

Homosexual Orientation in Twins: A Report on 61 Pairs and Three Triplet Sets

Frederick L. Whitam, Ph.D.,¹ Milton Diamond, Ph.D.,^{2,3}
and James Martin, B.A.¹

Twin pairs in which at least one twin is homosexual were solicited through announcements in the gay press and personal referrals from 1980 to the present. An 18-page questionnaire on the "sexuality of twins" was filled out by one or both twins. Thirty-eight pairs of monozygotic twins (34 male pairs and 4 female pairs) were found to have a concordance rate of 65.8% for homosexual orientation. Twenty-three pairs of dizygotic twins were found to have a concordance rate of 30.4% for homosexual orientation. In addition, three sets of triplets were obtained. Two sets contained a pair of monozygotic twins concordant for sexual orientation with the third triplet dizygotic and discordant for homosexual orientation. A third triplet set was monozygotic with all three concordant for homosexual orientation. These findings are interpreted as supporting the argument for a biological basis in sexual orientation.

KEY WORDS: homosexuality; twins; triplets; sexual orientation; genetics.

INTRODUCTION

The question of whether homosexual orientation is biologically determined, socially learned, or results from some type of interaction has been one of the classic debates in sex research as far back as the mid-19th century with the work of Karl Ulrichs. All of the important sex researchers of the late 19th and 20th century were interested in this question. Magnus Hirschfeld, Havelock Ellis, and John Addington Symonds held that homo-

¹Department of Sociology, Arizona State University, Tempe, Arizona 85287-2101.

²Department of Anatomy and Reproductive Biology, John A. Burns School of Medicine, University of Hawaii, 1951 East-West Road, Honolulu, Hawaii 96822.

³To whom correspondence should be addressed.

sexual orientation was biological in origin while Sigmund Freud and later Alfred Kinsey and William Masters and Virginia Johnson held that it was socially learned.

At about the same time that Kinsey *et al.* (1953) published *Sexual Behavior of the Human Female*, Kallmann's well-known articles on homosexuality in twins appeared. Kallmann (1952) found nearly 100% concordance for homosexual orientation in monozygotic (MZ) and about 10% concordance in dizygotic (DZ) twins. These findings jarred the widely held notion that homosexual orientation was socially determined. A decade later Schlegel (1962) reported on 113 twin pairs with 95% concordance for homosexuality in MZ twins and 5% concordance in DZ twins. Because Schlegel's work was published in German, it has not been cited as frequently as Kallmann's by English-speaking writers.

For nearly four decades after its publication Kallmann's work would remain the most widely cited and the most harshly criticized work on the topic of homosexual orientation in twins. Hardly any work in the field of human sexuality has been so bitterly attacked. Some of these criticisms seem justified—especially that Kallmann's subjects came partly from correctional facilities and psychiatric institutions, though it is also true that some of his respondents came from the general homosexual community. Many of his critics were adherents of the social learning position who dismissed Kallmann's work out of hand, because of a distaste for the idea that homosexual orientation might be biological. Julian (1973) exemplifies this tendency, who, after reporting on the work of Kallmann and Schlegel, stated that “. . .to date there is no strong evidence that homosexuality is biologically determined” (p. 231).

By 1960 researchers began to report on single cases or small numbers of MZ twins discordant for homosexual orientation. Discordance for homosexual orientation in single or small numbers of MZ twins were reported by Rainer *et al.* (1960), Klintworth (1962), Meskinoff *et al.* (1963), Parker (1964), Heston and Shields (1968), Green and Stoller (1971), Davison *et al.* (1971), Perkins (1973), Friedman *et al.* (1976), and Zuger (1976). By the mid 1970s it became apparent that a more rigorous study of the sexual orientation of twins probably would yield cases of MZ twins discordant for homosexual orientation. The normality for both concordance and discordance for homosexuality among twins emerged when early results from twin studies were reported at professional meetings by Whitam and Whitam (Whitam and Diamond, 1985, 1986; Diamond and Whitam, 1987; Diamond *et al.*, 1987; Whitam *et al.*, 1988). In 1986, Whitam and Diamond reported a 75% concordance rate for homosexual orientation in twenty pairs of male MZ twins and a 19% concordance rate for homosexual orientation in 16 pairs of male DZ twins. A large study completed by Bailey and Pillard (1991)

found a 52% concordance rate for homosexual orientation in 56 MZ male pairs and a 22% concordance rate for 54 DZ male pairs. A more recent study by King and McDonald (1992) reported a 25% concordance rate among monozygotic twins (5 of 20) and a 12.5% concordance rate among dizygotic twins. The present study, begun in 1980 and ongoing, presents our concordance data to date and compares them with these previous reports.

METHOD

This research was begun in 1980, soliciting gay and lesbian twins regardless of type of twin, sex, or sexual orientation of the co-twin. Initial contacts were made through ads and announcements in the gay press or through personal referrals by persons acquainted with homosexual twins. (see Appendix A.) Initial conversations were usually made by telephone at which time the researchers asked basic questions about age, sex, whether the twins were identical (MZ) or fraternal (DZ), reared together or apart, and whether the sexual orientation of the co-twin was known. Respondents were then asked if they were willing to be interviewed personally or, if this was not possible, to fill out and return an 18-page questionnaire on the sexuality of twins.

Questionnaires were obtained in various ways. Ideally, both twins were administered the questionnaire at the same time in the presence of a researcher. Separate interviews then followed. This ensured that no collaboration took place between the twins. This ideal method of administering the questionnaire was possible with only 12 pairs, usually when twins lived in the same area as the investigators or when investigators traveled to cities where the twins lived. In 20 pairs, one twin was interviewed personally with the co-twin returning the questionnaire by mail and information on his or her sexual orientation also derived from the index twin. No face-to-face contact was possible with either twin in the remaining 29 pairs where contact was made through telephone and mailed questionnaires. In these cases we included the data only if the index twin was certain of the co-twins' sexual orientation and the co-twin's behavior could be attested to by a third party. Often twins were referred to us by an individual who knew them both intimately.⁴

⁴Our reasoning was that, judging from our interviews with the index twin or third-party informant and considering them reliable and knowledgeable, even if the brother or third party were “off” in their assessment, the evaluation of orientation would not be so wrong that it would change the evaluation more than one category (e.g., an estimation of $K = 0$ would still be applicable if the true value should be $K = 2$ and an estimate of $K = 5$ would not invalidate a true value of $K = 6$ or even $K = 3$). If either the index twin or informant expressed doubt we rejected the pair from our sample.

With regard to the triplets, one set was interviewed extensively by a graduate assistant who visited with them for several days. Each member of the two remaining triplet sets was contacted by telephone and returned questionnaires. These triplet sets were also known to reliable third parties who, with the permission of the respondents, were able to corroborate their sexual orientation.

The mean age of the respondents was 32 with a range of 20 to 68 years. Three pairs of the twins were African-Americans, two pairs were Hispanic, and the remainder were Caucasian. A total of 61 pairs of twins and 3 sets of triplets were obtained. Zygosity was measured by the Nichols and Bilbro (1966) instrument which correlates highly with blood typing for zygosity. Sexual orientation was established by use of the 7-point Kinsey scale (Kinsey *et al.*, 1948). For this crucial question each respondent was asked to check the description that best matched his or her behaviors on a list of all 7 points. (See Appendix B.) In our analysis three categories are used: (i) concordance, (ii) partial concordance, and (iii) discordance. Twins were judged concordant for sexual orientation if their Kinsey ratings were the same (e.g., both are K-6) or adjacent (e.g., one is K-5 and the other K-6). The assumption here is that the Kinsey ratings are global and somewhat imprecise. Twins were judged partially concordant when Kinsey ratings showed a disparity of 2 or 3 points on the Kinsey scale. For example, a twin pair where the index twin is a K-6 and the co-twin is a K-4 or K-3, is judged partially concordant. Discordance is judged to occur when twins are separated by more than 3 points on the Kinsey scale (for example, a K-4 and a K-0). Admittedly these categories are somewhat arbitrary. Unless we were to adopt a very different point spread, however, it would have made no difference in our main results.

Any research project soliciting subjects through newspapers elicits a number of crank responses. Attempts were made to eliminate such responses by our rephoning the respondent a few days after the initial call and asking similar questions in different ways. If false telephone numbers were given, respondents were dropped. If correspondence was returned with "incorrect address, addressee unknown, etc.," respondents were eliminated. From among all the twins contacted it was decided to use only those data where we had questionnaires from both the index twin and co-twin or where at least one questionnaire was completed through a personal interview or returned by mail, and the researchers, after conversations and correspondence, felt that the index twin was knowledgeable about the sexual orientation of the co-twin.

Bailey and Pillard (1991) also did a screening of their respondents and conducted personal interviews where possible. King and McDonald (1992) apparently did not screen their respondents for crank contacts nor

did they attempt to contact personally either the index twin or the co-twin to verify the information obtained. We think these differences partially account for finding our results similar to those of Bailey and Pillard and unlike those of King and McDonald. King and McDonald also apparently did not obtain a Kinsey rating for their respondents but allowed them to identify themselves as homosexual, bisexual, or heterosexual. This also prevents direct comparison of the King and McDonald data with those of ourselves or Bailey and Pillard. These researchers paid their respondents for participation (personal communication) whereas none of our respondents were paid for participation.

Photographs of the twins together were requested. About one fourth of the respondents were willing to send researchers current and/or family photographs of both twins together. In several cases where twins were interviewed personally by the researchers, the twins allowed the researcher to peruse family photo albums with the twins much in evidence or to photograph them and consent to having their photographs shown at scientific meetings. Confidentiality with regard to all material obtained from the twins was assured.

This series of twins came mainly from the West Coast, Southwest, and South. The larger cities represented include Dallas, Denver, Honolulu, Los Angeles, New Orleans, Orlando, Phoenix, and San Francisco. Some twins of course lived in smaller cities and towns surrounding these areas. All but two male MZ pairs were reared together. One pair was concordant for sexual orientation and the other pair discordant.

RESULTS AND DISCUSSION

Because of the small number of cases of partial concordance and the single case of a MZ female pair discordant for sexual orientation, attention focused on the major configurations that appear in this population: (i) MZ males concordant for sexual orientation; (ii) MZ males discordant for sexual orientation; (iii) MZ females concordant for sexual orientation; (iv) DZ males and females concordant and discordant for sexual orientation; and (v) triplets.

Concordant MZ Males

As may be seen from Tables I and II, concordance is the most common pattern for MZ male pairs (64.7% for 34 pairs). This observation is consistent with both Kallmann (1952) and Bailey and Pillard (1991). A sig-

Table I. Monozygotic Twins Individual Comparisons of Kinsey Ratings

Pair no.	Kinsey ratings	
	Index twin	Co-twin'
Concordant		
Males		
1	6	6
2	6	6
3	6	6
4	6	6
5	6	6
6	6	6
7	6	5
8	6	6
9	6	6
10	6	6
11	6	6
12	6	6
13	6	6
14	6	6
15	5	5
16	5	6
17	5	5
18	5	5
19	5	6
20	5	6
21	5	6
22	4	4
Females		
23	6	6
24	6	6
25	6	6
Partially concordant		
Males		
26	6	3
27	4	2
Discordant		
Males		
28	6	0
29	6	0
30	6	0
31	6	0
32	6	0
33	6	0
34	6	0
35	6	0
36	6	0
37	6	1
Females		
38	6	0

Table II. Summary of Concordance Rates by Twin Type and Sex

	n/N	%
Monozygotic twins		
Monozygotic males		
Concordance	22/34	64.7
Partial concordance	2/34	5.9
Discordance	10/34	29.4
Monozygotic females		
Concordance	3/4	75.0
Discordance	1/4	25.0
Monozygotic combined male and female pairs		
Concordance	25/38	65.8
Partial concordance	2/38	5.3
Discordance	11/38	28.9
Dizygotic twins		
Dizygotic male-male pairs		
Concordance	4/14	28.6
Discordance	10/14	71.4
Dizygotic male-female pairs		
Concordance	3/9	33.3
Partial concordance	2/9	22.2
Discordance	4/9	44.4
Dizygotic combined male-male and male-female pairs		
Concordance	7/23	30.4
Partial concordance	2/23	8.7
Discordance	14/23	60.8

nificantly lower rate of concordance was found by King and McDonald (1992). While Kallmann's findings are often reported as 100% concordance for MZ males, a closer examination of his data as adapted in Table III reveals that four of his 37 male pairs are partially concordant if analyzed by our criteria for concordance. As is well known Kallmann found no MZ pairs that were discordant. It is difficult to understand how Kallmann was able to find such a high concordance rate for his twins and not find a single discordant MZ pair. Very early in our research it became obvious that discordance for sexual orientation in MZ males is not uncommon. Such discordances continued to appear throughout the investigation. The present findings are generally consistent with those of Bailey and Pillard, who also found that in MZ males, concordance is the most common pattern but that discordance for sexual orientation is not rare.

While some pairs of MZ twins concordant for sexual orientation are more similar than others, there was a tendency for many to be remarkably similar in their sexual attractions and practices. One pair interviewed and photographed personally by the researchers reported a striking similarity

Table III. Kallmann's Monozygotic Twins
Individual Comparisons of Kinsey Ratings

Pair no.	Kinsey ratings	
	Index twin	Co-twin
1	6	6
2	6	6
3	6	6
4	6	6
5	6	6
6	6	6
7	6	6
8	6	6
9	6	6
10	6	6
11	6	6
12	6	6
13	6	6
14	6	6
15	6	6
16	6	6
17	6	5
18	6	5
19	6	5
20	5	6
21	5	6
22	5	6
23	5	5
24	5	5
25	5	5
26	5	4
27	5	3
28	5	3
29	4	5
30	4	4
31	4	4
32	4	3
33	4	3
34	3	5
35	3	5
36	3	4
37	3	4

in their sexuality from very early childhood until the time they were interviewed at age 25. As children of 7 or 8 they played a self-invented sex game which they called "chase the rabbits." Living near a garbage dump, they disrobed completely in a nearby wooded area and exhibited themselves to garbage men unloading their trucks. Some of the drivers co-operated in

the game by chasing the nude boys and taking them into their trucks to fondle them. Each of the twins perceived this as "good fun" and report they enjoyed the "game" until discovered by their mother who forced them to stop. Responses to the items on the questionnaire dealing with their sexuality are virtually identical. They have lived with or near each other throughout their lives and have had the occupation of hair stylist most of their adult lives. Both report sexual attraction to very masculine, working-class men in their 40s.

Another pair of homosexual MZ twins, aged 35, both accountants, reported that they did not reveal their sexual orientation to each other until fairly late. After mutual revelation, they discovered that both, completely independently and unknown to each other, simultaneously for a period of about a year while living in different cities, had photographed shirtless construction workers over the age of 40 and later at home masturbated to the photographs. This reported behavior is of course difficult to understand in terms of any contemporary explanatory system other than coincidence. It is nonetheless consistent with some of the seemingly inexplicable material that emerged from the Minnesota study of MZ twins reared apart (Jackson, 1980).

One pair of homosexual MZ twins, both K-6, were identical with respect to their mannerisms including effeminate behavior. They lived together, aspired to be entertainers and had put together a twin night club act consisting of skits, singing and dancing, and identical costumes. Another pair of MZ twins, judged K-4, both married heterosexually at about the same time, had children, and maintained ongoing homosexual relationships unknown to their wives. One notable exception to this general pattern of resemblance occurred in the case of a pair of homosexual MZ twins who differed slightly in Kinsey rating. One was a K-6 and one a K-5. Although the twins resembled each other closely in physical appearance, the K-5 twin was noticeably masculine in manner whereas the K-6 twin was somewhat effeminate. These twins differed more than most MZ twins in their specific sexual interests and attractions.

Discordant MZ Males

Among our MZ male twins, 29.4% were discordant for sexual orientation; the most common pattern was the index twin K-6 and his brother K-0 (Tables I and II). These findings are consistent with those of Bailey and Pillard (1991). Two such pairs were interviewed extensively. In a third case the homosexual twin was interviewed by the researcher, while the heterosexual co-twin, who lived in another region of the country, was quite

cooperative in returning a completed questionnaire. The mother and non-twin sister of this pair were also interviewed and confirmed discordance for sexual orientation as well as other aspects of the lives of these twins. The mother was especially cooperative and interested in the research project, furnishing the researchers with copies of medical reports on blood typing at age 23, with 17 measures of zygosity. In all 17 tests the twins tested identically and were judged by the supervising physician to be monozygotic without any doubt. The mother of this pair initiated the blood typing because she was, and continues to be, puzzled by the fact that one twin is homosexual and one is heterosexual. She can think of nothing in their rearing or family life that caused different sexual orientations.

The main behavioral differences between the homosexual and heterosexual male twins of the MZ type seems to lie in those areas regarded by Whitam and Mathy (1986) as classic behavioral differences between homosexual and heterosexual men—athletic interest and interest in entertainment and arts. In three cases of MZ twins discordant for sexual orientation, respondents were interviewed personally and asked "In which ways do you and your twin differ most/least?" All three pairs reported lower levels of athletic interest and higher levels of interest in entertainment and the arts for the homosexual twin than for the heterosexual twin. In each case these were the first behavioral differences mentioned and were elaborated upon in some detail such as "My straight brother was much more athletic than me. In high school I played tennis and swam but he played football, baseball, and basketball." or "My gay brother was more artistic than me. He liked to draw and paint as a child but I didn't. Later in high school he was more interested than I was in school plays and activities of that type. I was more athletic-minded." This suggests that the athletic-entertainment interests are so closely linked to sexual orientation that they follow sexual orientation more closely than zygosity alone.

Discordant MZ twins tend to know and accept without problem the other's sexual orientation. In other respects they tend to be similar in appearance and mannerisms. In one incident related to us, the homosexual twin put on his heterosexual brother's suit and went to his brother's office where he "worked" for a full day without being found out. Later, the heterosexual twin successfully repeated this "experiment" in the office of the homosexual twin.

Concordant MZ Females

The concordance rate for Female MZ twins for homosexual orientation was 75% (Tables I and II). The sample for female twins is quite small

and a larger number might well produce a different rate of concordance, perhaps approximating that for males. Despite the small sample, finding that three of the four pairs of females MZ are concordant for sexual orientation questions Eckert's notion based on the Minnesota twin data that male homosexuality may be biologically derived while female homosexuality is learned behavior (Eckert *et al.*, 1986).

The small number of female twins is probably related to several factors. First, the lesbian population in general is about half the size of the male homosexual population—about 2–3% of the female population compared with 5–6% of the male population (Diamond, 1993). A second factor is the method of recruitment—through articles and ads in the gay press. While the gay press carries news and other material related to lesbians, it tends to be controlled by, oriented toward, and more widely read by gay men than lesbians. A third factor is that lesbians tend to be more private in their sexuality than are gay men and less responsive to sex research especially when conducted by male researchers. Those lesbians who decided to participate in the study were quite cooperative once they made the decision to participate, yet far fewer women responded initially to announcements about the research project than did men. Concordant MZ females, like gay men, tend to be similar to each other in their sexual interests and attractions. In one set of female twins, both had married at about the same age, had a single child, and then divorced before pursuing fully their homosexual lives.

Concordant and Discordant DZ Twins

Although the number of DZ twins is greater than MZ twins in the general population, our sample contains more MZ twins than DZ twins. This may reflect a tendency of DZ twins to separate psychologically and physically more than MZ twins. In our sample, MZ twins were more likely to live near each other and to be in close touch with each other than DZ twins. MZ twins seemed to exhibit greater interest in twin research. Several MZ pairs stated "We have always wanted to be in a twin study." MZ homosexual twins were more likely to be known in the gay communities of the cities in which they lived and were more likely to be referred to the researchers by third parties.

There are two types of male DZ twins: those whose co-twin is male and those whose co-twin is female (Tables II and IV). The concordance rate for homosexuality in the former is 28.6% and in the latter 33.3%. Concordance for homosexuality is slightly higher for male DZ twins with sisters, though the difference is small and could change with a larger sample. The

Table IV. Dizygotic Twins Individual Comparisons of Kinsey Ratings

Pair no.	Kinsey ratings	
	Index twin	Co-twin
Concordant		
Male/male		
1	6	6
2	6	6
3	6	6
4	5	6
Male/female		
5	6 (M)	6 (F)
6	6 (M)	6 (F)
7	6 (M)	6 (F)
Partially concordant		
Male/female		
8	6 (M)	4 (F)
9	5 (M)	3 (F)
Discordant		
Male/male		
10	6	0
11	6	0
12	6	0
13	6	0
14	6	0
15	6	0
16	6	0
17	6	0
18	5	0
19	5	0
Male/female		
20	6 (M)	0 (F)
21	6 (M)	0 (F)
22	6 (M)	0 (F)
23	4 (M)	0 (F)

combined concordance rate for male DZ twins with either a homosexual brother or sister is 30.4%.

The sexual behavior of DZ twins of the same sex does not seem strikingly similar as is often the case with MZ twins. Their sexuality does not appear to be more similar than that of brothers or friends growing up in the same city. It is difficult, of course, to assess the similarity of the sexual behavior of male-female DZ pairs because of sex differences. One male-female DZ pair, aged 23 and both interviewed personally, bore a rather striking physical similarity to each other and seemed "equivalent" in the sense that the gay male twin exhibited early childhood "sissy" behavior and

the lesbian twin exhibited early childhood "tomboy" behavior. These behaviors were noticed quite early by the family and friends who frequently commented that "He should have been the girl and she should have been the boy." Both actively identify as gay/lesbian, have ongoing homosexual relationships, and are active in gay/lesbian social activities. The occurrence of male-female pairs concordant for homosexual orientation at the same rate as male-male raises an interesting question about the dynamics of simultaneous emergence of homosexual male and homosexual female sexual orientation *in utero*, if such is the case. A higher than chance rate of concordance for DZ male pairs seems to Bailey and Pillard (1991) a not unexpected outcome in keeping with a genetic explanation. These authors suggest "if discordant MZ twins were less likely to participate than discordant DZ twins, this would inflate the difference in concordance rates between MZ and DZ twins and could lead to a significant difference in observed concordance rates even if there were no true difference in the population." As yet we do not know if a higher than chance rate of concordance for male-female DZ pairs is suggestive of a biological explanation or a response bias.

Male-female DZ twins discordant for sexual orientation do not appear to have any more in common with regard to their sexuality than a homosexual brother might have with a heterosexual sister. The sisters tend to be married with families. Tables I and IV present individual comparisons of twin pairs for Kinsey ratings so that readers may compare them with Kallmann's data, which were similarly arranged in Table III.

Triplets

Three sets of triplets appear in our sample (Table V). The first set of triplets, 33 years of age, consists of a MZ male pair, both homosexual, with a heterosexual sister. This triplet set was not interviewed face-to-face but questionnaires were received from all three and several telephone conversations were held with the MZ pair. This triplet set is also known to a third party who was able to corroborate the sexual orientation of the individuals. One of the two homosexual males in this triplet set reports that the sister, who is heterosexual, as a child was more athletic than either of the males. One of the males was interested in ceramics and is today an interior designer. His male co-twin was interested in theater and music and is presently a teacher. The second set consists of three females 24 years of age with a pair of MZ twins who are both lesbian and a third heterosexual DZ sister. This case is well-documented in that a female student research assistant made contact with the triplets, flew to the city where

Table V. Triplets Individual Comparisons of Kinsey Ratings

	Kinsey rating
Set 1	
MZ male	6
MZ male	6
DZ female	0
Set 2	
MZ female	5
MZ female	4
DZ female	0
Set 3	
MZ male	4
MZ male	4
MZ male	4

they lived and spent several days with them, interviewing and obtaining questionnaires and photographs from them. A third MZ male triplet set reports not only the same sexual orientation but similar life-style patterns. All three married heterosexually early in life, all had a single daughter, and all at about age 40 divorced, self-defined themselves as gay, and presently report very strong same-sex attractions. These three triplet sets have not been included in the figures for MZ twins and are considered separately (Table V). If the two MZ pairs found within the triplet sets and the MZ triplets were counted as MZ pairs the combined concordance rate for sexual orientation for MZ twins would rise to 67.6%.

Twins Reared Apart

Twins reared apart attract special attention. In contemporary American society it is increasingly difficult to find such twins. That this is possible though is seen from the well-known work of Bouchard *et al.* (1990). It is very expensive to bring twins reared apart together for interviewing and testing. Bouchard's sample did yield 5 sets of homosexual MZ twins reared apart—2 male and 3 female. It is impossible to infer conclusions about the origins of sexual orientation from such a small number of twins. Finding a sample of 61 pairs with a homosexual index twin *and* reared apart would indeed be a formidable task. Two such pairs did appear in our sample. A Canadian-American pair, aged 25, was separated within weeks of birth by the adoption of one of the brothers into a wealthy American family. The other twin was raised in a Canadian city in modest

circumstances by his natural mother. The twins did not know of each other's existence until they met accidentally in a gay bar in Canada at age 15. One of the researchers visited the Canadian city where the index twin lived and spent a week with him, observing, interviewing, and administering questionnaires to him. The American twin, who lived in San Francisco for several years, was ill with AIDS and subsequently died. The facts of this case are based solely on reports by the Canadian twin. According to this subject the twins met only three times after the initial accidental meeting. They did discuss their sexuality and even had sexual relations, which reportedly were "not particularly successful." Both had similar sexual attractions and interests, though the San Francisco twin was reported to have been into less conventional sexual practices—S-M, fisting, etc.—than the Canadian twin. A noteworthy similarity reported by the Canadian twin was their precocious sexuality. Both experienced an early puberty at about age 9 and at about 10 years of age each experienced full and pleasurable sexual relations with an adult man.

The second pair of male MZ twins reared apart were separated prior to their second birthday and reared in different parts of the country in different religious traditions—one Protestant, the other Jewish.

Discovering fairly late by accident that they were adopted, they arranged a reunion and remain in touch. Both were interviewed personally by different researchers at age 42. These twins are discordant for sexual orientation but both are interested in some unconventional sexual activities such as S-M. Whether this is merely a coincidence or of theoretical importance cannot be determined from a single instance.

King and McDonald (1992) attend at great length to the sexual interrelations of their twin population. Their finding that 15% of their twins reported shared sexual activities is in clear disagreement with our findings. Indeed, there is a rich sexual fantasy tradition about twins especially among gay men in gossip, folklore, pornography, and fiction. One occasionally hears about MZ twins who have been lifelong lovers. Some gay men have a sexual fantasy involving sexual relations with a pair of MZ twins as a threesome. None of the twin pairs analyzed here admitted to an adult sexual/lover relationship with each other and except for the one case mentioned above for a set of twins reared apart, none of the twins reported any adult sexual relations with each other. Occasionally the investigators were told of MZ twin pairs who were involved in such relationships, but attempts to verify these cases failed. Puterbaugh's (1990) review of homosexuality among twins also finds that "all the male MZ twins raised together emphatically denied any sexual interest in their co-twins at any time in their lives. This presents a strong contrast to the male MZ twins raised apart, where such attraction was reported." Our twins do report some

shared childhood sexual activity and occasional experimentation in adolescence. The level of this activity is not high however, and appears no more extensive than that which nontwin siblings of any sex might have.

CONCLUSIONS

Our findings are generally consistent with those of Bailey and Pillard, rather than Kallmann, Schlegel, or King and McDonald. The recent publication of studies with large samples raises serious questions about the sample used by Kallmann or the face validity of his work in the early 1950s. Both the Bailey and Pillard study and the present study are in general agreement about rates for concordance of sexual orientation in MZ and DZ twins. In both studies the rates of concordance for MZ twins are sufficiently high as to suggest a strong biological basis for sexual orientation. The rate of concordance for both MZ and DZ twins is considerably higher than might be expected by chance. Several alternative explanations present themselves: (i) Sexual orientation has a high heritability.⁵ Obviously any genetic patterning is complex because most parents of homosexuals are heterosexual. The concept of pleiotropy must be considered, with recognition that traits selected for by a mating couple are typically independent of the sexual orientation of future children. Genetic transmission may follow patterns of other behaviors assumed to have a strong genetic component that yet do not display 100% concordance in MZ pairs. Kaij (1960) found, for example, the rate of concordance for alcoholism to be 54% in MZ pairs and 24% for DZ pairs. Klerman (1978) found 70 to 100% concordance for manic-depression in MZ twins and 15 to 25% in DZ twins. Nagylaki and Levy (1973), found MZ twins have more reversed asymmetries than DZ pairs; there is a larger proportion of discordance of handedness in MZ pairs. Bouchard *et al.* (1990) found among the twins they studied, many reared apart since birth, that the traits most fixed by heredity were "traditionalism or obedience to authority": the tendency to follow rules and authority, to endorse high moral standards and strict discipline; "harm avoidance": the tendency to shun the excitement of risk and danger; "aggression": the tendency to be physically aggressive and vindictive. But not all twins showed these traits equally. (ii) Sexual orientation is partly genetic

⁵Heritable is not the same as "inheritable" as understood in lay terminology; it is a term used in genetics. Heritability is the probability that two individuals in a population would mate and produce offspring that show a particular character. Note this speaks of a *population*. There is rarely any predictive value for any specific individual(s) or behavior. And heritability does not have a fixed value that more studies will better define. It is a characteristic only of the particular population studied.

and partly socially derived and the social environment in which the discordant twins develop, rather than being alike is actually quite different. Even Siamese twins while still joined often exhibit some differences. (iii) Sexual orientation is biologically but not genetically transmitted and related to an *in utero* condition such as chorion-type — the features of the embryo coverings that eventually form the fetal part of the placenta and are variously shared by the twins. Melnick *et al.* (1978) have suggested that mono-chorionic twins are more alike than dichorionic twins. However, the shared blood circulation of the common chorion may be more unfavorable for one twin than the other. There may be, for instance, significant differences in birth weight between MZ twins. (iv) Sexual orientation is biologically but not genetically determined *in utero* by biochemical mechanisms which remain to be identified.

It is clear that the question of nature vs. nurture remains only partially answered by the present study. If Kallmann's and Schlegel's near 100% high rates of concordance for MZ twins had been confirmed, the issue would be far more clear-cut. We are left then with the conclusion that biological factors are strongly operating in the determination of sexual orientation with the precise nature of these factors yet to be understood. Such was the conclusion presented previously by the present authors (Diamond, 1965, 1976, 1979, 1982, 1993, in press; Whitam and Mathy, 1986). As with other classic questions in the sciences, attempts at final answers are only partially successful and beget still other scientific puzzles.

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APPENDIX A

The advertisement read as follows:
Researchers Seek Twins for Study: Dr. . . . and Dr. . . . are directing a national study of the sexuality of lesbian and gay twins. Twin research is an important technique for understanding the nature vs. nurture problem in the social sciences ascertaining which aspects of human sexuality are learned and which are biologically determined.

If you are a lesbian or gay twin your cooperation in this study is solicited. Both types of twins- fraternal and identical- are needed. It does not matter whether your co-twin is male or female or heterosexual or homosexual. All types and combinations of twins are sought.

Participation in this project involves being interviewed and filling out a sex questionnaire. Your confidentiality is assured in this project. If you are a twin and would like to participate call collect . . .

APPENDIX B

The exact wording was as follows:

As you consider your actual behavior, where would you place yourself on the following scale? (Check one.)

- _____ 0 Exclusively heterosexual
- _____ 1 Predominantly heterosexual, only incidentally homosexual
- _____ 2 Predominantly heterosexual, but more than incidentally homosexual
- _____ 3 Equally heterosexual and homosexual
- _____ 4 Predominantly homosexual, but more than incidentally heterosexual
- _____ 5 Predominantly homosexual, only incidentally heterosexual
- _____ 6 Exclusively homosexual

This was in a section dealing with adult sexual behavior. We also asked about behaviors during childhood and adolescence.

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