

Research tracks interplay of genes and environment on physical, educational outcomes

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Over the course of the 20th century, genes began to play a greater role in the height and body mass index (BMI) of Americans, while their significance decreased in educational attainment and occurrence of heart disease.

The findings, from research by Princeton sociologist Dalton Conley and colleagues, shed new light on how the genetic and environmental landscape of American society has changed over the past century, and highlight the power of combining new genetic tools with traditional [social science research](#).

"We now have genetic signatures that can strongly predict education, height, BMI and heart disease," said Conley, the Henry Putnam University Professor in Sociology. "So, we used data on Americans born from the 1920s to the 1950s to examine how predictive genes were in these areas. What we found were these significant trends in the role of genetics, upward for BMI and height and downward for education and heart disease."

The research is detailed in an article titled "Changing Polygenic Penetrance on Phenotypes in the 20th Century Among Adults in the US Population" published online Tuesday, July 26, in the journal *Scientific Reports*. Conley co-authored this study with Thomas Laidley of New York University, Jason Boardman of the University of Colorado-Boulder

and Benjamin Domingue of Stanford University.

The researchers utilized demographic data and genetic information on nearly 9,000 Americans born between about 1920 and 1955 that was collected as part of the Health and Retirement Study, which began tracking a representative sample of older Americans in 1992.

They compared a million different DNA markers for each participant against genetic signatures that highlight parts of the genome known to affect outcomes such as height, BMI, education and heart disease. By tracking how closely the participants' outcomes matched their genetic predisposition, a picture emerged of how the significance of genes changed over the 20th century.

"It has only recently become possible to use DNA to (partially) predict outcomes such as height, BMI, heart disease and [educational attainment](#)," said Daniel Benjamin, an associate professor of economics at the University of Southern California whose research incorporates genetic data into economics research but wasn't involved in this study. "This paper is one of the first to use these methods to examine how the effects of genes have changed in the U.S. over the 20th century. It helps shed light on the complex interplay of genes and environments in shaping people's outcomes."

Conley said it wasn't surprising to find that the role of genes in determining height and BMI increased, as food scarcity became a less prevalent environmental impact on such outcomes.

"If you were born in the Great Depression, no one had enough food and it didn't matter what your genotypic weight would be because everyone was restrained," Conley said. "Today, average weight has gone up, but the effect of your genetic signature in predicting your weight is also more powerful in recent birth cohorts."

The same increase in the availability of food, much of it unhealthful, may contribute to the decreasing importance of genes in occurrence of [heart disease](#), Conley said.

The reasons genes played less of a role in educational outcomes over time are less clear, Conley said. One possibility is that the increase in educational opportunities over the 20th century may have lessened the need for people to have strong [genetic predisposition](#) to succeed academically, he said.

Conley said the education finding rebuts the idea, popularized by the 1994 book "The Bell Curve," that achievement in modern society is mostly dependent on innate ability.

"We asked if the genetic signature for cognitive ability and educational attainment predict better now or in the past. It predicted better in the past, so it's going in the opposite direction of what 'The Bell Curve' argued," Conley said.

This research fits into Conley's broader research portfolio, which focuses in part on the intersection of [genes](#) and the environment. Work in this area is the focus of a book by Conley and Jason Fletcher of the University of Wisconsin-Madison titled "[The Genome Factor: What the Social Science Genomics Revolution Reveals about Ourselves, Our History, and the Future](#)," which will be published early next year.

"We're all responding differently to environmental influences and shocks happening to us all the time in society, but we haven't had any idea who was going to respond how," Conley said. "Now we're uncovering the genetic tools needed to answer those questions."

More information: Dalton Conley et al, Changing Polygenic Penetrance on Phenotypes in the 20th Century Among Adults in the US

Population, *Scientific Reports* (2016). [DOI: 10.1038/srep30348](https://doi.org/10.1038/srep30348)

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