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Research identifies links between genetic variants and educational attainment

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A multi-national team of researchers has identified genetic markers that predict educational attainment by pooling data from more than 125,000 individuals in the United States, Australia, and 13 western European countries.

The study, which appears in the journal *Science*, was conducted by the Social Science Genetic Association Consortium (SSGAC), which includes researchers at NYU, Erasmus University, Cornell University, Harvard University, the University of Bristol, and the University of Queensland, among other institutions.

The SSGAC conducted what is called a genome-wide association study (GWAS) to explore the link between genetic variation and educational attainment—the number of years of schooling completed by an individual and whether he or she graduated college. In a GWAS, researchers test hundreds of thousands of genetic markers for association with some characteristics such as a disease, trait or life outcome.

Because the sample included people from different countries—where markers for schooling vary significantly—the research team adopted the International Standard Classification of Education (ISCED) scale, which is a commonly used method for establishing a uniform measure of educational attainment across cohorts.

Anticipating that very large samples would be required to credibly detect genetic associations, the SSGAC researchers assembled a total sample

size more than 10 times larger than any previous genetic study of any social-scientific outcome. The team examined associations between educational attainment and genetic variants called single-nucleotide polymorphisms, or SNPs, which are tiny changes at a single location in a person's genetic code.

The study found that the genetic markers with the strongest effects on educational attainment could each only explain two one-hundredths of a percentage point (0.02 percent). To put that figure into perspective, it is known from earlier research that the SNP with the largest effect on human height accounts for about 0.40 percent of the variation.

Combining the two million examined SNPs, the SSGAC researchers were able to explain about 2 percent of the variation in educational attainment across individuals, and anticipate that this figure will rise as larger samples become available.

"We hope that our findings will eventually be useful for understanding biological processes underlying learning, memory, reading disabilities and cognitive decline in the elderly," said co-author Daniel Benjamin, a behavioral economist at Cornell who is a co-director of the SSGAC.

"Another contribution of our study is that it will strengthen the methodological foundations of social-science genetics," said David Cesarini, an NYU assistant professor at the Center for Experimental Social Science and the Center for Neuroeconomics, who also co-directs the SSGAC. "We used 125,000 individuals to conduct this study. Previous studies used far smaller samples, sometimes as small as 100 individuals and rarely more than 10,000. These small samples make sense under the assumption that individual genes have large effects. However, if genes have small effects, as our study shows, then sample sizes need to be very large to produce robust findings that will reliably replicate in other samples."

The researchers were careful to note that they have not discovered "the gene for education" or that these findings somehow imply that a person's educational attainment is determined at birth.

"For most outcomes that we study as social scientists, genetic influences are likely to operate through environmental channels that are modifiable," explained NYU sociologist Dalton Conley, one of the study's co-authors who also serves on the Advisory Board of the SSGAC. "We have now taken a small but important first step toward identifying the specific genetic variants that predict educational attainment. Armed with this knowledge, we can now begin to examine how other factors—including public policy, parental roles, and economic status—dampen or amplify genetic effects and ultimately devise better remedies to bolster educational outcomes."

More information: "GWAS of 126,559 Individuals Identifies Genetic Variants Associated with Educational Attainment," by C.A. Rietveld et al. *Science*, 2013.

Provided by New York University