose one):

I was approached about the study at a night club

I was approached about the study at a PRIDE event

I was approached about the study at the Alberta Rockies Gay Rodeo in Calgary

I was approached about the study while attending a community event (not affiliated with a PRIDE event) or while attending a social event being held by an organization/social club

I heard about the study through an email distribution list

I heard about the study through a friend

I heard about the study through an advertisement at the University of Lethbridge

I have participated in Dr. Vasey's research before, provided my contact information, and indicated that

I would be interested in participating in future studies being conducted by his research team

Other If "other," please indicate how you heard about this study

11. Do you have any children (choose one):

Yes

No

If "yes," please indicate how many children you have:

**KSOI:**

**5. Which statement best describes your sexual feelings during the last year:**

Sexual feelings only towards females

Most sexual feelings towards females, but an occasional fantasy about males

Most sexual feelings toward females, but some definite fantasy about males

Sexual feelings about equally divided between males and females.

No strong preference for one or the other

Most sexual feelings toward males, but some definite sexual feelings toward females

Most sexual feelings toward males, but an occasional fantasy about females

Sexual feelings toward males only

No, or very little, sexual feelings toward either males or females

**Questions about interest in nieces and nephews:**

**Instructions:** Imagine that the brother or sister that you are closest to has children and has asked you to help in some child care activities. Imagine that this sibling lives nearby. Using the 7-point scale, please rate how willing would you be to help in the following ways:

1. Baby-sitting for an evening

Very Unwilling                      1            2            3            4            5            6            7            Very Willing

2. Baby-sitting on a regular basis

Very Unwilling                      1            2            3            4            5            6            7            Very Willing

3. Taking care of the children for a week while their parents are away

Very Unwilling                      1            2            3            4            5            6            7            Very Willing

4. Buying toys for the children

Very Unwilling                      1            2            3            4            5            6            7            Very Willing

5. Tutoring one of the children in a subject you know well

Very Unwilling                      1            2            3            4            5            6            7            Very Willing

6. Helping to expose the children to art and music

Very Unwilling                      1            2            3            4            5            6            7            Very Willing

7. Contributing money for daycare

Very Unwilling                    1            2            3            4            5            6            7            Very Willing

8. Contributing money for the children's medical expenses

Very Unwilling                    1            2            3            4            5            6            7            Very Willing

9. Contributing money for the children's education

Very Unwilling                    1            2            3            4            5            6            7            Very Willing

**Questions about general interest in children:**

**Instructions:** Imagine that someone who is not your relative (e.g., not your brother or sister) has children and has asked you to help them in some child care activities. Imagine that this person lives nearby. Using the 7-point scale, please rate how willing would you be to help in the following ways:

1. Baby-sitting for an evening

Very Unwilling									Very Willing
	1	2	3	4	5	6	7		

2. Baby-sitting on a regular basis

Very Unwilling									Very Willing
	1	2	3	4	5	6	7		

3. Taking care of the children for a week while their parents are away

Very Unwilling									Very Willing
	1	2	3	4	5	6	7		

4. Buying toys for the children

Very Unwilling									Very Willing
	1	2	3	4	5	6	7		

5. Tutoring one of the children in a subject you know well

Very Unwilling									Very Willing
	1	2	3	4	5	6	7		

6. Helping to expose the children to art and music

Very Unwilling									Very Willing
	1	2	3	4	5	6	7		



7. Contributing money for daycare

Very Unwilling            1            2            3            4            5            6            7            Very Willing

8. Contributing money for the children's medical expenses

Very Unwilling            1            2            3            4            5            6            7            Very Willing

9. Contributing money for the children's education

Very Unwilling            1            2            3            4            5            6            7            Very Willing

## APPENDIX B:

### Questionnaire Package: Sexually Antagonistic Gene Hypothesis

Please answer the following questions to the best of your ability. Most of the questions require you to use your mouse to highlight the appropriate answer. Some others require you to type in your responses. You do not have to answer any questions you find upsetting or objectionable.

**\*\*\*This survey asks questions about your family. Please only include information regarding BIOLOGICAL relatives. Please DO NOT include information about relatives who are adopted, relatives by marriage, or step-family.**

Once you have completed the survey, please click the "Submit" button at the bottom of the page to submit your responses. Thank you.

#### **BIOGRAPHIC INFORMATION:**

1. a) Are you Male or Female?

Female

Male

1. b) Which of the following gender identities do you prefer to identify with?

Woman

Man

Other

If "other," please indicate which gender you prefer to identify with, if any (optional)

2. What is your age? years and month(s).

3. Sexual Orientation (choose one):

Heterosexual

Homosexual

Bisexual

Asexual

Other If "other," please indicate which sexual orientation you prefer to identify with, if any (optional)

4. In what socio-economic bracket were you raised for most of your life (choose one):

Upper Class  
Upper Middle Class  
Middle Class  
Lower Middle Class  
Lower Class

5. What is your current socio-economic bracket (choose one):

Upper Class  
Upper Middle Class  
Middle Class  
Lower Middle Class  
Lower Class

6. In what type of area were you raised for most of your life (choose one):

Rural  
Urban  
Suburban

7. In what type of area are you currently living (choose one):

Rural  
Urban  
Suburban

8. What is the highest level of education you have achieved?

None  
Less than elementary school  
Elementary school  
Less than high school  
High school  
Some post-secondary (college, trade school, or university)  
Post-secondary (college, trade school, or university)  
Post-graduate

9. What is your current religious affiliation (choose one):

Protestant  
Catholic  
Jewish  
Muslim  
Buddhist  
None  
Other

10. Are you religious? (choose one):

Not at all religious							Extremely religious
1	2	3	4	5	6		7

11. How would you describe your ethnic background (choose one):

African Canadian  
Asian Canadian  
European Canadian  
Hispanic Canadian  
Native Canadian  
Other

12. Which is your dominant or preferred hand (choose one)?:

Right-handed      Left-handed      Ambidextrous

13. Do you currently live in Canada (choose one)?:

Yes  
No

14. In general, what socio-economic bracket would you say your parents lived in for most of their lives (choose one):

Upper Class  
Upper Middle Class  
Middle Class  
Lower Middle Class  
Lower Class

15. In general, what socio-economic bracket would you say your mother's parents (your maternal grandparents) lived in for most of their lives (choose one):

Upper Class  
Upper Middle Class  
Middle Class  
Lower Middle Class  
Lower Class

16. In general, what socio-economic bracket would you say your father's parents (your paternal grandparents) lived in for most of their lives (choose one):

Upper Class  
Upper Middle Class  
Middle Class  
Lower Middle Class  
Lower Class

17. In general, what type of area did your parents live in for most of their lives (choose one):

Rural  
Urban  
Suburban

18. In general, what type of area did your mother's parents (your maternal grandparents) live in for most of their lives (choose one):

Rural  
Urban  
Suburban

19. In general, what type of area did your father's parents (your paternal grandparents) live in for most of their lives (choose one):

Rural  
Urban  
Suburban

20. In general, what socio-economic bracket would you say your mother's brothers and sisters (your maternal aunts and uncles) lived in for most of their lives (choose one):

Upper Class  
Upper Middle Class  
Middle Class  
Lower Middle Class  
Lower Class

21. In general, what socio-economic bracket would you say your father's brothers and sisters (your paternal aunts and uncles) lived in for most of their lives (choose one):

Upper Class  
Upper Middle Class  
Middle Class  
Lower Middle Class  
Lower Class

22. In general, what type of area did your mother's brothers and sisters (your maternal aunts and uncles) live in for most of their lives (choose one):

Rural  
Urban  
Suburban

23. In general, what type of area did your father's brothers and sisters (your paternal aunts and uncles) live in for most of their lives (choose one):

Rural  
Urban  
Suburban

24. Please indicate how you heard about this study (choose one):

I was approached about the study at a night club

I was approached about the study at a PRIDE event

I was approached about the study at the Alberta Rockies Gay Rodeo in Calgary

I was approached about the study while attending a community event (not affiliated with a PRIDE event) or while attending a social event being held by an organization/social club

I heard about the study through an email distribution list

I heard about the study through a friend

I heard about the study through an advertisement at the University of Lethbridge

I have participated in Dr. Vasey's research before, provided my contact information, and indicated that I would be interested in participating in future studies being conducted by his research team

Other If "other," please indicate how you heard about this study

**KSOI:**

For each question below, check the choice that best describes your sexual feelings or activity for the specified time period.

**1. Which statement best describes your sexual feelings during adolescence (between ages 12 and 18):**

Sexual feelings only towards females

Most sexual feelings towards females, but an occasional fantasy about males

Most sexual feelings toward females, but some definite fantasy about males

Sexual feelings about equally divided between males and females.

No strong preference for one or the other

Most sexual feelings toward males, but some definite sexual feelings toward females

Most sexual feelings toward males, but an occasional fantasy about females

Sexual feelings toward males only

**2. Which statement best describes your sexual activity during adolescence (between ages 12 and 18):**

Sexual activity only with females

Most sexual activity with females, but occasional contact with males

Most sexual activity with females, but some definite contact with males

Sexual contact about equally divided between males and females.

No strong preference for one or the other.

Most sexual activity with males, but some definite contact with females

Most sexual activity with males, but occasional contact with females

Sexual activity with males only

**3. Which statement best describes your sexual feelings, overall, during adulthood (after age 18):**

Sexual feelings only towards females

Most sexual feelings towards females, but an occasional fantasy about males

Most sexual feelings toward females, but some definite fantasy about males

Sexual feelings about equally divided between males and females.

No strong preference for one or the other

Most sexual feelings toward males, but some definite sexual feelings toward females

Most sexual feelings toward males, but an occasional fantasy about females

Sexual feelings toward males only



**4. Which statement best describes your sexual activity, overall during adulthood (after age 18):**

- Sexual activity only with females
- Most sexual activity with females, but occasional contact with males
- Most sexual activity with females, but some definite contact with males
- Sexual contact about equally divided between males and females.
- No strong preference for one or the other.
- Most sexual activity with males, but some definite contact with females
- Most sexual activity with males, but occasional contact with females
- Sexual activity with males only

**5. Which statement best describes your sexual feelings during the last year:**

- Sexual feelings only towards females
- Most sexual feelings towards females, but an occasional fantasy about males
- Most sexual feelings toward females, but some definite fantasy about males
- Sexual feelings about equally divided between males and females.
- No strong preference for one or the other
- Most sexual feelings toward males, but some definite sexual feelings toward females
- Most sexual feelings toward males, but an occasional fantasy about females
- Sexual feelings toward males only

**6. Which statement best describes your sexual activity during the last year:**

- Sexual activity only with females
- Most sexual activity with females, but occasional contact with males
- Most sexual activity with females, but some definite contact with males
- Sexual contact about equally divided between males and females.
- No strong preference for one or the other.
- Most sexual activity with males, but some definite contact with females
- Most sexual activity with males, but occasional contact with females
- Sexual activity with males only

**Family Structure Survey**

**Instructions:** This survey has three sections and is designed to allow you to give us a picture of your family tree. Please only include information regarding BIOLOGICAL relatives. DO NOT include information regarding family members who are adopted, related to you by marriage, or step-family. Please answer each question to the best of your ability.

**SECTION 1: Maternal Relatives (Questions about BIOLOGICAL relatives on your mother's side of the family)** There are six general questions followed by enough spaces to provide specific information for up to 20 of your maternal grandparents' children. Please list the information for your maternal grandparents' children in the order that they were born (first-born to last-born). You do not have to fill in all 20 spaces. Once you have provided information for all of your maternal grandparents' children, please scroll down to Section 2.

I. How many sons (male children) did your mother's parents (your maternal grandparents) have?

II. With a high degree of certainty, how many of these sons (your uncles) would you say are homosexual (gay) or bisexual?

III. How many daughters (female children) did your mother's parents (your maternal grandparents) have?

IV. With a high degree of certainty, how many of these daughters (including your mother and your aunts) would you say are homosexual (lesbian) or bisexual?

V. Using the 7-point scale below, please indicate how confident you are that your knowledge of your mother's side of the family is accurate?

Not at all confident							Extremely confident
1	2	3	4	5	6	7	

VI. Please use the box below to indicate any information that you feel is important for describing your family tree on your mother's side of the family, but is otherwise not possible to report given the structure of this survey:

1. The following questions are about your mother's parents' (your maternal grandparents')  
**1st** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

2. The following questions are about your mother's parents' (your maternal grandparents')  
**2nd** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

3. The following questions are about your mother's parents' (your maternal grandparents') **3rd** child:

a) This person is

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

4. The following questions are about your mother's parents' (your maternal grandparents') **4th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

5. The following questions are about your mother's parents' (your maternal grandparents') **5th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

6. The following questions are about your mother's parents' (your maternal grandparents') **6th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

7. The following questions are about your mother's parents' (your maternal grandparents') **7th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

8. The following questions are about your mother's parents' (your maternal grandparents') **8th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

9. The following questions are about your mother's parents' (your maternal grandparents') **9th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

10. The following questions are about your mother's parents' (your maternal grandparents') **10th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

11. The following questions are about your mother's parents' (your maternal grandparents') **11th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**



d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

12. The following questions are about your mother's parents' (your maternal grandparents') **12th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

13. The following questions are about your mother's parents' (your maternal grandparents') **13th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

14. The following questions are about your mother's parents' (your maternal grandparents') **14th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

15. The following questions are about your mother's parents' (your maternal grandparents') **15th** child:

a) This person is:

Your Mother  
Your Aunt  
Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female  
Male

16. The following questions are about your mother's parents' (your maternal grandparents') **16th** child:

a) This person is:

Your Mother  
Your Aunt  
Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

17. The following questions are about your mother's parents' (your maternal grandparents') **17th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

18. The following questions are about your mother's parents' (your maternal grandparents') **18th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

19. The following questions are about your mother's parents' (your maternal grandparents') **19th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

20. The following questions are about your mother's parents' (your maternal grandparents') **20th** child:

a) This person is:

Your Mother

Your Aunt

Your Uncle

- b) How many sons did this person have?
- c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**
- d) How many daughters did this person have?
- e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**
- f) Was this person's first child a biological Male or a biological Female?

Female  
Male

**SECTION 2: Paternal Relatives (Questions about BIOLOGICAL relatives on your father's side of the family)**

There are six general questions followed by enough spaces to provide specific information for up to 20 of your paternal grandparents' children. Please list the information for your paternal grandparents' children in the order that they were born (first-born to last-born). You do not have to fill in all 20 spaces. Once you have provided information for all of your paternal grandparents' children, please scroll down to Section 3.

I. How many sons (male children) did your father's parents (your paternal grandparents) have?

II. With a high degree of certainty, how many of these sons (including your father and your uncles) would you say are homosexual (gay) or bisexual?

III. How many daughters (female children) did your father's parents (your paternal grandparents) have?

IV. With a high degree of certainty, how many of these daughters (your aunts) would you say are homosexual (lesbian) or bisexual?

V. Using the 7-point scale below, please indicate how confident you are that your knowledge of your father's side of the family is accurate?

Not at all confident							Extremely confident
1	2	3	4	5	6	7	

VI. Please use the box below to indicate any information that you feel is important for describing your family tree on your father's side of the family, but is otherwise not possible to report given the structure of this survey:

1. The following questions are about your father's parents' (your paternal grandparents') **1st** child:

a) This person is:

Your Father  
Your Aunt  
Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

2. The following questions are about your father's parents' (your paternal grandparents') **2nd** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male



3. The following questions are about your father's parents' (your paternal grandparents') **3rd** child:

a) This person is:

Your Father  
Your Aunt  
Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female  
Male

4. The following questions are about your father's parents' (your paternal grandparents') **4th** child:

a) This person is:

Your Father  
Your Aunt  
Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

5. The following questions are about your father's parents' (your paternal grandparents') **5th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

6. The following questions are about your father's parents' (your paternal grandparents') **6th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

7. The following questions are about your father's parents' (your paternal grandparents') **7th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

8. The following questions are about your father's parents' (your paternal grandparents') **8th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

9. The following questions are about your father's parents' (your paternal grandparents') **9th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

10. The following questions are about your father's parents' (your paternal grandparents') **10th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

11. The following questions are about your father's parents' (your paternal grandparents') **11th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

12. The following questions are about your father's parents' (your paternal grandparents') **12th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

13. The following questions are about your father's parents' (your paternal grandparents') **13th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

14. The following questions are about your father's parents' (your paternal grandparents') **14th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

15. The following questions are about your father's parents' (your paternal grandparents') **15th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

16. The following questions are about your father's parents' (your paternal grandparents') **16th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male



17. The following questions are about your father's parents' (your paternal grandparents') **17th** child:

a) This person is:

Your Father  
Your Aunt  
Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female  
Male

18. The following questions are about your father's parents' (your paternal grandparents') **18th** child:

a) This person is:

Your Father  
Your Aunt  
Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

19. The following questions are about your father's parents' (your paternal grandparents') **19th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

20. The following questions are about your father's parents' (your paternal grandparents') **20th** child:

a) This person is:

Your Father

Your Aunt

Your Uncle

b) How many sons did this person have?

c) With a high degree of certainty, how many of these sons are homosexual (gay) or bisexual? **(Do not include yourself)**

d) How many daughters did this person have?

e) With a high degree of certainty, how many of these daughters are homosexual (lesbian) or bisexual? **(Do not include yourself)**

f) Was this person's first child a biological Male or a biological Female?

Female

Male

**SECTION 3: Birth Order (Questions about how many older and younger BIOLOGICAL brothers and sisters you have. All questions pertain to only brothers and sisters you have that have the SAME mother as you.)**

I. Older Brothers: How many sons (male children) did your mother give birth to **before** you?

II. Younger Brothers: How many sons (male children) did your mother give birth to **after** you?

I. Older Sisters: How many daughters (female children) did your mother give birth to **before** you?

II. Younger Sisters: How many daughters (female children) did your mother give birth to **after** you?

**PLEASE ANSWER THESE FINAL QUESTIONS BEFORE SUBMITTING YOUR RESPONSES**

F1. Please type in the city and province in which you currently live in the text box below:

F2. Will this be the first time you have filled out this survey and submitted your responses?

Yes

No

F3. Would you be interested in hearing more about and possibly participating in future studies being conducted by Dr. Paul L. Vasey and his research group?

If "No", thank you for your participation in this survey and please continue below to submit your responses.

If "Yes", please use the text box below to enter your email address. Your email address will be kept confidential and will only be used by Dr. Vasey and members of his research group to inform you of studies being conducted and opportunities to participate.

**When you are done, please click the button below to submit your responses.**

## **APPENDIX C:**

### **Consent Form for the Kin Selection Study**

#### **INFORMED CONSENT**

I understand I have been asked to participate in two studies being conducted by Dr. Paul L. Vasey and Ms. Deanna L. Forrester at the University of Lethbridge, Alberta: (1) The Interest in Childcare Questionnaire, and (2) The Intersexual Competition Questionnaire.

I understand that I will be answering questions about myself.

I understand that the risks associated with participating in this study are no greater than the risks associated with everyday life.

I understand that my participation will involve approximately 10 to 15 minutes of my time.

I understand that, even if I choose to participate, I am under no obligation to discuss things that I do not wish to discuss.

I understand that I may withdraw from this study at any point, even after I have begun to participate, at no penalty to myself.

I understand that the information I provide will remain confidential and anonymous; my name will never be revealed to anyone other than Ms. Forrester, Dr. Vasey, and their research collaborators.

I understand that the only persons who will have access to these anonymous data are Ms. Forrester, Dr. Vasey, and their research assistants.

I understand that the results of this study will be published, but I will never be identified individually in any publication.

I understand that I can request that Ms. Forrester and Dr. Vasey mail me the results of this study or describe to me the results of this study once it is completed.

I understand that I can contact Ms. Forrester and Dr. Vasey by email at [deanna.forrester@uleth.ca](mailto:deanna.forrester@uleth.ca) or [paul.vasey@uleth.ca](mailto:paul.vasey@uleth.ca) for more information.

I understand that I may contact the Office of Research Services at University of Lethbridge in Canada by email ([research.services@uleth.ca](mailto:research.services@uleth.ca)), if I have any questions regarding my rights as a participant in this research.

Thank you for your interest and participation.

Dr. Paul L. Vasey and Ms. Deanna L. Forrester

To fill out the survey click "Go to Survey" below. By clicking on "Go to Survey" you are acknowledging that you have read the above statements and consent to participating.

## APPENDIX D:

### Consent Form for the Sexually Antagonistic Gene Study

#### INFORMED CONSENT

**Study: Sex, sexual orientation, and family structure.**

I understand I have been asked to participate in a study being conducted by Ms. Deanna Forrester and Dr. Paul Vasey on the family structure of heterosexual and homosexual men and women in Canada.

I understand that I will be answering questions about my family and about myself.

I understand that the risks associated with participating in this study are no greater than the risks associated with everyday life.

I understand that my participation will involve approximately 15 minutes of my time.

I understand that, even if I choose to participate, I am under no obligation to discuss things that I do not wish to discuss.

I understand that I may withdraw from this study at any point, even after I have begun to participate, at no penalty to myself.

I understand that the information I provide will remain confidential and anonymous; my name will never be revealed to anyone other than Ms. Forrester, Dr. Vasey, and their research collaborators.

I understand that the only persons who will have access to these anonymous data are Ms. Forrester, Dr. Vasey, and their research assistants.

I understand that the results of this study will be published, but I will never be identified individually in any publication.

I understand that I can request that Ms. Forrester and Dr. Vasey mail me the results of this study or describe to me the results of this study once it is completed.

I understand that I can contact Ms. Forrester and Dr. Vasey by email at [deanna.forrester@uleth.ca](mailto:deanna.forrester@uleth.ca) or [paul.vasey@uleth.ca](mailto:paul.vasey@uleth.ca) for more information.

I understand that I may contact the Office of Research Services at University of Lethbridge in Canada by email ([research.services@uleth.ca](mailto:research.services@uleth.ca)), if I have any questions regarding my rights as a participant in this research.

Thank you for your interest and participation.

Dr. Paul L. Vasey and Ms. Deanna Forrester

To fill out the survey click "Go to Survey" below. By clicking on "Go to Survey" you are acknowledging that you have read the above statements and consent to participating in the study entitled "Sex, sexual orientation, and family structure." by Ms. Deanna Forrester and Dr. Paul Vasey.