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Boys Will Be Boys

The Science of the Y Chromosome

It appears men aren't doomed to extinction after all. In June, researchers from several institutions, including the Human Genome Research Project and the Genome Sequencing Center at Washington University School of Medicine in St. Louis, finished sequencing the Y chromosome—the chromosome found only in men—and found that, contrary to earlier assessments of the Y as largely "a genetic wasteland," in fact it contains "genes that impact male fertility, vast stretches of mirror-image DNA, and an assortment of functional and vestigial genes," as the Howard Hughes Medical Institute (which contributed researchers to the project) reported.

The beleaguered Y chromosome, estimated to be 300 million years old, has only 78 genes, far less than the female X. As a result, some geneticists feared that, within a mere 5 or 10 million years, the Y would become extinct, the victim of its inability to swap bad genes with a paired chromosome—not, as some radical feminists hoped and men's movement advocates feared, the result of feminization through social conditioning.

One of the more interesting findings of the Y studies, two of which were published in the journal *Nature* in June, is that the Y chromosome overcomes this challenge by swapping genes with itself. "We have found that many of the genes on the Y … occur in pairs," reported David C. Page of M.I.T.'s Whitehead Institute for Biomedical Research. This means that genes on the Y chromosome trade with their mirror images on the Y, rather than swapping with another chromosome, as happens in women with the two X chromosomes. "This Y-Y gene conversion is, I think, the most important finding of our work," Page said in a press release. This finding will likely lead to a better understanding of the genetic causes of male infertility and the differences in susceptibility to certain diseases between men and women.

The mapping of the Y is not without controversy, however. The findings of some of these studies will likely reignite an already heated debate about historical migrations, particularly those surrounding the claim that the ancestors of present-day

Native American groups were the first to settle the North American continent. Researchers are able to trace lineage most effectively through the Y chromosome, since, as *New York Times* science reporter Nicholas Wade has noted, "all men carry the same Y chromosome, a surprising situation derived from the fact that in the ancestral human population some men had no children or only daughters, so that in each generation some Y chromosomes disappeared until only one was left," with the only variation coming from occasional mutations. As the British newspaper *The Guardian* reported in 2001, "evidence has been growing that the [North American] continent was well-populated long before [Native Americans'] arrival. In the past few years, a dozen or so ancient skulls have been unearthed in North America, and not only do they date from a time before the arrival of the mammoth hunters, but their shape and proportions have little in common with those of northern Asians. Instead, they look like people from southeast Asia and the Pacific." Genetic testing of the skulls confirms these findings, and an improved understanding of the Y chromosome will make more detailed testing possible.

Also in Britain, new studies of the lineage of the Y chromosome suggest that "the Anglo-Saxons failed to leave as much of a genetic stamp on the U.K. as history books imply," the BBC recently reported. An examination of Y chromosomes from all around Britain suggests that the Celts endured waves of invasions of Vikings, Normans, Danes, and the like without ever totally ceding their genetic turf. Reporting on a study published in *Current Biology* in May, the *New York Times* noted, "Nowhere were [the Celts] entirely replaced by the invaders and they survive in high proportions, often 50 percent or more, throughout the British Isles."

Other potentially controversial findings stemming from the Y chromosome studies concern infidelity, physical symmetry, and homosexuality. *The Guardian*'s Jerome Burne notes that new studies of the Y chromosome suggest that infidelity is not as common as supposed. Based on a study of men with the British surname "Sykes," researchers found that the rate of infidelity in the clan was closer to 1 percent, not the 5 and 10 percent estimates bandied about in other family studies.

The same *Guardian* story reports that in 2000, a researcher at the University of Toronto found that "younger brothers, but not sisters, are more likely to be slightly asymmetrical than their older siblings, and the more older brothers you have, the more asymmetrical you are likely to be." Other research suggests that "the more older brothers you have, the more likely you are to be gay." Some scientists theorize that the presence of a Y chromosome in a fetus might spark specific reactions from the mother's immune system during pregnancy—reactions that might lead to asymmetry or homosexuality.

Is the resurgence of interest in the Y chromosome ushering in a new "science of maleness," as the *San Francisco Chronicle* recently suggested? Perhaps. Geneticist Steve Jones, a professor at University College, London, recently published a book-length examination of the Y chromosome called *Y: The Descent of Men*, and observers of the infertility industry have noted an increase in the attention paid to male infertility. Others wonder if Y studies might revive the battle between the sexes by pinpointing more genetic differences between men and women. As Dr. Page of M.I.T. told the *New York Times*, "We all

recite the mantra that we are 99 percent identical and take political comfort in it, but the reality is that the genetic difference between males and females absolutely dwarfs all other differences in the human genome." If those differences reveal a hardier female genome, men might need Save-the-Males organizations after all.