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Researchers confirm association between gene and intelligence

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If you're particularly good with puzzles or chess, the reason may be in your genes. A team of scientists, led by psychiatric geneticists at Washington University School of Medicine in St. Louis, has gathered the most extensive evidence to date that a gene that activates signaling pathways in the brain influences one kind of intelligence. They have confirmed a link between the gene, CHRM2, and performance IQ, which involves a person's ability to organize things logically.

"This is not a gene FOR intelligence," says Danielle M. Dick, Ph.D., assistant professor of psychiatry and lead author on the study. "It's a gene that's involved in some kinds of brain processing, and specific alterations in the gene appear to influence IQ. But this single gene isn't going to be the difference between whether a person is a genius or has below-average intelligence."

Dick's team comprehensively studied the DNA along the gene and found that several variations within the CHRM2 gene could be correlated with slight differences in performance IQ scores, which measure a person's visual-motor coordination, logical and sequential reasoning, spatial perception and abstract problem solving skills. When people had more than one positive variation in the gene, the improvements in performance IQ were cumulative. The study's findings are available online in Behavioral Genetics and will appear in an upcoming print issue of that journal.

IQ tests also measure verbal skills and typically include many subtests.

For this study, subjects took five verbal subtests and four performance subtests, but the genetic variations influenced only performance IQ scores.

"One way to measure performance IQ may be to ask people to order pictures correctly to tell a story," Dick explains. "A simple example might be pictures of a child holding a vase, the vase broken to bits on the floor and the child crying. The person taking the test would have to put those pictures into an order that tells the story of how the child dropped the vase and broke it and then cried."

The researchers studied DNA gathered as part of the Collaborative Study on the Genetics of Alcoholism (COGA). In this multi-center study, people who have been treated for alcohol dependence and members of their families provide DNA samples to researchers, who isolated DNA regions related to alcohol abuse and dependence, as well as a variety of other outcomes.

Some of the participants in the study also took the Wechsler Adult Intelligence Scale-Revised, a traditional IQ test. In all, members of 200 families, including more than 2,150 individuals, took the Wechsler test, and those results were matched to differences in individuals' DNA.

By comparing individual differences embedded in DNA, the team zeroed in on CHRM2, the neuronal receptor gene on chromosome 7. The CHRM2 gene activates a multitude of signaling pathways in the brain involved in learning, memory and other higher brain functions. The research team doesn't yet understand how the gene exerts its effects on intelligence.

Intelligence was one of the first traits that attracted the attention of people interested in the interplay of genes and environmental influences. Early studies of adopted children, for example, showed that when

children grow up away from their biological parents, their IQs are more closely correlated to biological parents, with whom they share genes, than adoptive parents, with whom they share an environment.

But in spite of the association between genes and intelligence, it has been difficult to find specific variations that influence intelligence. The genes identified in the past were those that had profoundly negative effects on intelligence — genes that cause mental retardation, for example. Those that contribute to less dramatic differences have been much harder to isolate.

Dick's team is not the first to notice a link between intelligence and the CHRM2 gene. In 2003, a group in Minnesota looked at a single marker in the gene and noted that the variation was related to an increase in IQ. A more recent Dutch study looked at three regions of DNA along the gene and also noticed influences on intelligence. In this new study, however, researchers tested multiple genetic markers throughout the gene.

"If we look at a single marker, a DNA variation might influence IQ scores between two and four points, depending on which variant a person carries," Dick explains. "We did that all up and down the gene and found that the variations had cumulative effects, so that if one person had all of the 'good' variations and another all of the 'bad' variations, the difference in IQ might be 15 to 20 points. Unfortunately, the numbers of people at those extremes were so small that the finding isn't statistically significant, but the point is we saw fairly substantial differences in our sample when we combined information across multiple regions of the gene."

Dick says the next step is to look at the gene and its numerous variants to learn what is going on biologically that might affect cognitive performance. Presently, she says it's too early to predict how small

changes in the gene might be influencing communication in the brain to affect intelligence, and she says it's nearly certain CHRM2 is not the only gene involved.

"Perhaps as many as 100 genes or more could influence intelligence," she says. "I think all of the genes involved probably have small, cumulative effects on increasing or decreasing I.Q., and I expect overall intelligence is a function of the accumulation of all of these genetic variants, not to mention environmental influences ranging from socio-economic status to the value that's placed on learning when children are growing up."

Source: Washington University School of Medicine