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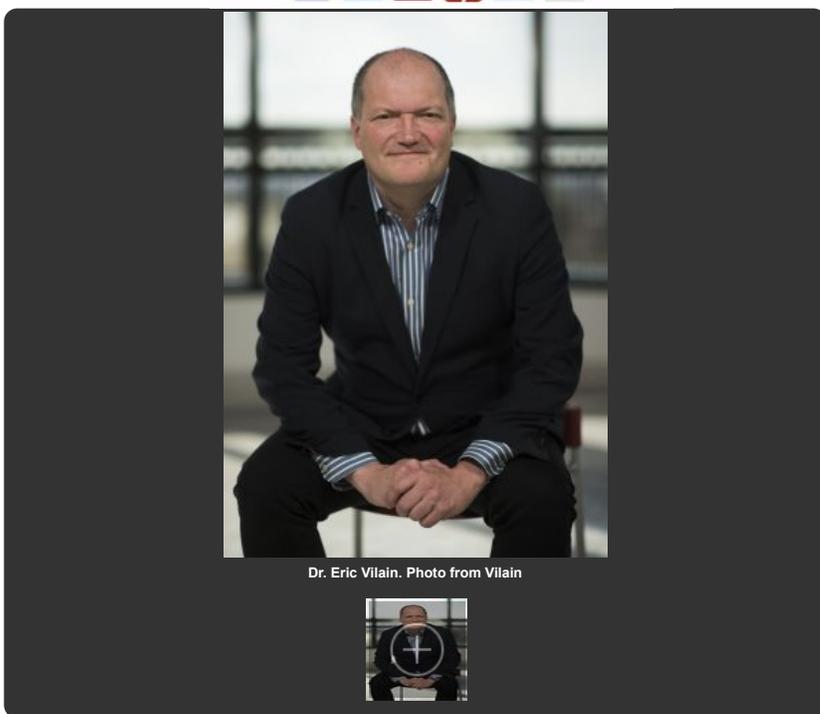
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WINDY CITY TIMES

Gender identity, sexual orientation, genetics boundaries researched
Special to the online edition of Windy City Times
by A. J. Smuskiewicz
2017-02-21



Although some "macho men" may not want to admit it, each person is a mix of male and female.

Men have some estrogen circulating through their bodies, and women have some testosterone in theirs. And although there are stereotypical male and female behavior patterns, these too cross gender lines to produce a broad spectrum of personalities. Transgender people totally erase the neatly drawn artificial boundaries between male and female.

The biological complexities of gender and sex—including those of transgender, homosexual, and intersex individuals—have long been the primary research interest of Eric Vilain, M.D., Ph.D., director of the Center for Gender-Based Biology at the University of California, Los Angeles (UCLA). Vilain is considered one of the world's foremost authorities in the genetics of sexual development and behavior. He has noted, "Society has categorical views on what should define sex and gender, but the biological reality is just not there to support that."

Vilain is interested in the role that genetic influences, as well as the combination of genetic and environmental influences, play in directing an individual's sexual orientation and gender identity. Scientific research into such combinations—a field known as epigenetics—investigates how environmental influences, such as exposure to certain hormones, infections, environmental chemicals, or other chemical or biological factors, act to turn certain genes on or off. Research in epigenetics has shown that the genes we inherit do not necessarily guide our physical or behavioral characteristics by themselves, because the genes may not be expressed unless they are activated by particular environmental signals during the growth and development of the body. When genes are expressed, they code for the production of particular proteins that direct certain cellular activities.

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Although Vilain's investigative team has not examined epigenetic factors associated with transgenderism, it has found some genetic clues. Often-cited research published by Vilain's group in 2009 in *Biological Psychiatry* compared the genes of 112 male-to-female transsexuals (their term) with those of 258 non-transsexual males ([www.biologicalpsychiatryjournal.com/article/S0006-3223\(08\)01087-1/abstract?cc=y](http://www.biologicalpsychiatryjournal.com/article/S0006-3223(08)01087-1/abstract?cc=y)).

The researchers found that, on average, the transsexuals had more repetitions of the CAG segment of the AR gene than the non-transsexuals. Such repetitions typically result in less sensitivity to androgen hormones, such as testosterone. Although these results were statistically significant, the association was not very strong, according to Vilain. He told *Windy City Times*, "In other words, you certainly can't predict who will be transgender based on the number of CAG repeats in one individual." Vilain added, "There are also some associations with variants of CYP17, a gene involved in the making of steroids, with FTM [female-to-male] transgenderism. Also, there is some association of MTF [male-to-female transgenderism] with Klinefelter syndrome [characterized by XXY chromosomes] but this has not been studied properly on an unbiased series." Existing evidence suggests to Vilain that genetic factors might play a mild to moderate influence in gender identity.

Vilain's team is presently studying epigenetic factors as they relate to sexual orientation. Vilain told WCT, "We are looking at the association between epigenetic changes and sexual orientation, asking whether there are differences in the epigenome [chemical compounds and proteins that attach to DNA and direct such actions as turning genes on or off, controlling the production of proteins in cells] of identical twins who are discordant for sexual orientation (one straight and one gay). We don't have a large enough sample to [reach conclusions] yet." He further noted that a similar type of epigenetics study "could be done with twins who are discordant for gender identity, but I don't think it has been done."

Vilain cited a 2009 study by other researchers (led by Shanna Swan at the University of Rochester School of Medicine and Dentistry) who found that fetal exposure to phthalates—an environmental factor—reduced stereotypical male behavior in boys by altering brain development (onlinelibrary.wiley.com/doi/10.1111/j.1365-2605.2009.01019.x/abstract). Phthalates are estrogen-like chemical compounds found in many plastic products, high-fat foods, and other common consumer items. Of this study, Vilain said, "Phthalates are clearly associated with changes of gender expression, with an increase of stereotypically feminine play behavior in boys. [But] I am not aware of other good studies [in this area]."

In an interview posted on an Annenberg Foundation website (www.learner.org/courses/biology/units/gender/experts/vilain.html), Vilain summarized the possible role of genes and environment in sexual development by noting that "hormones cannot explain everything in the making of a brain, whether it's a masculine or a feminine brain. But we don't know really what the other factors are. We suppose that some of these factors may be genetic. Maybe pieces of the Y chromosome are important at some level in the brain sexual differentiation. Maybe some environmental factors are also important: there are compounds in the environment that are hormone-like, they're estrogen-like for instance, that might play a role in this [such as the previously mentioned phthalates]. These are purely speculative arguments, but those are the kind of things that we are trying to decipher."

Regarding brain studies of transgender individuals, Vilain told WCT, "The work of Ivanka Savic [of the Karolinska Institute in Sweden] using functional brain imaging suggests that there may be differences in the way body perception is processed in some groups of transgender individuals."

Vilain has stated that gender identity is "really the big enigma and, to me, it's also the most important aspect of sex determination to understand, because I believe out of all the definitions of sex, gender is the most important. In fact, it's how people feel that is important, regardless of what they look like, of what their levels of hormones are, or what their face or genitalia look like. It's what they feel within themselves. That's what's important.

"And to understand what makes gender identity happen at some point in a human life is absolutely fascinating and extremely complicated to study, but that's certainly the next challenge in the research in sex determination."

This article is the second of a series of articles summarizing selected recent scientific studies related to LGBT issues.



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