

The Trouble with Inversion: An examination of science and sexual orientation

Rebekah Johnston

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Article abstract

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THE TROUBLE WITH INVERSION: AN EXAMINATION OF SCIENCE AND SEXUAL ORIENTATION

REBEKAH JOHNSTON
WILFRID LAURIER UNIVERSITY

ABSTRACT

Although some are excited about the possibility of using current scientific research into the biological causes of sexual orientation to ground rights claims, I argue that basing rights claims on this research is unwise because this research, specifically the hormonal, genetic, and structural research, is organized around the inversion assumption, a conceptual scheme within which some aspect of the biology of gay men and lesbians is thought to be inverted along sex lines. While there are many reasons to worry about the use of the inversion assumption, I focus on problems that arise from a further set of claims that must be assumed in order to make the use of the inversion assumption coherent. This further set of assumptions includes the claims (1) that heterosexuality is the standard state and that (2) this standard state is sexually-dimorphic and (3) deterministic. I argue that this set of assumptions is problematic because it results in ideological consequences that are both sexist and heterosexist.

RÉSUMÉ

Plusieurs militants et militantes croient que la découverte d'un siège biologique de l'homosexualité permettra aux personnes homosexuelles de revendiquer leurs droits. Cependant, nous estimons qu'il est problématique de fonder ces revendications sur des recherches reposant sur certaines hypothèses qui sont implicites. En particulier, la notion d'inversion (*inversion assumption*) joue un rôle clef dans ces recherches. Ce qui veut dire que le schème conceptuel qui cadre cette recherche scientifique suppose que certains traits des hommes et des femmes homosexuelles sont inversés. Donc, les mâles homosexuels jouent le rôle de la femelle et les lesbiennes prennent celui du mâle dans la relation de couple. Pour que ce schème soit cohérent, plusieurs autres suppositions doivent être prises pour acquises et nous discutons trois d'entre-elles. En premier lieu, on suppose que l'hétérosexualité est la norme de base; deuxièmement que cette norme est dimorphe et finalement qu'elle est déterminée. Nous arguons que ces suppositions sont non seulement contestables mais qu'elles engendrent des idéologies à la fois sexistes et hétérosexistes.

INTRODUCTION

Recent scientific research directed at discovering the biological causes of homosexuality is controversial and has generated a great deal of political interest. Some hope that such research will provide a basis from which to make arguments for gay and lesbian rights. Others worry that the biological evidence, rather than validating rights claims, will lead to further forms of discrimination such as selective abortions, genetic engineering, and general medical intervention.¹ I think that there are reasons to be wary of making arguments for gay and lesbian rights on the basis of current scientific research because this research is constructed in accordance with what is commonly referred to in the literature as the “inversion assumption.”² According to the inversion assumption, homosexuality is caused by an inversion at some sexually dimorphic site such that gay males resemble female heterosexuals at this site and lesbians resemble male heterosexuals at this site.³ Research based on the inversion assumption, I will argue, requires several further assumptions. This set of assumptions yields both heterosexist and sexist results and thus provides a reason to resist the use of such research to ground rights arguments. In Part One, I provide a review of the research in order to show that the inversion assumption is operating in these studies. In Part Two, I consider the further assumptions required by the inversion assumption and the heterosexist and sexist implications of the research. Finally, I consider and argue against a possible strategy for defending the research projects.

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PART ONE: THE INVERSION ASSUMPTION AND THE SCIENTIFIC RESEARCH

Contemporary scientific research into the biological causes of homosexuality can be organized into three distinct but overlapping categories: 1) hormonal theories, 2) structural theories, and 3) genetic theories.⁴ While researchers working in these three areas differ in terms of where they expect to find the biological basis of homosexuality, they are all similar insofar as they share a conception of homosexuality that relies on the inversion assumption. It is assumed that lesbians are similar to heterosexual men in a way that heterosexual women are not and it is assumed that gay men are similar to heterosexual women in a way that heterosexual men are not. At a descrip-

tive level, this assumption can be seen as relatively unproblematic. Gay men and heterosexual women share a sexual interest in men and lesbians and heterosexual men share a sexual interest in women. Researchers, however, are not merely describing a social phenomenon. They are looking for the biological bases which cause lesbians and straight men to desire women and which cause gay men and straight women to desire men. The basic theory, although it varies in terms of which biological states are examined, is that lesbians are sexually interested in women *because* they share some biological feature with heterosexual men which *causes* them to desire women and similarly for gay men and heterosexual women. Furthermore, the existence of the biological feature that causes attraction to women is taken as standard in men, but abnormal in women and the existence of the biological feature that causes attraction to men is taken as standard in women and abnormal in men. In other words, in the case of lesbians, it is assumed that some aspect of their biology is male-typical and, in the case of gay men, there is some aspect of their biology that is female-typical. The claim that some aspect of the biology of homosexuals is inverted along sex lines serves as the starting point for many of the scientific investigations insofar as it provides a conceptualization of homosexuality and insofar as it shapes the form experiments take. A review of the hormonal, structural and genetic literature will show how the inversion assumption operates in each type of research. My concern in setting out the various research paradigms is not to evaluate the findings, but to show how the inversion assumption is incorporated into the research.⁵ As I will argue in section two, the inversion assumption involves a conception of homosexuality that is heterosexist and which supports sexist claims. Its appearance as a fundamental aspect of the research projects should make us skeptical about employing the results of these experiments.

HORMONAL RESEARCH

Research into the hormonal basis of sexual orientation is shaped around the claim that since hormones play a significant role in whether an individual develops along male-typical or female-typical lines, they will also play a role in determining one's sexual orientation. More specifically, hormone studies are organized around the claim that a homosexual orientation is caused by the presence and activity of hormones and/or hormone receptors that are atypical of one's sex. Male

homosexuals are thought to have experienced a more female typical pattern of hormone exposure and female homosexuals are thought to have experienced a more male typical pattern of hormone exposure. The line of inquiry that predominates in contemporary hormonal research is prenatal hormone exposure.⁶ Most of the research into prenatal hormones focuses on exposure to androgens, but a few researchers consider the role of estrogens as well. In his 1995 article, "Psychoneuroendocrinology and Sexual Pleasure: The Aspect of Sexual Orientation," Meyer-Bahlburg provides a review of the major research projects concerned with prenatal hormone exposure.

Studies involving human subjects and the relationship between prenatal testosterone exposure and homosexuality are based on data from subjects who experienced atypical levels of prenatal testosterone exposure due to Congenital Adrenal Hyperplasia (CAH) or due to Androgen Insensitivity Syndrome (AIS).⁷ The choice of subjects with CAH or AIS clearly illustrates the role the inversion assumption plays in shaping the hormonal research projects. CAH is a condition where genetic females (XX) experience exposure to a level of prenatal androgens that is higher than the typical level of exposure experienced by genetic females and is similar to the exposure level experienced by genetic males. Due to this androgen exposure, females with CAH are born with varying degrees of external genital ambiguity, but with typical ovaries, fallopian tubes, and uteri.⁸ CAH subjects, then, were chosen for studies precisely because they are females who experienced atypical i.e., inverted, exposure to prenatal androgen levels.⁹ AIS subjects are genetic (XY) males who experienced decreased or no exposure to testosterone in the prenatal phase of development. Such males are able to produce testosterone, but defects in the androgen receptors impede their ability to respond to this hormone. Subjects who have complete androgen insensitivity do not respond to testosterone at all and thus develop female-typical genitalia and are raised as girls.¹⁰ Subjects who have partial androgen insensitivity produce androgens, but respond only partially. They experience partial genital masculinization and are most often raised as boys.¹¹ Finally, a third group of subjects, those who produce typical amounts of testosterone but are unable to convert it into its usable form (dihydrotestosterone) develop female external genitalia but virilize at puberty due to testosterone circulation.¹² Research based on all three of these versions of androgen insensitivity select subjects with AIS because this condition represents what is seen as a more female-typical pattern of prenatal hormone exposure.

In addition to theories based on atypical exposure to androgens, some researchers consider the role estrogens play in the development of sexual orientation. Subjects who were exposed prenatally to a drug called Diethylstilbestrol (DES) are considered appropriate research subjects because females exposed to this drug experience reduced estrogen exposure.¹³ A second site of interest concerns experiments which measure responses to luteinizing hormone (LH). In female rats, rising estrogen levels trigger an LH surge. Female rats, however, that have been prenatally exposed to excess androgens experience no LH surge.¹⁴ This response has been studied in human subjects as a way to gauge the likelihood of atypical prenatal hormone exposure. Gay and transsexual men were injected with estrogen and researchers found that, like women, they responded with an LH surge. This was taken as a sign that such men experienced a deficiency of prenatal androgens.¹⁵ In other words, researchers choose to investigate whether gay and transsexual men, like women, respond to estrogen injections with an LH surge. Since the presence of an LH surge is tied to a lower level of prenatal exposure to androgens (female-typical) and the absence of an LH surge is tied to a higher level of prenatal exposure to androgens (male-typical), the assumption functioning in this experiment is that gay men and transsexuals experienced an inverted, i.e. more female-typical, exposure to prenatal androgens. Again, these experiments are shaped around the idea that homosexuality in males is caused by a pattern of prenatal hormone exposure that is like the pattern experienced by females.

STRUCTURAL STUDIES

Theories about the causes of homosexuality based on structural studies of the human brain are organized around two claims: 1) that there are sexually dimorphic regions of the brain and 2) that in the case of gay men and lesbians these structures are fully or partially inverted along sex lines.¹⁶ The most famous studies of brain structure focus on the hypothalamus and the corpus callosum. While some other studies of the hypothalamus have been conducted, LeVay's study revealed new results and served as an attempt to replicate the older studies.¹⁷ In 1991, LeVay reported that the INAH3 region of the hypothalamus is two times larger in heterosexual women and gay men than in heterosexual men and he speculated that lesbians would have the same sized INAH3 as heterosexual men.¹⁸ The corpus callosum

is another site of interest for structural research and in 1992 Gorski and Allen reported a partial inversion in homosexual men of the sexually dimorphic anterior commissure.¹⁹ This site is thought to be larger in women than in men and Gorski and Allen found that this site was 18% larger in gay men than in heterosexual women and 34% larger in gay men than in heterosexual men. In all of these studies, the sites of interest were chosen precisely because they are thought to be sexually dimorphic and thus able to constitute a site where inversion is possible.

In addition to studies of these particular areas, researchers also look for inversion in cognitive abilities and brain lateralization. That is, they expect that the brains of homosexuals will be organized like the brains of opposite sex heterosexuals. In his 1995 article "Science and Belief: Psychobiological Research on Sexual Orientation," Byne reports on recent theories in this area. One theory is that as compared with heterosexual men, homosexual men exhibit inverted cognitive profiles. That is, they have decreased visuospatial ability and increased verbal ability.²⁰ Again, the organizing idea is that homosexuals will have brains or brain sites that are similar to the brain sites of opposite sex heterosexuals.

GENETIC STUDIES

Genetic studies incorporate the inversion assumption in less explicit ways and it is possible to extricate them from this assumption. Nevertheless, the inversion assumption, while it is not a necessary assumption in this research, does enter into the research in various subtle ways. In their article, "The Genetics of Sexual Orientation: From Fruit Flies to Humans," Pattatucci and Hamer provide a useful summary both of their own genetic research and of the major research projects in the other main branch of genetic theories, i.e. twin studies. Briefly, twin studies are organized around the idea that if homosexuality has a genetic cause, then people with the same genetic material should be concordant for sexual orientation.²¹ While these experiments are based on case studies, more recent research is somewhat more sophisticated. The studies of Dean Hamer and Angela Pattatucci seek to determine whether or not sexual orientation has a genetic basis by assembling family pedigrees and by studying linkage patterns.²² Neither of these types of research makes reference to the inversion assumption and it is plausible that they are looking for a genet-

ic basis that would work on some other model, perhaps a model where one gene caused homosexuality in both males and females. While this is a possible turn their research could take, there are reasons to think that the inversion assumption is operating in a subtle way. First, some researchers look to cross-gender behavior as a way to further validate their claims about genetics.²³ This implies that researchers assume that the same inversion mechanism causes atypical gender formation and atypical sexual orientation. Second, genetic studies are often taken as one part of an explanatory model that incorporates inversions at other sites such as hormone exposure or brain structures. That is, genetics do not directly cause sexual orientation, rather they work through various sexually dimorphic sites. Insofar as genetic studies link to other inverted sites, genetic studies employ the inversion assumption.

PART TWO: BACKGROUND ASSUMPTIONS AND IDEOLOGICAL CONSEQUENCES

It is clear, then, that contemporary research into the biology of homosexuality relies on the inversion assumption. While such a reliance is potentially problematic in itself, further problems arise when the set of assumptions required to support the inversion assumption are examined.²⁴ I argue that the inversion assumption, when considered along with its necessary background assumptions, commits one to a conception of homosexuality that is grounded in heterosexism and sexism. The argument proceeds in two parts. First I argue that the inversion assumption requires two further claims: 1) heterosexuality must be assumed to exist as a sexually dimorphic biological state and 2) heterosexuality must be assumed to exist as a deterministic biological state. These claims, however, are merely further assumptions. Second, I argue that the inversion assumption along with these two further assumptions imply a conception of homosexuality that is not only heterosexist but also sexist.

2A. TWO ASSUMPTIONS REQUIRED BY THE INVERSION ASSUMPTION

In order to shape their experiments around the inversion assumption, researchers must assume that there is a standard state against which an inversion can be identified.²⁵ This standard state is hetero-

sexuality. Furthermore, not only do researchers have to assume that heterosexuality exists at the biological level, they must also assume that it exists as a state with a particular set of characteristics. That is, in order for such a state to be able to serve its role as the standard against which inversions can be identified, heterosexuality must be assumed to exist as a sexually dimorphic, deterministic biological state.²⁶

First, heterosexuality must be assumed to exist as a sexually dimorphic trait. There must be a male-typical form of heterosexuality, i.e. attracted to females, and a female-typical form of heterosexuality, i.e. attracted to males. If heterosexuality takes the same biological form in males and females, e.g. if heterosexuality exists as a biological state that makes both males and females 'other preferring' in terms of sex, then inversion does not make sense conceptually. In order to employ the idea of inversion at least two elements must be involved; for inversion is a concept that says something about the arrangement of two elements. If there is only one element, then one can speak of difference and otherness, but not about inversion. In order to conceptualize the research projects in terms of inversion, researchers must hold that heterosexuality, as the standard, is a sexually dimorphic trait.

Second, the relationship between the biological level and the trait, heterosexuality, must be a deterministic one. If the biological state that makes us call a particular male a heterosexual, i.e. X = attracted to females, does not determine his attraction to females, then it is possible that he could have the same biological state, yet be attracted to males. When we turn to homosexuality as construed in terms of the inversion assumption, researchers expect that if a female has trait X, then she will be a lesbian. If, however, having trait X does not function in a deterministic manner such that a male with trait X may nevertheless experience attraction to males, then a female with trait X may also experience attraction to males. Such a scenario does not accurately divide people into categories of sexual orientation and this makes identifying such a trait useless in terms of identifying the causes of homosexuality.²⁷ Heterosexuality then must be assumed to exist as a deterministic biological state if it is to serve as the standard against which inversions can serve an explanatory role.

While a conception of the biology of heterosexuality as sexually dimorphic and deterministic is necessary in order to make sense or use of the inversion assumption, such a conception is merely an

assumption. Aspects of sexual orientation having to do with desires other than the sex of one's partner, aspects such as a desire to have sex in public places, a preference for people with short hair or blue eyes, etc., are not assumed to be sexually dimorphic nor determined aspects of sexual orientation. Until scientists can provide compelling reasons for treating preference in terms of the sex of one's partner in another manner, a commitment to heterosexuality as a sexually dimorphic, deterministic biological state cannot be raised above the level of assumption.

Furthermore, the claim that most people are heterosexual and experience their heterosexuality as determined does not provide a reason to believe either that it is determined or that it is determined by biology. There is clearly a normative force that operates to make people into heterosexuals.²⁸

The inversion assumption, then, requires a commitment to a further set of assumptions about the biological nature of heterosexuality. What is important to notice about this set of assumptions is that researchers cannot merely remove one or the other of the subset of assumptions and still use inversion as the model. Researchers may try to defend their research against claims that it is deterministic or that it employs inappropriate claims about sexual dimorphism by denying that they hold these positions. My point, here, is that researchers cannot deny any of these assumptions while at the same time continuing to rely on the inversion assumption.

2B. IDEOLOGICAL CONSEQUENCES

This set of assumptions, while necessary for the conceptualization of the research projects, has two worrying ideological consequences. Research that employs the inversion assumption conceptualizes homosexuality in a way that ultimately undermines it. Homosexuality is not conceptualized as a state where a male is attracted to a male or a female to a female. Rather, homosexuality is conceived of as a result of a female part of a male causing his attraction to males and a male part of a female causing her attraction to females. Such a conceptualization, rather than altering heterosexist views about the primacy of heterosexuality, merely reinforces heterosexuality by explaining homosexuality in terms of a deterministic heterosexual model. Essentially, homosexuality disappears insofar as the biological accounts transform it into a version of heterosexuality.

In addition to reinforcing a heterosexist explanatory model for homosexuality, the inversion assumption, along with its necessary background assumptions, serves to reinforce sexist claims. Research organized around the inversion assumption requires the extra assumption, as I argued above, that heterosexuality is a sexually dimorphic biological trait, i.e. male heterosexuals have biological trait X and female heterosexuals have biological trait Y. Since gay men are, for the most part, chromosomal and gonadal males and lesbians are, for the most part, chromosomal and gonadal females, basic sex differences cannot serve as the sexually dimorphic site where inversion takes place.²⁹ Researchers, therefore, must assume biological differences between males and females in addition to basic sex differences. In what follows, I argue that the requirement for a multiplication of sexually dimorphic sites leads to a worrisome erosion of the distinction between sex and gender insofar as gender is naturalized.³⁰ More specifically, I show that the research paradigms assume that heterosexual males and females differ at site X but that this claim is controversial at best.

The first way that the distinction between sex and gender is eroded is through the naturalization of desire. It relegates women's attraction to men and men's attraction to women to the biological sphere. This relegation is crucial to the conception of the research into homosexuality but it does not have firm scientific support. Moreover, many feminists have argued that women's participation in heterosexuality is encouraged and enforced by society, such that it properly belongs to gender. The scientific paradigms, on the other hand, assume heterosexuality to be innate and biological such that participation in heterosexuality is a result of one's sex.³¹ So, not only is heterosexual desire relegated to the biological sphere, it is considered to be a function of one's sex. Part of what it means to be biologically male is to be attracted to females and part of what it means to be biologically female is to be attracted to males.

The second way in which the distinction between sex and gender is eroded is through the general sexing of the body. In order to carry out their research, particular sites of sexual dimorphism in which sexual dimorphism with respect to heterosexuality can reside must be assumed. Assuming that parts of the body not explicitly related to one's sex are sexually dimorphic provides a further basis from which to undermine the distinction between sex and gender. That is, the view of the relation between sex and gender that is supported by the

scientific research is one where the focus shifts from the claim that males and females do not differ in significant ways even though the social meanings attached to being a woman and being a man do differ significantly, to the claim that males and females differ in significant ways and the differences involved in being a man and being a woman at the social level exist because of the underlying biological differences. While it is now suspect to claim that women cannot, for instance, participate in higher level intellectual pursuits because they have a uterus, such claims can be supported by positing sex differences in those bodily sites that conceivably do make a difference in one's abilities.³² The scientific research into the biology of homosexuality is especially troubling because it identifies brain sites as the relevant sexually dimorphic sites; the sites where inversion takes place. This explanation of homosexuality requires that heterosexual males and females differ at these brain sites.

It is not, however, clear that heterosexual males and females do differ at these sites. Through an examination of the use of hormones, the hypothalamus and the corpus callosum in the research paradigms, it will become clear that the required claims about sexual dimorphism in the brain are not supported adequately and at best are controversial claims that require more investigation.

Hormonal research is problematic because it proceeds according to the organizational model, a model which supports a view about male-typical versus female typical brain sites, but, as I will show, the reasons for choosing this model are ideological rather than scientific. Hormonal research into the causes of homosexuality operates according to the prevailing model for studying sexual development in animals. This model, the organizational theory, posits that prenatal hormones serve to masculinize or feminize both the genitals and the brains of developing embryos and that at puberty circulating hormones activate these brain sites.³³ While Fausto-Sterling argues that this model is problematic both for studying animals and for studying humans, research into how prenatal hormones cause homosexuality employs this model.³⁴ Researchers speculate that homosexual men, by being exposed to a more female-typical level of prenatal hormone exposure, develop a more female-typical brain with respect to the site or sites that determine sexual attraction and that lesbians, by being exposed to a more male-typical level of prenatal hormone exposure, develop a more male-typical brain with respect to the site or sites that determine sexual attraction.

This model for studying sexual development reinforces the claim that heterosexual males and females have different brains.³⁵ Claiming that heterosexual males and females have different brains provides the biological basis for attributing social differences between men and women to the biological sphere. The hormonal accounts of the biology of homosexuality assume and require this sexually dimorphic brain difference but researchers do not have decisive reasons for holding this assumption.

It is my view that the choice of the organizational model, the model which supports the existence of sexually dimorphic brain sites, for studying sexual orientation is influenced by ideological rather than by scientific reasons. Consider the following two ways of thinking about how hormones function. On the one hand, it is commonly accepted that the so-called 'male hormones' and the so-called 'female hormones' exist and function in both males and females.³⁶ For instance, both kinds of hormones function in males and females with respect to muscle growth, liver function, etc.³⁷ On the other hand, a sexually dichotomous function, according to the organizational model, is used to explain hormone function at other sites. The question of why research into sexual orientation uses the second rather than the first model is revealing in terms of ideological considerations.³⁸

The first model of hormone function could potentially support a reconceptualization of our beliefs about just what, in the body, is sexed.³⁹ That is, while the organizational model could be used to explain sex differentiation in terms of genitalia, differences between male and female bodies would be isolated and contained in the sex organs rather than generalized to the brain. Scientists, however, organize experiments according to the organizational theory whenever the site under consideration is thought to correspond to and support gender dichotomies. That is, in the general culture and in scientific culture, there is a firm belief that male sex hormones are what make a male a man and female sex hormones are what make a female a woman. This choice of theory is clearly driven by societal assumptions about differences between men and women.

Research into the hormonal causes of homosexuality is driven by the same cultural beliefs. That is, scientists assume that part of what makes a male a man is being sexually attracted to women and part of what makes a female a woman is being sexually attracted to men. Since the model according to which females and male brains are significantly different supports cultural beliefs about the differences

between men and women, this is the model that is chosen for organizing the experiments.

So, while there is a commitment to the idea that male and female hormones function in both males and females at various sites, there is also a commitment to sexually dimorphic functioning at certain other sites. In looking at sites informed by cultural beliefs about gender differences, the latter commitment takes precedence over the former. This predominance, while it is more culturally than scientifically grounded, makes an appearance in the research on sexual orientation. That is, theory choice is influenced by the social concern with maintaining gender divisions by grounding them in the body rather than by any clear indication that hormones influence sexual orientation. By construing the etiology of homosexuality in terms of sexually dimorphic hormone function, the general sexing of the body is reinforced even though such claims are speculative and highly controversial.

Research involving claims about both the hypothalamus and the corpus callosum also serve to reinforce the general sexing of the entire body, yet claims about sex differences in the hypothalamus and the corpus callosum are highly controversial claims. There have been only five studies of the human hypothalamus (including LeVay's) and of these studies three are unreplicated studies from the same research group and two are only partially replicated.⁴⁰ Given that there are so few studies, no definite view of sex differences can be maintained. While research into sex differences in the corpus callosum, on the other hand, is extensive, no consensus has been reached. Fausto-Sterling claims that a review of 34 scientific papers written between 1982 and 1997 reveals that even though researchers used the latest techniques, including MRIs, computerized measurements, and complex statistics, researchers still disagree.⁴¹ Studies about homosexuality and these two areas, however, obscure the inconclusive state of this research. By claiming to show that gay men have brain structures like those of heterosexual women and lesbians have brain structures like those of heterosexual men, they reinforce the idea that differences between heterosexual men and women exist at these sites. Reinforcing these claims, as background requirements for their claims about homosexuals, serves to enforce sex differences in multiple sites and serves to perpetuate the idea that gender differences exist because of differences in the bodies of males and females, yet it has not been shown that such differences between heterosexual males and females really exist.

PART THREE: A CRITIQUE OF A STRATEGY FOR DEFENDING THE RESEARCH

I have been arguing that the current research into the biological basis of homosexuality is problematic because it is organized around the inversion assumption. The inversion assumption is problematic because it reinforces a heterosexist model of sexual attraction and it requires the claim that the brains of heterosexual males and females are, at certain sites, sexually dimorphic. Given the controversial assumptions that operate in the scientific research about the biology of homosexuality, what should be made of the research? In other words, can the research be salvaged from the assumptions it employs? Although the scientific research incorporates a number of assumptions, scientists may attempt to defend their results by claiming that the success of their projects provides a good reason for thinking that the assumptions employed in the framing of the projects are reasonable assumptions. This may be politically unfortunate for those concerned with heterosexism and sexism but it is not scientifically problematic.

It is commonplace in discussions about objectivity in science to make a distinction between the context of discovery and the context of justification. The context of discovery refers to the formulation of a hypothesis and the context of justification refers to the methodology according to which that hypothesis is tested. In debates about whether or not science can achieve objectivity, it is regularly admitted that assumptions, biases, and prejudices operate in the context of discovery. The site of contention in debates about the objectivity of science is the context of justification. Some hold that scientific methodology, if properly followed, is sufficient to eliminate the biases and assumptions that operate in the context of discovery. Others hold that scientific methodology does not adequately purge the results of such subjective factors.⁴² Contemporary biological research into the causes of homosexuality can be usefully analyzed in terms of the question of whether or not the context of justification sufficiently tests and discards or accepts the assumptions that inform the initial formulation of the research projects. While I do not wish, here, to take a stand on whether or not objectivity and value-neutrality is possible in science, I will argue that with respect to this research the assumptions that operate in the context of discovery remain unquestioned even when the results of the research projects provide reasons to suspect their value.

Those who wish to defend the hormonal and structural paradigms of research may claim that while assumptions play a role in the context of discovery, these assumptions are either refuted or given solid grounding through the experimental procedures and interpretive methods that the experimenters use. I contend, however, that these assumptions are not questioned and instead function as assumptions from the inception of the idea to the report of the final results. The inversion assumption, along with the background assumptions of biologically determined heterosexuality and sexual dimorphism, are never tested and thus cannot be either confirmed or refuted. One way to illustrate that these assumptions are taken as firm truths rather than as assumptions to be tested is to look at how results that do not fully support the hypothesis are interpreted. That is, if assumptions are viewed as assumptions, then imperfect research results should prompt a reevaluation of the framing assumptions. If, however, the assumptions are taken as truths that do not require testing, then imperfect findings may prompt questioning about other aspects of the experiment, but not about these assumptions. In general, less than perfect confirmations of the hypotheses in the scientific research on homosexuality have not resulted in a reevaluation of these assumptions and have not prompted subsequent experiments that employ a different set of framing assumptions.

Consider, for instance, the way the results of research into prenatal hormone exposure are evaluated. Studies of CAH girls and girls who were exposed to DES, show that these subjects are more likely than the girls in the control group to experience sexual attraction for women. Although they were more likely to experience such attraction, the *majority* of these subjects did not experience sexual attraction to women.⁴³ This finding, then, does not confirm the hypothesis that prenatal exposure to inverted levels of hormones causes women to become attracted to women. Evaluations of those findings, however, do not include questions about whether the inversion assumption is correct, whether heterosexuality is hard-wired and can serve as a standard, or whether hormones function along clear, sexually dimorphic lines. Instead, questions about the timing of exposure, the degree of exposure, or additional locations, may be explored, but in general no one suggests that the initial assumptions may be mistaken and subsequent researchers do not incorporate such questions into their research by organizing experiments along alternative conceptual lines. In **Queer Science**, LeVay provides a list of reasons why the

majority of CAH girls do not become lesbians. He includes the possibilities that: 1) the timing of increased androgen levels may not coincide with clinical timing for partner preference, 2) androgen levels may not have been high enough, 3) the subjects may not have been followed long enough to determine their sexuality, and 4) prenatal hormone levels may not be the sole determinants of adult sexual orientation.⁴⁴ It is not suggested that these results may come about because sexuality is not hard-wired, because the inversion assumption is incorrect, or because hormones do not influence sexual orientation.

Similar trends in interpreting studies and devising new studies can be found in the treatment of the results from the structural research. In his 1991 **Science** article, LeVay says:

The existence of 'exceptions' in the present sample (that is presumed heterosexual men with small INAH 3 nuclei, and homosexual men with large ones) hints at the possibility that sexual orientation, although an important variable, may not be the sole determinant of INAH3 size. It is also possible, however, that these exceptions are due to technical shortcomings or to misassignment of subjects to their subject groups.⁴⁵

Again, the evaluation does not include serious doubts about the validity of the initial set of assumptions. Gorski and Allen's study of the corpus callosum is evaluated in a similar way. Although the results were not perfect, they claim that they expect to find that the entire brain is inverted in homosexuals.⁴⁶ This clearly shows that they did not consider reevaluating either the claim that this area is sexually dimorphic or that homosexuality results from inversion.

It seems clear, then, that researchers do not take seriously the idea that the inversion assumption and its necessary background assumptions may be mistaken. Individual researchers do not, for the most part, consider reframing experiments using a different set of assumptions, and subsequent studies by other authors do not show a trend toward rethinking these general positions. Rather than testing the background assumptions through the appropriate scientific methods, researchers allow these assumptions to function as truths even when the evidence does not clearly support this conclusion.

CONCLUSION

I have argued that assumptions are incorporated into scientific research about sexual orientation, that these assumptions remain untested, and that this research reinforces both heterosexism and sexism. Put in more general terms, as a number of philosophers of science have claimed, the assumptions operating in the wider culture are incorporated into the scientific paradigms and are returned to the wider culture as scientifically grounded even though they have not been tested. While the position of power that science enjoys is sufficient to facilitate the reentry of these assumptions/facts into the wider culture, this process can be helped or hindered by what others do with the results. In the case of making arguments for gay and lesbian rights on the basis of the scientific research, simply making the arguments helps to smooth the transition of these assumptions back into society. Making the arguments implies consent to the heterosexist and sexist consequences of the research and such consent helps these consequences to function in society, not under the label of heterosexism and sexism, but under the label of facts. This complicity, however unintentional, allows people in the wider culture to hold onto their heterosexist, anti-homosexual, and sexist views under the guise of accepting facts. Alternatively, it allows those who are not homophobic, yet nevertheless have a strong stake in heterosexual and sex-based privilege, a way to accept homosexuality without undermining or encouraging an examination of any of their beliefs about the naturalness of heterosexuality or of sex inequalities. For these reasons, feminists, gays and lesbians should resist the use of such research to support demands for rights.⁴⁷

NOTES

1 For a review of these concerns see: Stein, 1999, p. 305-327.

2 See, for instance: Stein, 1999, p. 202-205; Byne, 1995, p. 306-307; Haumann, 1995, p. 68; Birke, 1986, p. 22-23; Birke, 1982, p. 75. Although the inversion assumption has been widely used in classifying homosexuals since the middle of the nineteenth century, there are many other historical models as well. The inversion assumption is a culturally and historically bounded classificatory mechanism. That is, homosexuality can be and has been conceptualized without reference to the inversion assumption. See: Stein, 1999, p. 204-205.

Examining these models and the advantages and disadvantages of the different models is beyond the scope of this paper. For the history of classificatory models see: Halperin, 2002; Greenberg, 1997; and Terry, 1995a.

3 Other assumptions that appear in the research include: the naturalness of heterosexuality, the appropriateness of biologically deterministic models and the existence of various sites of difference between the sexes. I will show that the inversion assumption relies on several of these assumptions as well but my main focus will be on the problematic way in which homosexuality is conceptualized in this body of research.

4 These categories can be seen as distinct insofar as researchers tend to focus their inquiries on one of these three areas. These categories overlap, however, insofar as explanations at each level are often taken as essential pieces in a larger puzzle. For instance, the different explanations may fit together such that genetics cause hormonal inversions and hormonal inversions cause structural inversions. Sociobiologists are also interested in the biology of homosexuality. Their discussions, however, focus on explaining how homosexuality is compatible with natural selection. Haumann, 1995, p. 26, explains that sociobiological theories focus not on the question of why a particular person becomes a homosexual but on the question of why some individuals become homosexuals. In other words, sociobiologists focus on how homosexuality can be seen as advantageous from the perspective of natural selection. I will not focus on the sociobiological research because it is concerned with a distinct question. Insofar as sociobiologists offer an account of the mechanisms that cause homosexuality, their explanations fit under the category of genetic theories. For discussions of homosexuality from the sociobiological perspective see: Weinrich, 1995, p. 197-213; Levay, 1993; Ruse, 1988, p. 130-149. For critiques of the sociobiological perspective on homosexuality see:

Dickermann, 1995, p. 147-183, and Stein, 1999, p. 179-189. For a general criticism of sociobiology see: Hubbard, 1982, p. 17-46.

5 Many scholars have provided critiques of this research from a methodological perspective. They identify such problems as: problematic definitions of homosexuality, small sample sizes, inappropriate sampling techniques, failure to match control groups for factors such as age and socio-economic status, and unfounded assumptions about the direction of causation being from biology to behavior rather than from behavior to biology. See, for instance: Stein, 1999, p. 191-221; Byne, 1995, p. 308-309; McGuire, 1995; Birke, 1982, p. 76-77.

6 While theories concerning inversions of adult hormone levels have generated some interest, Meyer-Bahlburg reports in his 1995 review that by the time of his 1984 review of the hormonal research the consensus was that there are no significant hormonal differences between adult homosexuals and adult heterosexuals. See: Meyer-Bahlburg, 1995, p.137.

7 A great number of studies have been done involving prenatal hormone manipulation in animals and the studies on humans were shaped around trying to replicate findings involving animals in human subjects. While this research is both important insofar as researchers rely on it and problematic insofar as difficulties attend generalizations from other species to humans, I will focus only on the research involving human subjects. First of all, because the studies involving humans are representative of the conceptual apparatus involved in the animal studies and secondly because any results found on the basis of animal studies, if they are to be taken seriously, must be confirmed using human subjects. In this sense, the human studies are a step closer to being relevant to possible political uses. For a critique of the current model (the organizational model) for studying the sexual development of animals see: Fausto-Sterling, 1995. For critiques of making generalizations from animals to humans see: Byne, 1995, p. 310-312; Birke, 1982, p. 74-77.

8 Meyer-Bahlburg, 1995, p. 140.

9 Meyer-Bahlburg reports that Ehrhardt, Evers, and Money performed the first experiments on CAH subjects in 1968 and described an increase of bisexual and homosexual orientation in these subjects. More recent studies: Money et al., 1984, and Dittman et al., 1992 have replicated the original findings. See: Meyer-Bahlburg, 1995, p. 140.

- 10 Meyer-Bahlburg, 1995, p. 141. Meyer-Bahlburg reports that Masica et al., 1971 found that a sample of subjects with complete androgen insensitivity became erotically attracted to men, but no further investigations have been reported. The possibility that their erotic attraction to men may have been a result of being raised as girls was not tested.
- 11 Meyer-Bahlburg reports that Money and Ogunro 1975 found that subjects raised as boys and subjects raised as girls both became erotically attracted to females and Gooren and Cohen-Kittens 1991 found that subjects raised as girls often undergo a gender change and live as men. See: Meyer-Bahlburg, 1995, p. 141.
- 12 Meyer-Bahlburg reports that Imperato-McGinley et al., 1974, found that these subjects develop an attraction to females and adopt a male gender role, but no replication studies have been reported. See: Meyer-Bahlburg, 1995, p.141.
- 13 Meyer-Bahlburg, 1984 reported an increase in bisexuality in women who were prenatally exposed to DES. See: Meyer-Bahlburg, 1995, p. 143.
- 14 Meyer-Bahlburg, 1995, p. 143.
- 15 Meyer-Bahlburg reports that Dorner, 1988 and Dorner and Docke, 1987 reported an LH response to estrogen in transsexual and gay men. See: Meyer-Bahlburg, 1995, p. 143.
- 16 Because 'partial inversion is a possibility, these studies would be compatible not only with binary notions of sexuality but although with continuum models.
- 17 For a review of studies of the hypothalamus see: Swaab, Gooren, and Hofman, 1995.
- 18 LeVay, 1991.
- 19 Gorski and Allen, 1992.
- 20 Byne directs readers to: McCormack & Whitelson, 1991 and Willmott & Brierley, 1984. Byne also provides a review of articles on handedness and brain lateralization with respect to homosexuality. See: Byne, 1995, p. 315-317.
- 21 Pattatucci and Hamer explain that Kallmann found the first patterns of concordance in his early twin studies. Subsequent studies by Bailey and Pillard and their research groups, while finding less than the original concordance rates, have found significant concordance rates for sexual orientation. See: Pattatucci and Hamer, 1995, p. 156-158. For the specific studies Pattatucci and Hamer refer readers to: Kallman, 1952a; Kallmann, 1952b; Pillard and Weinrich, 1986; Pillard, Poumadere and Carretta, 1981; Bailey and Benishay, 1993; Buhrich, Bailey and Martin, 1991; Bailey and Pillard, 1991; Bailey, Pillard, Neale and Agyei, 1993.
- 22 Pattatucci and Hamer, 1995, p. 161-168.
- 23 For instance, Buhrich et al., 1991 and Bailey et. al., 1991 try retrospectively to confirm the presence of childhood gender non-conformity, i.e. inverted gender roles, as a way further to validate the claim that such 'sissy boys' and 'tom-boy girls' were genetically determined to become homosexuals. Taking such gender non-conformity as evidence for their genetic theories is an obvious incorporation of the inversion assumption into their conceptualization of homosexuality. Furthermore, McWhorter points out that Hamer, in considering homosexuality and genetics from the sociobiological view, speculates that perhaps the 'gay gene' caused only effeminacy, rather than attraction to men, in some males so that their genes would still be passed on. This speculation indicates that Hamer views the genetics of homosexuality as being tied up with the inversion assumption. See: McWhorter, 1999, p. 133.
- 24 See note 3 above for some of those problems.
- 25 Assuming that there is a standard state implies that homosexuality is an abnormal or deviant state. Commentators on the research, such as Byne, 1995; and Birke, 1982, p. 22 identify this as an assumption that operates in the research.
- 26 This state could consist of one isolated site or it could consist of a group of sites.
- 27 While this may appear to support a finding about bisexuality, it is a somewhat different point. That is, if the biological state that supports heterosexuality is not deterministic, then researchers have only the potential to find that all people are bisexual and this is clearly not their aim in employing the inversion assumption. Bisexuality presents a rather difficult problem for

research that involves the inversion assumption. While some researchers report that subjects experience bisexual attraction, it is difficult to understand what kind of explanation they can give for this. For, given the inversion assumption, bisexual people should have both the typical trait for their sex and the inverted trait. For instance, they should have experienced both typical and atypical hormone exposure or they should have both a large and a small hypothalamus. Researchers do not, however, address these conceptual problems. Most often, bisexuals are grouped together with homosexuals.

28 See Rich, 1980.

29 The work of feminist scientists such as Fausto-Sterling has problematized the claim that sex itself is a dimorphic trait. That is, Fausto-Sterling has challenged the claim that people are divisible into two sex groups, male and female. Instead, she argues that sex itself is a socially and scientifically managed dichotomy which, rather than occurring naturally, is constructed. My point, in the present section, is that even if researchers assume that sex is a naturally occurring dichotomy, this dichotomy is not enough to ground inversion claims. See: Fausto-Sterling, 2000.

30 Some feminists have questioned the distinction between sex and gender on the grounds that claims about sex, especially when grounded in biomedical discourse, incorporate gender claims and read them onto the body. See, for instance, Fausto-Sterling, 2000; Wijngaard, 1997; Birke, 1986; Fausto-Sterling, 1985. For a discussion of how gender claims are inappropriately read into nature at the molecular level see: Spanier, 1991. The feminist project of questioning the distinction between sex and gender is significantly different than the erosion that takes place in the biological research. Feminist scholars point out that sex is really gendered, while the researchers concerned with sex differences want to claim that gender is really grounded in sex.

31 Birke argues that, not only is heterosexuality naturalized, women are relegated to the passive position and men are granted the active position. That is, cultural assumptions about the passive nature of women and the active nature of men are read into the biological realm so that any elements construed as active are called masculine and any elements construed as passive are called feminine. For instance, if a lesbian is intelligent and likes to play sports, these elements are called masculine. See: Birke, 1986, p. 70-72.

32 The general form does not require a view about the particular site involved. The specific form requires a particular site. Byne explains that in order for the inversion assumption to work, "...the brains of heterosexual men and women must differ with regard to the observed parameters, though the required sex differences have not been conclusively demonstrated" (Byne 1995, p. 306).

33 Fausto-Sterling, 2000, p. 195-232; Van Den Wijngaard, 1997, p. 4-6; Fausto-Sterling, 1995.

34 Fausto-Sterling provides an account of accumulating evidence that points to the need significantly to modify the original premise both for understanding rodent and human behavior. The modifications, she argues, are sufficiently extensive to require a replacement of this theory with a theory that takes into account the roles learning and experience play in developing behaviors. See: Fausto-Sterling, 1995.

35 Van Den Wijngaard argues that the move to sexing the brain occurred in order to provide support for existing gender differences that were coming under question from feminists. See: Van Den Wijngaard, 1997, p. 4-6.

36 For the developments in endocrinology that led to this conceptualization see: Oudshoorn, 1994.

37 Fausto-Sterling, 2000.

38 My point, here, is not to suggest that all hormone functioning should be explained according to one model. My point is that the choice of models to investigate certain sites is ideologically influenced.

39 Oudshoorn, 1994, p. 145.

40 Fausto-Sterling, 1985, p. 246-247.

41 Fausto-Sterling, 2000, p. 126. For a further review of the research on the corpus callosum see: Byne, 1995, p. 320-326.

42 Various feminist scholars have entered into these debates. Sandra Harding proposes that feminist critiques of objectivity in science can be organized

into three categories: feminist empiricism, standpoint epistemologies, and feminist postmodernism. Feminist empiricists and standpoint theorists both agree that objectivity in science is possible. The empiricists, however, hold that following scientific methodology is sufficient to generate that objectivity while the latter require that certain standpoints, including the standpoints of women, be privileged. Feminist postmodernists, on the other hand, hold that objectivity is not possible. See: Harding, 1986.

43 See: Dittman et al., 1992; Zucker et. al., 1992; Meyer-Bahlburg, 1984; and Money et al., 1984.

44 LeVay, 1996, p. 123.

45 LeVay, 1991, p. 1035.

46 Gorski and Allen, 1992.

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