

Brain May 'Hard-Wire' Sexuality Before Birth

ScienceDaily (Oct. 22, 2003) — Refuting 30 years of scientific theory that solely credits hormones for brain development, UCLA scientists have identified 54 genes that may explain the different organization of male and female brains. Published in the October edition of the journal *Molecular Brain Research*, the UCLA discovery suggests that sexual identity is hard-wired into the brain before birth and may offer physicians a tool for gender assignment of babies born with ambiguous genitalia.

“Our findings may help answer an important question — why do we feel male or female?” said Dr. Eric Vilain, assistant professor of human genetics and urology at the David Geffen School of Medicine at UCLA and a pediatrician at UCLA’s Mattel Children’s Hospital. “Sexual identity is rooted in every person’s biology before birth and springs from a variation in our individual genome.”

Since the 1970s, scientists have believed that estrogen and testosterone were wholly responsible for sexually organizing the brain. In other words, a fetal brain simply needed to produce more testosterone to become male. Recent evidence, however, indicates that hormones cannot explain everything about the sexual differences between male and female brains.

Vilain and his colleagues explored whether genetic influences could explain the variations between male and female brains. Using two genetic testing methods, they compared the production of genes in male and female brains in embryonic mice — long before the animals developed sex organs.

To their surprise, the researchers found 54 genes produced in different amounts in male and female mouse brains, prior to hormonal influence. Eighteen of the genes were produced at higher levels in the male brains; 36 were produced at higher levels in the female brains.

“We didn’t expect to find genetic differences between the sexes’ brains,” Vilain said. “But we discovered that the male and female brains differed in many measurable ways, including anatomy and function.”

In one intriguing example, the two hemispheres of the brain appeared more symmetrical in females than in males. According to Vilain, the symmetry may improve communication between both sides of the brain, leading to enhanced verbal expressiveness in females. “This anatomical difference may explain why women can sometimes articulate their feelings more easily than men,” he said.

Overall, the UCLA team’s findings counter the theory that only hormones are responsible for organizing the brain.

“Our research implies that genes account for some of the differences between male and female brains,” Vilain said. “We believe that one’s genes, hormones and environment exert a combined influence on sexual brain development.”

The scientists will pursue further studies to distinguish specific roles in the brain’s sexual maturation for each of the 54 different genes they identified. What their research reveals may provide insight into how the brain determines gender identity.

“Our findings may explain why we feel male or female, regardless of our actual anatomy,” Vilain said. “These discoveries lend credence to the idea that being transgender — feeling that one has been born into the body of the wrong sex — is a state of mind.

“From previous studies, we know that transgender persons possess normal hormonal levels,” he said. “Their gender identity likely will be explained by some of the genes we discovered.”

Vilain's findings on the brain's sex genes may also ease the plight of parents of intersex infants, and help their physicians to assign gender with greater accuracy. Mild cases of malformed genitalia occur in 1 percent of all births — about 3 million cases. More severe cases — where doctors can't inform parents whether they had a boy or girl — occur in one in 3,000 births.

“If physicians could predict the gender of newborns with ambiguous genitalia at birth, we would make less mistakes in gender assignment,” Vilain said.

Lastly, Vilain proposes that the UCLA findings may help to explain the origin of homosexuality.

“It's quite possible that sexual identity and physical attraction is 'hard-wired' by the brain,” he said. “If we accept this concept, we must dismiss the myth that homosexuality is a 'choice' and examine our civil legal system accordingly.”

The UCLA study was supported by the National Institute of Child Health and Human Development, the National Science Foundation and with start-up funds from the UCLA Department of Urology. Vilain's co-authors included Phoebe Dewing, Steve Horvath and Tao Shi, all of UCLA.

Adapted from materials provided by [University Of California Los Angeles](http://www.ucla.edu).