

A parent's genes can influence a child's educational success, inherited or not

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A child's educational success depends on the genes that they haven't inherited from their parents, as well as the genes they have, according to a new study led by UCL researchers.

Funded by the Nuffield Foundation, the study confirms that genes a person inherits directly are most likely to contribute to their achievements in education. But parent genes that aren't directly inherited, yet have still shaped [parents'](#) own education levels and subsequently influenced the lifestyle and family environment they provide for their children, are also important and can affect how well a person does at school and beyond.

The study, a [systematic review](#) and meta-analysis of prior evidence of genetic impacts on educational outcomes, is published today in the *American Journal of Human Genetics*.

Children resemble their parents because of nature (the genes they inherit) and nurture (the environment they grow up in). But nature and nurture effects are intertwined.

Mothers and fathers each pass on half of their genes to their children, and although the other half of their genes are not passed on, they continue to influence the parents' traits and ultimately influence the traits in their children. For example, parents with a higher genetic propensity for learning may have a greater interest in activities such as reading that, in turn, nurture learning in their offspring.

This concept—when parents' genes influence outcomes for their offspring by shaping the environment that they provide for them—is called genetic nurture. It describes how parents' genes indirectly their children's characteristics.

For the current paper, researchers reviewed and analyzed 12 studies in several countries and used a method called polygenic scoring to study the influence of millions of genetic variants on [educational attainment](#) in nearly 40,000 parent and child pairs.

The researchers found that genetic nurture had about half as much impact on education success as genetic inheritance.

Genetic nurture effects captured by [polygenic scores](#) in the studies explained at least 1.28% of variance in educational outcomes, while direct genetic effects explained at least 2.89% of variance in educational outcomes. The researchers say the findings are underestimated given that polygenic scores only capture a fraction of heritability in educational outcomes; the actual genetic effects could be multiple times higher, but direct genetic effects would probably still be roughly double those of genetic nurture effects.

Lead researcher Dr. Jean-Baptiste Pingault (UCL Psychology & Language Sciences) says that they "discovered genetic nurture has a significant effect on a child's educational achievement. The effects were mainly down to their parents' education and how it influences the environment they provide. We also found that fathers and mothers had similar genetic nurture effects, suggesting both parents are equally important in shaping and fostering an environment favorable for a child's learning."

"This study illustrates how complex the relationship between [genes](#) and the environment is. Although our study uses genetic methods, it provides strong evidence that, as well as genetics, the environment really matters when we talk about education."

"Two aspects are complementary here. First, some of it depends on the genetic lottery, so parents do not have complete control and not everything is down to what they do. That said, what parents do and their choices do seem to matter. Our findings show that socioeconomic status and parental education are probably key."

"It is really important to understand how educational attainment (years

of [education](#), highest degree obtained) and achievement (scores and grades achieved) are passed on through families, and how this knowledge could help us break cycles of disadvantage across generations."

First author of the paper, Dr. Biyao Wang (UCL Psychology & Language Sciences) says that "it is too early yet to say whether the most important is what happens within the family (such as parents reading to their children) or outside the family (such as parents choosing the best school and activities). Next we hope to work out which pathways genetic nurture operates through, if it changes during different stages of development, and identify what aspects of the environment are most important. This will be key to designing new interventions to encourage and support all children to succeed."

More information: Biyao Wang et al, Robust genetic nurture effects on education: A systematic review and meta-analysis based on 38,654 families across 8 cohorts, *The American Journal of Human Genetics* (2021). [DOI: 10.1016/j.ajhg.2021.07.010](https://doi.org/10.1016/j.ajhg.2021.07.010)

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