

## ON THE INFLUENCE OF GENETIC FACTORS ON THE FORMATION OF HOMOSEXUALITY BY DATA OF TWIN STUDIES

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Results of twin studies are presented; these demonstrate that in a number of cases genetic effects can play a role of mild predisposing factors for the development of homosexuality, but the main part in its formation is accounted for by psychological and social factors. The opinion that genetic factors play the only and dominant role in the genesis of homosexuality does not hold water due to the fact that if it were so then their concordance for homosexuality in monozygotic twins would be 100 %, but it is not observed in reality. The studies conducted with the correct selection of examinees revealed 20 % of the concordance for homosexuality in male monozygotic twins and 24 % in female ones (J. M. Bailey et al., 2000). The use of Holzinger's formula for analyzing the obtained numerical findings demonstrated that in the above case the proportion between heritable and environmental factors for male persons was 0.2 (20 %) versus 0.8 (80 %), for female persons it being 0.15 (15 %) versus 0.85 (85 %). Earlier twin studies (J. M. Bailey, R. C. Pillard, 1991) revealed that their concordance for homosexuality in siblings (biological brothers, who are not twins) was lower than in adopted brothers (9.2 % versus 11 %), it contradicting to the idea of genetic determination of same-sex attraction. Moreover, attention is also attracted by the fact that dizygotic male twins demonstrated a significantly higher concordance for homosexuality than siblings (22 % versus 9.2 %). But it is known that dizygotic twins, like siblings, have on an average only 50 % of common genes. If there were genetic determination, such differences would not exist; the revealed difference demonstrates environmental effects, since it is evident that family upbringing of dizygotic twins is much more similar. Also it is necessary to pay attention to the fact that the rate of homosexuality in adopted homosexual brothers (11 %) considerably exceeded recent estimations of the part of homosexuals in the general population and was actually equal to the value for siblings, once again convincingly demonstrating a significant role of the environment in the formation of

sexual orientation. We should not also ignore the fact that upbringing of monozygotic twins is even more similar than that of dizygotic ones; this phenomenon can cause their larger concordance for homosexuality.

**KEY WORDS:** homosexuality, formation, twin studies, genetic factors, role.

## **О ВЛИЯНИИ ГЕНЕТИЧЕСКИХ ФАКТОРОВ НА ФОРМИРОВАНИЕ ГОМОСЕКСУАЛЬНОСТИ ПО ДАННЫМ БЛИЗНЕЦОВЫХ ИССЛЕДОВАНИЙ**

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Приведены результаты близнецовых исследований, которые свидетельствуют о том, что в ряде случаев генетические влияния могут играть роль мягких предрасполагающих факторов в развитии гомосексуальности, но основное значение в ее формировании принадлежит факторам психологическим и социальным. Мнение, что генетические факторы выполняют доминирующую и единственную роль в генезе гомосексуальности, не выдерживает критики в связи с тем, что если бы это было так, то соответствие по гомосексуальности среди однояйцовых близнецов составляло бы 100%, чего на самом деле не наблюдается. Исследования, проведенные с корректным подбором исследуемых, свидетельствуют о 20% конкордантности по гомосексуальности среди однояйцевых близнецов мужского пола и 24% – среди женского (J. M. Bailey и соавт., 2000). Использование формулы Хольцингера при анализе полученного цифрового материала свидетельствует о том, что в данном случае соотношение наследственных и средовых факторов для лиц мужского пола составляет 0,2 (20%) против 0,8 (80%), а для женского – 0,15 (15%) против 0,85 (85%). В более ранних близнецовых исследованиях (J.M. Bailey, R. C. Pillard, 1991) было выявлено, что соответствие по гомосексуальности у сиблингов (родных братьев, но не близнецов) было ниже, чем у приемных братьев (9,2% против 11%), что входит в противоречие с идеей генетической обусловленности однополого влечения. Помимо этого, обращает на себя внимание тот факт, что у дизиготных близнецов мужского пола соответствие по гомосексуальности значительно выше, чем у сиблингов (22% по сравнению с 9,2%). Однако известно, что дизиготные близнецы, также как и сиблинги, имеют в среднем лишь 50% общих генов. Если бы речь шла о генетической детерминации, то таких различий не должно было бы быть, и выявленное отличие свидетельствует о средовых влияниях, так как очевидно, что у двужайцовых близнецов воспитание в семье будет гораздо более схожим. Также

необходимо обратить внимание на тот факт, что частота гомосексуальности у приемных братьев гомосексуалов (11%) намного превышала последние оценки доли гомосексуалов в общей популяции и практически была равна показателю для сиблингов, что в очередной раз убедительно свидетельствуют о значимости роли социальной среды в формировании сексуальной ориентации. Нельзя обойти вниманием и тот факт, что у однояйцевых близнецов воспитание является еще более схожим, чем у двуяйцевых, что может сказываться на их большем соответствии по гомосексуальности.

**КЛЮЧЕВЫЕ СЛОВА:** гомосексуальность, формирование, близнецовые исследования, генетические факторы, роль.

## **ПРО ВПЛИВ ГЕНЕТИЧНИХ ФАКТОРІВ НА ФОРМУВАННЯ ГОМОСЕКСУАЛЬНОСТІ ЗА ДАНИМИ БЛИЗНЮКОВИХ ДОСЛІДЖЕНЬ**

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Наведено результати близнюкових досліджень, які свідчать про те, що в ряді випадків генетичні впливи можуть грати роль м'яких факторів у розвитку гомосексуальності, але основне значення в її формуванні належить факторам психологічним і соціальним. Думка, що генетичні чинники виконують домінуючу і єдину роль в генезі гомосексуальності, не витримує критики у зв'язку з тим, що якби це було так, то конкордантність за гомосексуальністю серед однояйцевих близнюків становила б 100%, чого насправді не спостерігається. Дослідження, проведені з коректним підбором досліджуваних, свідчать про 20% конкордантність за гомосексуальністю серед однояйцевих близнюків чоловічої статі і 24% – серед жіночої (J. M. Bailey і співавт., 2000). Використання формули Хольцингера при аналізі отриманого цифрового матеріалу свідчить про те, що в даному випадку співвідношення спадкових і середовищних факторів для осіб чоловічої статі становить 0,2 (20%) проти 0,8 (80%), а для жіночої – 0,15 (15%) проти 0,85 (85%). У більш ранніх близнюкових дослідженнях (J. M. Bailey, R. C., Pillard, 1991) було виявлено, що конкордантність за гомосексуальністю у сиблингів (рідних братів, але не близнюків) була нижче, ніж у прийомних братів (9,2% проти 11%), що входить в протиріччя з ідеєю генетичної обумовленості одностатевого потягу. Крім цього, звертає на себе увагу той факт, що у дизиготних близнюків чоловічої статі конкордантність за гомосексуальністю значно вище, ніж у сиблингів (22% в порівнянні з 9,2%). Однак відомо, що дизиготні близнюки, також як і сиблинги, мають в середньому лише 50% загальних генів. Якби мова

йшла про генетичну детермінацію, то таких відмінностей не повинно було б бути, і виявлена відмінність свідчить про середовищні впливи, так як очевидно, що у двуйцевих близнюків виховання в сім'ї буде набагато більш схожим. Також необхідно звернути увагу на той факт, що частота гомосексуальності у прийомних братів гомосексуалів (11%) набагато перевищувала останні оцінки частки гомосексуалів в загальній популяції і практично дорівнювала показнику для сиблінгів, що в черговий раз переконливо свідчить про значимість ролі соціального середовища у формуванні сексуальної орієнтації. Не можна обійти увагою і той факт, що у однойцевих близнюків виховання є ще більш схожим, ніж у двуйцевих, що може позначатися на їх більшій конкордантності за гомосексуальністю.

**КЛЮЧОВІ СЛОВА:** гомосексуальність, формування, близнюкові дослідження, генетичні фактори, роль.

The authors, who conduct genetic studies of homosexuality, often try to declare it a consequence of the prevailing influence of genes. But in order to make an objective opinion it is necessary to resort to presentation and analysis of the materials which deal with this problem.

Some studies of twins have recorded the concordance rate for homosexuality in monozygotic (monochorial), dizygotic (dichorial) twins and sibs/siblings (biological brothers and sisters, who are not twins) and revealed that the above concordance is higher in monozygotic twins, this fact demonstrating biological predisposition to homosexuality rather than its congenital character. The range of values of this concordance, according to different authors, varies greatly. Next are several examples.

In 1991 J. M. Bailey and R. C. Pillard [5], researchers from the Northwestern University and Boston University School of Medicine, published their findings that revealed in males their concordance for homosexuality in 52 % (29/56) of monozygotic twins, 22 % (12/54) of dizygotic twins, 9.2 % (13/142) of siblings and 11 % (6/57) of adopted brothers.

Discussing the above research it is necessary to point out the methodology of selection of the material that could significantly affect the findings. The authors did not study a random sample of homosexuals, because the cases were involved by means of advertisements in homosexual press. This method was highly dependent upon the readership of such issues and motives of those people who desired to participate in the above studies. This approach could result in distortion of findings: for example, an increased rate of homosexuality for twins because of selectivity in the formation of the group of respondents [7].

Attention is also attracted by the fact that the concordance for homosexuality in siblings was lower than in adopted brothers (9.2 % versus 11 %), it contradicting to the idea of genetic

predisposition to same-sex attraction. Moreover, we should consider that dizygotic twins demonstrated a significantly higher concordance for homosexuality than siblings (22 % versus 9.2 %). But it is known that dizygotic twins, like siblings, have on an average only 50 % of common genes. If there were genetic determination, such differences would not exist; the revealed difference demonstrates environmental effects, since it is evident that family upbringing of dizygotic twins is much more similar. Also it is necessary to pay attention to the fact that the rate of homosexuality in adopted homosexual brothers (11 %) considerably exceeded recent estimations of the part of homosexuals in the general population and was actually equal to the value for siblings, once again convincingly demonstrating a significant role of the environment in the formation of sexual orientation [2]. We should not also ignore the fact that upbringing of monozygotic twins is even more similar than that of dizygotic ones; this phenomenon can cause their larger concordance for homosexuality.

Determination of the heritability estimate using Holzinger's formula [1] demonstrates that the proportion of heritable and environmental factors in the above study was, respectively, 0.38 (38 %) and 0.62 (62 %), it revealing a more pronounced influence of environmental factors.

In 1993 J. M. Bailey et al. [6] published results of a similar study among adult females (lesbians and bisexuals). These findings were as follows: the concordance for homosexuality in monozygotic twins was 47.9 % (34/71), in dizygotic ones 16.2 % (6/37), in adopted sisters 5.7 % (2/35).

Some studies show a lower influence of heritable factors. M. King and E. McDonald [11] examined 46 homosexual males and females, who were twins. The reported level of concordance for homosexuality was 10 % or 25 % for monozygotic twins (depending upon the fact whether bisexuals were taken into consideration together with homosexuals). The levels of coincidence for dizygotic twins were 8 % and 12 % (also with consideration of the above dependence).

If homosexuality were congenital and caused by influence of genetic factors and if environmental (psychological and social) ones did not produce any effect on the formation of sexual orientation, then every monozygotic brother of a homosexual would be only homosexual. It should be emphasized that during explanation of a higher concordance rate for homosexuality in monozygotic twins we should not focus our attention only on a possible influence of genetic factors, since it is not only monozygotic twins but even dizygotic ones too have a similar hormonal environment during their prenatal period of life, when sexual differentiation of the brain takes place. Hence, the influence of hormonal factors in this case should not be ruled out. Neither ignored should be the fact that, as we have emphasized above, the monozygotic twins, who live in the same family, undergo the influence of the same ecological effects of the psychological and social character.

Examination of the twins, who were brought up in different conditions, would undoubtedly demonstrate more clearly the real role of biological (heritable) as well as psychological and social factors in the genesis of homosexuality. But for absolutely obvious reasons it is extremely difficult and actually impossible to conduct such a study with involvement of any significant number of respondents.

Discussing the problem of influence of genetic factors on the formation of homosexuality, R. Hubbard and E. Wald [10, p. 97] point out the fact that studies of dizygotic twins revealed, as a rough estimate, twice more homosexuals than among other biological brothers (siblings). This result demonstrates influence of the environmental factor on the above twins, since they, as we have already emphasized, do not have more biological similarities between themselves than non-twin brothers (siblings). Moreover, the authors insist that this finding should cover even more monozygotic twins; their acquaintances regard them as “identical” and treat them as identical, and they themselves often feel their similarity or identity.

R. Crooks and K. Baur [3, p. 246] report that for some time past the methods of selection of examinees, used in studies of homosexuality in twins, have been subjected to criticism. The works of 1990s turned out to be particularly vulnerable, as the examinees were invited with help of advertisements in publications for gays and lesbians or by using their acquaintances. Moreover, from the very beginning the examinees knew that they participated in the study of homosexuality. Therefore it could happen that the twins, who were invited to take part in such a study, took into account the sexual orientation of the other twin, their brother or sister, before deciding to participate in the study. And eventually it could result in higher values of coincidence than those ones that could be obtained for the general population. In this way the above authors unequivocally state that in order to increase the percentage of concordance in homosexuality among twins the homosexuals, who knew about the planned study and its purposes, took a decision about their participation or non-participation in the study with a resultant distortion and possible formation of an unrepresentative sample.

Taking into consideration these critical statements, J. M. Bailey et al. [4] conducted a new study of twins, whose results were published in 2000. The authors used the Australian National Health and Medical Research Council Twin Registry. All in all 1,538 twin pairs participated in the study: 312 pairs of monozygotic male twins, 182 pairs of fraternal male twins, 688 pairs of monozygotic female twins and 376 fraternal female twins. All the twins, who took part in the study, were chosen randomly, irrespective of data about the other twin, the brother or the sister. The concordance for homosexuality was 20 % in monozygotic male twins and 0 % in dizygotic ones; in representatives of the female gender the above proportion was 24 % versus 10.5 % [9].

Conspicuous is the fact that with such a correct approach to the study the percentage of the concordance for homosexuality in twins turned out to be much lower than in the studies led by the same author before (See Table 1).

The use of Holzinger's formula in analyzing the obtained numerical material demonstrates that in this case the proportion of heritable and environmental factors is 0.2 (20 %) versus 0.8 (80 %) for the male gender and 0.15 (15 %) versus 0.85 (85 %) for the female one. Taking this information into account it is not difficult to make the same conclusion as in the study mentioned, though if we consider the difference in the concordance between monozygotic and dizygotic twins during interpretation of the obtained data we can say about mild inherited predisposition.

**Table 1.**  
**The concordance for homosexuality in monozygotic and dizygotic twins of the male and female gender**

| <b>Concordance for homosexuality in twins</b> | <b>Monozygotic male twins</b> | <b>Dizygotic male twins</b> | <b>Monozygotic female twins</b> | <b>Dizygotic female twins</b> |
|---|-------------------------------|-----------------------------|---------------------------------|-------------------------------|
| Bailey J. M. and Pillard R. C., 1991          | 52 %                          | 22 %                        | –                               | –                             |
| Bailey J. M. et al., 1993                     | –                             | –                           | 47.9 %                          | 16.2 %                        |
| Bailey J. M et al., 2000                      | 20 %                          | 0 %                         | 24 %                            | 10.5 %                        |

Results of a large-scale and representative study of twins were published in 2002 by sociologists Peter S. Bearman and Hannah Brückner [8]. They used information about teenagers of the 7th-12th grades from the National Longitudinal Study of Adolescent Health (Add Health). Of 18,841 teenagers, 8.7 % reported about their attraction to people of the same sex, 3.1 % informed about romantic relationships with representatives of their gender, and 1.5 % had homosexual intercourses. Lawrence S. Mayer and Paul R. McHugh [13] point out that P.S. Bearman and H. Brückner did not find any confirmation for a significant genetic influence on sexual attraction. This influence would be significant if the concordance rate of same-sex attractions were considerably higher in monozygotic twins versus fraternal ones or non-twin brothers. But the revealed coefficients were statistically consistent: the concordance was 6.7 % in

monozygotic twins, 7.2 % in fraternal twins and 5.5 % in non-twin brothers (See Table 2). The authors came to the following conclusion: “it is more likely that any genetic influence, if present, can only be expressed in specific and circumscribed social structures” [8, p. 1198].

It should be noted that when assessing a number of twin studies we should keep in mind that homosexuality could be detected by sexual behaviour rather than by sexual attraction. Though often these factors correlate, they are not identical. A person can live a sexual life with representatives of the same sex without any sexual attraction to them. As it is known, there is homosexual experimentation of adolescents (when same-sex attraction is absent), homosexual prostitution, etc. Even such a term as “males practicing sex with males” exists, when sexual orientation and sexual identity are not taken into account. On the other hand, a person with same-sex attraction may not have any contacts with people of the same gender.

**Table 2.**

**The concordance of same-sex romantic attraction among different pairs of siblings**

| Type of pair            | All   |     | Males |     | Females |      |
|-------------------------|-------|-----|-------|-----|---------|------|
|                         | N     | %   | N     | %   | N       | %    |
| Monozygotic twins       | 45    | 6.7 | 26    | 7.7 | 19      | 5.3  |
| Dizygotic twins         | 83    | 7.2 | 48    | 4.2 | 35      | 11.4 |
| Siblings                | 183   | 5.5 | 89    | 4.5 | 94      | 6.4  |
| Other                   | 216   | 4.2 | 110   | 2.7 | 106     | 5.7  |
| All                     | 527   | 5.3 | 273   | 4.0 | 254     | 6.7  |
| P (Fisher's exact test) | 0.630 |     | 0.564 |     | 0.651   |      |

When assessing results of the twin method of researches we should keep in mind that it assumes equality among both monozygotic and dizygotic twins. But in real conditions even the twins, who live together, are subjected to different environmental effects with a resultant distortion of the true contribution of heritability and environment to the development of a certain sign. The above fact particularly concerns those signs, which are very sensitive to the influence of environmental factors. The following causes of different influence of the environment on the development of twins are singled out [1]:

- “accentuation of the likeness of monozygotic twins by their acquaintances;
- accentuation of differences of dizygotic twins, for example in succeeding in different kinds of activity; seeking of dizygotic twins to emphasize their dissimilarity;
- conditions of their development can reduce similarity of twins in both monozygotic and dizygotic pairs; as, for example, during their intrauterine development twins are often in unequal conditions:



- differences in blood supply;
- uneven compression of the placentas;
- differences in liability for birth injuries, etc.”

It is pointed out that differences between twins can increase during their postembryonic development. It may be caused by division of duties between twins during their differentiation on the “leader-subordinate” basis, etc.

Discussing this problem, Lawrence S. Mayer and Paul R. McHugh [13] nevertheless note: “One needs to bear in mind that identical twins typically have even more similar environments – early attachment experiences, peer relationships, and the like – than fraternal twins or non-twin siblings. Because of their similar appearances and temperaments, for example, identical twins may be more likely than fraternal twins or other siblings to be treated similarly. So some of the higher concordance rates may be attributable to environmental factors rather than genetic factors.”

In 2010 Niklas Långström et al. [12] published findings of their large-scale study of sexual orientation of twins in Sweden; they analysed data of 3,826 pairs of same-sex monozygotic and fraternal twins (2,320 monozygotic and 1,506 fraternal pairs). Having concluded that sexual orientation appears under the influence of both heritable and environmental factors, the Swedish scientists have stated that “the present results support the notion that the individual-specific environment does indeed influence sexual preference” [12, p. 79]. As Lawrence S. Mayer and Paul R. McHugh [13], who analysed this study, point out the findings received by the above authors demonstrate that we cannot deny the role of the genetic component in the development of homosexual behaviour, but it is the unique environmental factors that play a decisive and maybe dominating role.

It should be noted that in our article we have presented a characteristic of different sample groups, i.e. we are talking about the “group portrait”, where the role of genetic factors in the genesis of homosexuality was determined. But it is absolutely obvious that often this is in reference to merely acquired forms of homosexuality, where no role of genetic factors is seen at all. This fact is confirmed by clinical observations.

At the same time, in some cases predisposing biological factors apparently can, if their manifestation is large, particularly when this refers to their combinations, cause development of homosexual orientation even in the absence of any pronounced environmental homosexualizing effects (upbringing, informational influences of a certain kind, etc.).

On the basis of their comprehensive meta-analysis of a large number of studies of homosexuality the American medical researchers Lawrence S. Mayer and Paul R. McHugh Mayer [13] state the following: “Summarizing the studies of twins, we can say that there is no

reliable scientific evidence that sexual orientation is determined by a person's genes. But there is evidence that genes play a role in influencing sexual orientation.”

*To our mind it would be interesting to conduct a twin study of heterosexuality. I have no doubts that in this case the heritable factor would show itself in an absolutely another way and, apparently, we could state that it plays a large part in the formation of heterosexual orientation because it is in line with the human gender (!).*

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