Is Homosexuality Genetic?

The Gay Gene?

By Jeffrey Satinover, M.D.

[The following article was reprinted in our Jesus People Newsletter, Vol. 27 issue 1. If you want to receive a free newsletter write us.]

On July 15, 1993 National Public Radio (NPR) made a dramatic announcement on stations across the country: Was a team of scientists at the National Institutes of Health on the trail of a gene that causes homosexuality? Their report would be published the next day in *Science*, one of the two most prestigious scientific research journals in the world.[1]

The discussion that followed explained for the listening public the implications of these findings for social attitudes toward homosexuality and for public policy concerning it. Science was on the verge of proving what many had long argued: that homosexuality in innate, genetic and therefore unchangeable—a normal and commonplace variant of human nature. In the light of these findings, surely only the bigoted or ignorant could condemn it in any way.

Shortly after the announcement, amidst a well-orchestrated blizzard of press discussions, there ensued the watershed legal battle over "Proposition 2" in Colorado. (This popularly enacted legislation precluded making sexual orientation the basis of "privileged class" minority status, a status conferred previously only on the basis of immutable factors such as race.)

Among the many crucial issues raised by the legislation was the question as to whether homosexuality was indeed normal, innate and unchangeable. One prominent researcher testified to the court, "I am 99.5% certain that homosexuality is genetic." But this personal opinion was widely misunderstood as "homosexuality is 99.5% genetic," implying that research had demonstrated this. Certainly, that was the message promulgated by NPR's report on the recent research, and by all the discussions that followed. In a few weeks, *Newsweek* would emblazon across its cover the phrase that would stick in the public mind as the final truth about homosexuality: "Gay Gene?"

Of course, just near the end of the NPR discussion, certain necessary caveats were fleetingly added. But only an expert knew what they meant—that the research actually showed nothing whatever in the way of what was being discussed. The vast majority of listeners would think that homosexuality had been all but conclusively proven to be "genetic." But the real question is whether or not there is such a "gay gene."

In fact, there is not, and the research being promoted as proving that there is provides no supporting evidence. How can this be? In order to understand what is really going on, one needs to understand some little-known features of the emerging study of *behavioral genetics* (much subtler than the genetics of simple, "Mendelian" traits such as eye color).

When it comes to questions of the genetics of any behavior—homosexuality included—all of the following statements are likely to be at least roughly true:

1. Such and such a behavior "is genetic",
2. There are no genes that produce the behavior;
3. The genes associated with the behavior are found on such and such a chromosome;
4. The behavior is significantly heritable;
5. The behavior is not inherited.

The scientific distinctions that make these seeming contradictions perfectly reasonable and consistent seem completely misunderstood by the media who report on them.

For Example, in response to the "gay gene" research, the *Wall Street Journal* headlined their report (which appeared the next day), "Research Points Toward a Gay Gene."[2] A subheading of the *Journal* article stated, "Normal Variation"—Leaving the casual reader with the impression that the research lead to this conclusion.

It did not, nor could it have. The subhead alluded to nothing more than the chief researcher's personal, unsubstantiated *opinion* that homosexuality, as he put it, "is a normal variant of human behavior." Even the New York Times, in its more moderate front-page article, "Report Suggests Homosexuality is Linked to Genes," noted that other researchers warned against over-interpreting the work, "or taking it to mean anything as simplistic as that the 'gay gene' had been found."

At the end of the *Wall Street Journal* article, at the bottom of the last paragraph on the last page deep within the paper, a prominent geneticist was quoted for his reactions to the research. He observed that "the gene…maybe involved in something other than sexual behavior. *For example, it may be that the supposed gene is only 'associated' with homosexuality, rather than a 'cause' of it."*

This rather cryptic comment would be most difficult to understand without the needed scientific background. Yet it is the most critical distinction in the entire article; indeed, it renders the findings almost entirely worthless. Why bury and fail to explain what it means? Perhaps the motives were innocent, but in fact, the belief that homosexuality is "biological" or "genetic" causes people to develop more positive attitudes toward it. They need not have the foggiest understanding that what "biological" or "genetic" really mean in order to change their view:

> 105 volunteer[s]…were exposed to one of three…conditions…[T]he experimental group read a summary…emphasizing a biological component of homosexual orientation….[O]ne control group read a summary…focusing on the absence of hormonal differences between homosexual and heterosexual men. [A]nother control group w[as] not exposed to either article….As predicted, subjects in the experimental group had significant lower[3] scores [more positive attitudes toward homosexuals] than subjects in the control groups.[4]

And:

> Analysis indicated that subjects who believed that homosexuals are "born that way" held significantly more positive attitudes toward homosexuals than subjects who believed that homosexuals "choose to be that way" and/or "learn to be that way."[5]

What was actually going in the study the media was trumpeting? Dean Hamer and his colleagues had performed a kind of behavioral genetics study now becoming widespread—the so-called "linkage study." Researchers identify a behavioral trait that runs in a family and then look to see whether there is a chromosomal variant in the genetic material of that family, and if that variant is more frequent in the family members who have the trait.

To the uninitiated, a positive finding ("correlation" or "association" of a genetic structure with a behavioral trait) is taken to mean that the trait "is genetic"—that is, *inherited*.

In fact, it means absolutely nothing of the sort, and it should be emphasized that there is virtually no human trait without innumerable such correlations. We will see shortly just how this is can be so. The most important take-home messages will be these:

(1) All the research that has been done on homosexuality has been selectively trumpeted through the press in carefully crafted form in order to shape public opinion—hence public policy—in predictable ways. The research itself means almost nothing.

(2) The research projects that would *truly* mean something are scarcely being done because they would all explicitly or tacitly lead to but one end highly undesirable to activists: a method or methods for preventing homosexuality or changing it with ever-increasing efficacy; and to one conclusion: homosexuality per se is not inherited.

(3) Most of the research has been hastily and often sloppily done—but this point is a distraction. Even were it superb, the findings would still mean almost nothing.

(4) To whatever extent this research has been good enough to generate valid conclusions at all, these conclusions are precisely the opposite of what is claimed in the press.

Before we talk about specifics, here is what serious scientists think about the recent behavior-caused-by-genes research. From *Science*, 1994:

> Time and time again, scientists have claimed that particular genes or chromosomal regions are associated with behavioral traits, only to withdraw their findings when they were not replicated. "Unfortunately," says Yale's [Dr. Joel] Gelernter, "it's hard to come up with many" findings linking specific genes to complex human behaviors that have been replicated. "…All were announced with great fanfare; all were greeted unskeptically in the popular press; all are now in disrepute."[6]
>
> A scientist at Washington University School of Medicine calculated what would be required for such a replication. He:
>
> …projected that if the trait [in question] was 50% heritable…detecting [just] one of [its] genes would require studying 175 families—that is, almost 2000 people.[7] Replicati[on] would require studying 781 families—another 8000 people….[E]ach additional gene (for a polygenic trait), researchers would need…the whole business again. "Suddenly you're talking about tens of thousands of people and years of work and millions of dollars."[8]

Nothing even remotely close to this has been done with respect to homosexuality.

Using arguable-at-best methods, two American activists recently published studies showing that if one of a pair of identical twins is homosexual, the odds that the other one is, too, are less than 50% (the study examined a few dozens of pairs). On this basis, they argue that "homosexuality is genetic." British researchers generated comparable results in a similar study. Their conclusion? The surprisingly low odds that both twins were homosexual:

> …confirmed that genetic factors are insufficient explanation for the development of sexual orientation.[9]

Two Columbia University researchers (who have published the most comprehensive research summary on the subject to date) note the unexpectedly:

> …large proportion of monozygotic twins who [did not share] homosexuality despite sharing not only their genes but also their prenatal and familial environments.[10] The…[50% odds]…for homosexuality among the identical twins could be entirely accounted for by the increased similarity of their developmental experiences. In our opinion, the major finding of that study is that 48 percent of identical twins who were reared together [and where at least one was homosexual] were discordant for sexual orientation.[11]
>
> Two other genetics researchers (one heads one of the largest genetics departments in the country, the other is at Harvard) comment:
>
> …recent studies seeking a genetic basis for homosexuality suggest that…we may be in for a new molecular phrenology, rather than true scientific progress and insight into behavior.
>
> While the authors interpreted their findings as evidence for a genetic basis for homosexuality, we think that the data in fact proved strong evidence for the influence of the environment.[12]
>
> The author of the lead article on genes and behavior in a special issue of *Science* notes:
>
> …the growing understanding that the interaction of genes and environment is much more complicated than the simple "violence genes" and "intelligence genes" touted in the popular press. Indeed, *renewed appreciation of environmental factors is one of the chief effects of the increased belief in genetics' effects on behavior* [my emphasis]. The same data that show the effects of genes also point to the enormous influence of non-genetic factors.[13]

The director of the Center for Developmental and Health Genetics at Pennsylvania State University comments:

> Research into heritability is the best demonstration I know of the importance of the environment.

(Note the term "heritability;" we will be returning to it in detail as it lies at the heart of much confusion).

With regard to the work announced by NPR, genetics researchers from Yale, Columbia and Louisiana State Universities noted that:

> Much of the discussion of this finding [of a purported gene locus homosexuality] has focused on its social and political ramifications. [But] inconsistencies…suggest that this finding should be interpreted cautiously…
>
> The results are not consistent with any genetic model….neither of these differences [between homosexuality in maternal versus paternal uncles or cousins] is statistically significant…small sample sizes make these data compatible with a range for…hypotheses.
>
> [T]he…data…present no consistent support for the…results.[14]

By contrast to their public policy statements, the researchers responded carefully as follows:

> We did not say that [the chromosome segment under study] "underlies" sexuality, only that it contributes to it in some families. Nor have we said that [it] represents a "major" gene, only that its influence is statistically detectable in the population that we studied.[15]

Ignoring possible flaws in the research, have the researchers actually pointed to this more modest claim with any degree of certainty? In fact, they have not—as they themselves acknowledge, but in language that will surely evade general understanding—and that will continue to be avoided by the press:

> …the question of the appropriate significance level to apply to a non-Mendelian trait such as sexual orientation is problematic.[16]

English translation: "It is not possible to know what the findings mean, if anything, since sexual orientation cannot possibly be inherited the way eye-color is." Thus, to their fellow scientists, the researchers properly acknowledge what every serious researcher knows, but the public does not.

> Complex behavioral traits are the product of multiple genetic and environmental antecedents, with 'environment' meaning not only the social environment but also such factors as the 'flux of hormones during development, whether you were lying on your right or left side in the womb and a whole parade of other things'…the relationships among genes and environment probably have a somewhat different effect on someone in Salt Lake City than if that person were growing up in New York City.[17]

English translation: "You're more likely to become gay growing up in Manhattan than in Utah among Mormons and Christian fundamentalists, even if everything else is the same, including genes."

Unfortunately, anyone who is so disposed can readily offer the public partial truths which are seriously misleading. This is so only in part because of an easily led or poorly educated press. The major reason is really that the ideas being cooked beyond recognition once they leave the labs are inherently complex, even if originally formulated and presented properly. There are no "lite," sound-bite versions of behavioral genetics that are not fundamentally in error in one way or another.

Nonetheless, if one grasps at least some of the basics, in simple form, it will be possible to see exactly why the current research into homosexuality means so little—and will continue to mean little even should the quality of the research methods improve—so long as it remains driven by political, rather than scientific objectives.

There are really only two major principles that need to be carefully assimilated in order to see through public relations distortions to the actual meaning of recent research. They are as follows:

1. *Heritable* does not mean inherited.
2. Meaningful genetics research identifies and then focuses on traits that *are* directly *inherited*. One prominent genetics research (discussing a matter unrelated to homosexuality, but equally frustrated with the bad science reporting) flatly calls the question of heritability "trivial".

Heritable Does Not Mean Inherited

Heritability studies can be done on almost any human trait—physical, behavioral, emotional, etc.—and will show positive results. That is, almost every human characteristic you can think of is in significant measure *heritable* (thus discussing it is 'trivial"). But few human behavioral traits are directly inherited the way simple physiological traits are (e.g., eye color). *Inherited* means "determined directly by genes," with little or no way of changing the trait by choice, or by preventing it, or by modifying the environment in which the trait has emerged (or is more likely to emerge).

Here is a simple hypothetical example, but it is 100% plausible. It tracks the kinds of studies that have been done with innumerable other traits, including homosexuality. (But only in the area of homosexuality has the meaning of such studies been so badly distorted).

Suppose that for political reasons you want to demonstrate that there is a "basketball gene" that "makes" people become basketball players ("BBPs"). (Please suspend your immediate, correct understanding that the idea is absurd.) To make your case you would use the same methods as with homosexuality. These methods fall into three categories, and represent important forms of preliminary research when investigating any trait: (1) twin studies; (2) brain dissections; (3) gene 'linkage" studies.

Twin Studies

The basic idea in twin studies is to show that the more genetically similar are two people, the more likely it is that they will share the trait you are studying. So, you create a study set of pairs of people, divided into categories according to how genetically similar they are, as follows:

Pair Type	*Degree of similarity (% same genes)*
Identical Twins	100%
Fraternal Twins	60%
Non-Twin Siblings	50%
Unrelated People	<5%

The most similar are identical twins, the next most similar are fraternal twins (who are on average as different as non-twin brothers or sisters, but no more so), the least similar are unrelated people.

Then you identify those pairs of twins in which at least one is a BBP. It will not be difficult to show that if one such identical twin is a BBP, his brother (or his sister) more frequently will be, too, than would a non-identical twin or a non-twin sibling or a non-sibling. You would create groups of such different kinds of pairs to make the comparison in a large number of cases. (One set of identical twin pairs, one set of non-identical twin pairs, one set of non-twin siblings, and so on.)

From the "concordance rate" in each set (the percentage of pairs in each set in which either both are BBPs or both are not. Pairs in which one was and the other was not would be called "discordant for BBP") you would calculate a "heritability" rate. (Perhaps you have an armchair guess as to how many identical twin-pairs either *both* play or *both* do not play basketball. Probably a good deal more than half, the concordance rate for homosexuality in such twin-pairs.)

You respond to the reporter from *Sports Illustrations* that, "Our research demonstrates that BBP is very strongly heritable," and you would be right. But the article that comes out that month reads something slightly different, but completely wrong. "…Recent research shows that BBP is probably inherited. A

number of outside researchers examined the work and found it substantially accurate and well-performed. They cautioned against arriving at hasty conclusions, however," No one notices the difference.

Brain Dissections

Second, your colleagues perform a series of autopsies on the brains of some dead people who appear to have been BBPs. (Old jerseys, high-top sneakers and Knicks ticket-stubs were found among their possessions, for example.) They do the same with a group of dead non-players (no sneakers, jerseys or tickets.) They report that, on average, "certain parts of the brain long thought to be involved with BBP are much larger in the group of BBPs than in the controls." Certain national renowned newspapers in the Northeast pick up on the story and editorialize, "It will be very difficult for anyone except poorly educated yokels who believe in Santa Claus, the Tooth-Fairy and God to argue that BBP is not inborn. For not only has it been proven to run in families, even the *brains* of basketball players are different."[18]

In a pretense of balance, some of these papers interview diehard believers in the old view—yokels who still think that one must decide to play basketball, and play it for a long time, before you really can be considered "a BBP." One of them is quoted as claiming that, "maybe if you do something long enough your brain changes as you get better at it, and that part of the brain gets bigger." (Remarkably enough, this surmise seems obvious to the old-time believer.) The reporter does not merely report the comment, however, he also hints that it is especially idiotic—typical of diehards and yokels—since everyone knows the brain does not change.

Of course, you yourself are well aware that among neuroscientists it is extremely old news that the brain indeed changes, quite dramatically, in just the way the old diehard guessed: those parts responsible for an activity get much bigger over time (and there are definitely parts that are more utilized in BBP). You will not lie about it if asked (since you will not be), but neither will you go out of your way to confirm the truth.

Gene "Linkage" Studies

Now for the coup de grâce. You find a couple of families of BBPs and compare them to some families of non BBPs. You have a hunch that of innumerable genes of every imaginable sort likely to be "associated" or "linked" to BBP (you never use the word "causing" because you do not need to—no one knows the difference), there are some genes on, say the X-Chromosome. After a few false starts, sure enough, you find what you are looking for: among the BBP families one particular chromosomal variant (cluster of genes) is more commonly found (though not always) than among the non-players.

Now, sympathizers at National People's Radio were long ago quietly informed of your research, since they want people to come around to certain beliefs, too. So, as soon as your work hits the press, they are on the air: "Researchers are hot on the trail of the 'Basketball Gene!' In an article to be published tomorrow in *Sports Science*…" Learned-sounding commentators pontificate in soft, accentless, perfectly articulated and faintly condescending tones about the enormous public policy implications of this superb piece of science-in-the-service-of-humankind. Two weeks later, there it is again, at a jaunty angle across the cover of the major national newsweekly: "Basketball Gene."

Now what is wrong with this scenario? It is simple: of course BBP is *heritable* ("has a non-zero *heritability*" to use the words of homosexuality researchers). That is because many physiological traits—muscle strength, speed, agility, reflex speed, height, etc.—are themselves directly *inherited*, and they make it more or less likely that one can, and will want to, and will successfully, and will therefore continue to want to, and will in fact continue to, play basketball. In short, because of intermediate *inherited* traits *associated* with BBP (none of which *are* BBP), it shows significant *heritability*. (The genetic *association*, of course, is in no way necessary or predetermined, and is highly culturally conditioned: there were no BBPs at all in, say, ancient Greece, yet the same genes were there.)

BBP also shows a strong *biological representation in the brain*, both at birth (i.e., nervous system factors contributing to reflex speed) and especially later (e.g., the parts of the cortex that are cultivated and become responsible for the movements of basketball, as in the huge increases in finger-related brain tissue among blind people who learn Braille).

And the specific genes that run in families that are responsible for height, athleticism, etc. can surely be found and they will be statistically linked to BBP. And if one identical twin decides to play basketball, the unusually strong emotional bond between such siblings will make it even more likely that his twin will too. (The fact of their genetic identity, not their specific genes, are here influencing an outcome above and beyond the indirect contributions from any specific genes.)

The basic problem is this: BBP is "influenced" (made more or less an easy and enjoyable thing to do) by the presence or absence of other associated traits. For BBP we can readily guess what they are and so immediately see that the "genetic" component of BBP has nothing to do with the game itself but with these associated (facilitating) traits. What are these traits? Height, athleticism, bone structure, reflexes, muscle refresh rate, and so on. So evident are the specifics of this association that no serious researcher will waste his time looking into the genetics of BBP proper; he will concentrate on the obvious intermediate traits—height, athleticism and so on.

The same is true for homosexuality, except (a) the more important, intermediate traits with which it is associated are mostly unknown and suspected ones are harder to confirm, and (b) the research agenda is being distorted by the political requirement that no such associated traits be discovered and that homosexuality be falsely presented as directly inherited.

Meaningful Genetics Research Identifies and Focuses on Traits That Are Directly Inherited

Research into merely *heritable* traits is useful only in generating hypotheses about what the directly inherited traits might be. Here is what this means: Let us imagine that it was not immediately evident to us that the heritable aspects of BBP were intermediate traits such as height. A good researcher would not be at all tempted to conclude from the studies we described that BBP itself was inherited. He would conclude however that, indeed, there must be some inherited traits that facilitate BBP, and it would be those as-yet-unknown traits that were producing the "non-zero heritability" results. If he could identify the traits correctly, *he would find that the heritability results, when he redirected his genetics research, would increase dramatically.*

In other words, studying the genetics of BBP is really a crude way of unwittingly studying the genetics of height and athleticism, etc. If he selects his population on the basis of the indirect trait (BBP), when it is other traits that are really inherited, the researcher's results will be "fuzzed up" by the inevitable proportion of BBPs who lack these traits, or have them in lesser degree (e.g., a small number of shortish BBPs). But if he correctly identifies the traits in question, his next round of studies will "divide the herd" more efficiently, corralling his subjects not by BBP (or "sexual orientation"), but by height. Of course, there will be more BBPs among the tall subjects than among the short, but that is incidental. He will seek out other tall people who are not BBPs, and in his new study, the heritability factor (height) will be even more concentrated.

How might he guess at what the most important traits are, and then try to confirm his guess, so he could investigate the genetics of these traits? Very simply: he looks, does the best he can to name what he sees, and tries not to run afoul of the currently fashionable taboos enforced by the thought-police! He will probably have no trouble studying height, but he might run into difficulties should he suspect that athleticism (or even height) has a racial association. (More people of Nordic stock, being taller, become basketball players than do people of Appenzeller Swiss stock, being short. Perhaps other such groupings might occur to a researcher.)

In the case of homosexuality, the *inherited* traits that are more common among homosexuals (and that produce "non-zero *heritability"* in studies) might include such qualities as greater than average tendency to anxiety, shyness, sensitivity, intelligence, aesthetic abilities and so on. (Of course, these traits may themselves be further reducible to a variety of mutually influencing, associated genetic and non-genetic factors.) The brain changes that are more prevalent among homosexuals, the tendency of homosexuality to run in families (and to vary with degree of genetic similarity within families) and the presence of associated chromosomal markings are all certainly due to as yet unresearched and therefore not-yet-identified intermediate traits. There is *no* evidence that homosexuality itself is inherited.

Like height and BBP, these traits—intelligence, say, or anxiety—are surely widely distributed in the population at large and densely present therefore in groups that are properly selected to have them. If researchers had divided their populations by shyness or aesthetic sensibility, and ignored the homosexual/non-homosexual division, they might well have found even strong chromosomal linkages as well as brain changes and twin concordance rates.

Conclusion

Here, then is a final summary, in the form of a dialogue.

Isn't homosexuality heritable?
Yes, significantly.

So it is inherited?
No, it is not.

I'm confused. Isn't there a "genetic component" to homosexuality?
Yes, but "component" is just a loose way of indicating genetic associations and linkages. This will not make sense unless you understand what, and how little, "linkage" and "association" really means.

What about all the evidence that shows that homosexuality "is genetic"?
There is not any, and none of the research itself claims there is; only the press and, sadly, certain researchers do—when speaking in sound bites to the public.

But isn't homosexuality "biologically in the brain"?
Of course it is. So is just about everything else. I'll bet people who pray regularly have certain enlarged portions of their brains!

So doesn't that mean that homosexuality is "innate"?
No more than prayer is. The brain changes with use or nonuse as much as muscles do—a good deal more, in fact. We just do not usually see it happening.

But doesn't homosexuality run in families?
Yes.

So you get it from your parents, right?
You get viruses from your parents, too, and some bad habits. Not everything that is familial is innate or genetic.

But it just seems to make sense. From the people I know there's a type—it's got to be inherited—that runs in families and a lot of these people are gay, right?
That is what associated traits are—but what exactly is the associated trait—or traits—you are detecting? If there is one thing the research confirms, it is that it is not "gayness" itself. That is why these traits are sometimes in evidence at a very early age, long before sexuality is shaped.

So what are these traits?
An important question, indeed. Science is being seriously obstructed in its effort to answer that questions. If we were allowed—encouraged—to answer it, we would soon develop better ideas on what homosexuality is and how to change, or better, prevent it. We would know who was at greater risk for becoming homosexual and what environments—family or societal—foster it. As one prominent gay activist researcher implied, all genetic things being equal, it is a whole lot easier to become "gay" in New York than in Utah. So who do you think would benefit most from *that* kind of research?

Well, what traits do you guess are "associated" as you put it, with homosexuality?

May I speculate, perhaps wildly? That is how scientific hypotheses are first generated. The important thing is not to avoid ideas that prove wrong, just not to cling to them if they do.

Okay, go ahead, speculate.

Intelligence, anxiety, sensitivity, aesthetic abilities, taste. You know all the stereotypes.

But where do these traits come from? Aren't they inherited?

We do not know yet. Some may be. Or rather, we do not know how much is inherited, and which elements are direct and which merely further associated and linked with other yet more fundamental traits. But you are getting the picture. That is how the research ought to proceed. It is not necessarily that the traits that facilitate homosexuality are themselves bad; perhaps many are gifts. Athleticism is a generally good thing, and we think highly of people who satisfy their athletic impulses as, say, outstanding BBPs. Not so the fellow who merely becomes a thug.

Jeffery B. Satinover, M.D. has practiced psychoanalysis for more than nineteen years, and psychiatry for more than ten. He is a former Fellow in Psychiatry and Child Psychiatry at Yale University, a past president of the C.G. Jung Foundation, and a former William James Lecturer in Psychology and Religion at Harvard University. He holds degrees from MIT, the University of Texas, and Harvard University. He is the author of *Homosexuality and the Politics of Truth* (Baker Books, 1996).

***Endnotes*:**

[1] D.H. Hammer et al, "A Linkage Between DNA Markers on the X-chromosome and Male Sexual Orientation," *Science* (1993), 261, no. 5119, pp. 321-27.

[2] "Research Points Toward A Gay Gene," *Wall Street Journal*, 16 July 1993.

[3] A lower score on this scale means a less negative attitude toward homosexuality.

[4] Piskur and Degelman, "Attitudes Toward Homosexuals," *Psychological Reports* 71 (1992); my emphasis, pp. 1219-25 (part 2 of 3). See also K.E. Ernulf, "Cross-National Analysis."

[5] K.E. Ernulf, S.M. Innala, and F.L. Whitman, "Biological Explanation, Psychological Explanation, and Tolerance of Homosexuals: A Cross-National Analysis of Beliefs and Attitudes," *Psychological Reports* 65 (1989), pp. 1003-10 (1 of 3).

[6] Mann, C., "Genes and Behavior," *Science* 264:1687 (1994).

[7] None of the studies of the genetics of homosexuality (all of which are initial; none are replicatory) have come even remotely close to studying this many subjects.

[8] Mann, C., *op.cit.* p. 1688.

[9] King, M and McDonald, E., "Homosexuals who are twins: a study of 46 probands," *British Journal of Psychiatry* 160:407-409 (1992)

[10] Byne, W. and Parson, B., "Human sexual orientation: the biologic theories reappraised," *Archives of General Psychiatry*. 50, 3:230 (1993).

[11] Quoted by Horgan, J., *Scientific American*: Eugenics Revisited. June 1993, p. 123.

[12] Billings, P. and Beckwith, J. *Technology Review*, July, 1993. p. 60.

[13] Mann, C. *op. cit*. pp. 1686-1689.

[14] Risch, N., Squires-Wheeler, E., and Bronya, J.B.K., "Make Sexual Orientation and Genetic Evidence," *Science* 262 (1993), pp. 2063-65.

[15] Hamer, D.H., et al. Response to Risch, N. et al. *ibid*. p. 2065

[16] Hamer, D.H., et al. Response to Risch, N. et al. *loc cit*.

[17] Mann, C., *op. cit*. p. 1687

[18] Readers may recall Simon LeVay's much touted discovery that the certain parts of the brains of (supposedly) homosexual men were larger than among (supposedly) heterosexual men. But even if the research is valid—its quality has been strongly criticized—the discovery of brain differences per se is on a par with the discovery that athletes have bigger muscles than non-athletes. For though a genetic tendency toward larger muscles may make it

easier to—and therefore more likely that one will—become an athlete, becoming an athlete will certainly give one bigger muscles.

When this particular critique was raised, the press quickly took its accustomed potshot at the usual "poorly educated and easily led" religious groups for the suggestions' politically incorrect implications: "Some religious fundamentalists even suggested that homosexual activity somehow could have caused the structural differences [that LeVay claimed to have discovered]."

But as the editor of Nature—an equally prestigious publication—wrote, commenting on the LeVay research: "Plainly, the neural correlates of genetically determined gender are plastic at a sufficiently early stage….Plastic structures in the hypothalamus allowing the consequences of early sexual arousal to be made permanent might suit [those who claim an environmental origin to homosexuality] well." This editor is not, to anyone's knowledge, a religious fundamentalist.

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