TIM LAHAN

You Can Now Test Immigrants DNA For Intelligence Levels

Scientists have linked hundreds of genes to intelligence. One psychologist says it's time to test school kids.

by Antonio Regalado

Ready for a world in which a $50 DNA test can predict your odds of earning a PhD or forecast which toddler gets into a selective preschool?

Robert Plomin, a behavioral geneticist, says that's exactly what's coming.

For decades genetic researchers have sought the hereditary factors behind intelligence, with little luck. But now gene studies have finally gotten big enough—and hence powerful enough—to zero in on genetic differences linked to IQ.

A year ago, no gene had ever been tied to performance on an IQ test. Since then, more than 500 have, thanks to gene studies involving more than 200,000 test takers. Results from an experiment correlating one million people's DNA with their academic success are due at any time.

The discoveries mean we can now read the DNA of a young child and get a notion of how intelligent he or she will be, says Plomin, an American based at King's

College London, where he leads a long-term study of 13,000 pairs of British twins.

Plomin outlined the DNA IQ test scenario in January in a paper titled "The New Genetics of Intelligence," making a case that parents will use direct-to-consumer tests to predict kids' mental abilities and make schooling choices, a concept he calls precision education.

As of now, the predictions are not highly accurate. The DNA variations that have been linked to test scores explain less than 10 percent of the intelligence differences between the people of European ancestry who've been studied.

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Even so, *MIT Technology Review* found that aspects of Plomin's testing scenario are already happening. At least three online services, including GenePlaza and DNA Land, have started offering to quantify anyone's genetic IQ from a spit sample.

Others are holding back. The largest company offering direct-to-consumer DNA health reports, 23andMe, says it's not telling people their brain rating out of concern the information would be poorly received.

Several educators contacted by *MIT Technology Review* reacted with alarm to the new developments, saying DNA tests should not be used to evaluate children's academic prospects.

"The idea is we'll have this information everywhere you go, like an RFID tag. Everyone will know who you are, what you are about. To me that is really scary," says Catherine Bliss, a sociologist at the University of California, San Francisco, and author of a book questioning the use of genetics in social science.

"A world where people are slotted according to their inborn ability—well, that is *Gattaca*," says Bliss. "That is eugenics."

Finding the genes

To psychologists, IQ tests measure something called "*g*"—the general factor of intelligence. People who are better at math, spatial reasoning, verbal ability, and other skills that tests can measure have higher *g*.

And that's not all. The *g* factor is strongly correlated with income, happiness, health, and life span. More *g* seems to be a good thing all around. To Plomin it's the "omnipotent variable" in life.

It's also highly heritable. Comparisons of twins, both identical and fraternal, separated at birth or raised together, had shown that genetics must account for more than half of intelligence—a huge effect for genes. The rest is due to your schools, your diet, and other environmental factors.

But which specific genes are responsible? The search did not go well at first. Plomin failed to discover any links when he looked at the genomes of 7,900 children in 2010. He later became involved in a misadventure involving a Chinese sequencing company, BGI, to which he supplied the DNA of more than a thousand American geniuses. The project got derailed after news reports accused the Chinese of hatching a plot to breed "genius babies."

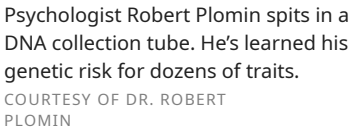
The gene hunt finally paid off in May 2017. A Dutch-led study of the genetic makeup of 78,308 people who'd taken tests (including 2,825 of Plomin's twins) zeroed in on variations in 22 genes linked to IQ scores. By this March, the tally had rapidly risen to 199,000 people and 500 genes. Plomin says a forthcoming report will establish links to 1,000 genes.

Each genetic variable found so far has only a tiny effect, either weakly increasing IQ on average or weakly decreasing it. The trick to turning the discoveries into a personal DNA IQ test? Simply add up all the pluses and minuses you find in a specific person's genome.

These types of assessments are called "polygenic scores." And they're quickly becoming a very big deal (see "10 breakthrough technologies 2018: Genetic fortune telling"). That's because they work for any trait, including heart disease, diabetes, and schizophrenia—in all, more than 2,000 traits so far.

Plomin was quick to sign up. Last year, he spit in a tube and had his DNA scores

calculated by his research center. Now, during talks, he presents his genetic rankings. He's on the high end of the risk for arthritis (he has some), lower than average for depression, and in the 94th percentile for being overweight.



Psychologist Robert Plomin spits in a DNA collection tube. He's learned his genetic risk for dozens of traits.
COURTESY OF DR. ROBERT PLOMIN

To Plomin, whose weight sometimes nears 240 pounds, the genetic prediction explains his lifelong battle with starches and sweets. "People will say, 'Oh, there's nothing you can do—you're a genetic fatty,' but it helps me to know. It's a constant battle of the bulge," he says.

Of course, he knows his percentile rank for predicted academic achievement, too. "It's 99-point-something—it's embarrassing," he says.

Are you Einstein or Bozo?

Several scientists told *MIT Technology Review* they don't believe genetic IQ tests can tell individuals anything useful and aren't sure why Plomin is saying they will.

"We will never be able to look into someone's DNA and say your IQ will be 120," says Danielle Posthuma, who led the big 2017 IQ study. "I don't think it makes much sense to use it that way. I would just give people an IQ test." Posthuma says her main interest is in discovering how the brain works at a basic level, where finding genes associated with intelligence can help.

Plomin, however, points out that IQ tests with colored blocks barely work for little kids, failing to accurately

capture how they will do on tests later in life. Your DNA, on the other hand, is there from the day you are born and doesn't change. Early in life, Plomin says, DNA may already provide a better intelligence prediction than any test does.

Still, the issue is accuracy—or lack of it. Right now, the polygenic scores capture only a fraction of the genetic determinants of intelligence and none of the environmental ones. That means the predictions remain fuzzy.

This is clear from Plomin's own data. His center calculated polygenic scores for hundreds of the twins he's followed since their birth and whose DNA it has on file. He then compared the gene scores with how well the twins (now in their 20s) had done on a UK-wide exam that everyone takes as a teenager.

Genetic studies of intelligence may shed light on school choices and social mobility. Here, boys from the elite British school Harrow have onlookers.
JIMMY SIME/CENTRAL PRESS/HULTON ARCHIVE/GETTY IMAGES

Plotted one against the other, the result looks more like a slightly elongated cloud of dots than a straight line. That is, the DNA predictions and the test scores tended to line up, though not perfectly. Some with low DNA scores had gotten great test results as teens. Others had bombed despite the promise in their genes.

To Aaron Panofsky, a sociologist of science with the University of California, Los Angeles, that's a huge problem. With this technology, you could end up branding an Einstein as a Bozo, and vice versa. "Is the claim that you are going to have kindergarteners spit in test tubes and get some traction on their achievement when they graduate high school? Well, in aggregate, it looks like it will be better than rolling dice," says Panofsky. "But what if we want to determine if *your* kid should be in the gifted or remedial program?"

When it comes to using DNA tests in the real world, Panofsky says, "I don't think they thought about it very hard."

IQ scores for sale

MIT Technology Review found that genetic IQ assessments are already being offered by websites that provide information to people who've previously had their DNA measured by 23andMe or Ancestry.com.

Users of GenePlaza, for example, can upload their 23andMe data and pay $4 extra to access an "Intelligence App," which rates their DNA using data from the big 2017 study on IQ genes.

It shows users where their genes place them on a bell curve from lower to higher IQ. A similar calculation is available from DNA Land.

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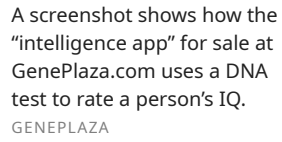
The results come with disclaimers saying the results don't mean much yet, because they predict

only about 5 points of IQ. “I hope people are not getting it thinking that this is a true measure of their intelligence,” says Alain Coletta, a bioinformatics scientist and the founder of GenePlaza.

He says he put up the app “for fun.”



A screenshot shows how the “intelligence app” for sale at GenePlaza.com uses a DNA test to rate a person’s IQ.
GENEPLAZA

So far, the major consumer DNA testing companies have steered clear of intelligence reports. “There are obviously some concerns about how it gets used and gets talked about,” says James Lu, cofounder of California-based Helix, a leading app store for DNA tests.

Given the history of eugenics, big companies have to fear being called out as Nazis and racists. What's more, customers might not be pleased to receive a prediction of less than average intelligence.

Take the testing company 23andMe, which has studied the DNA of more than five million people and offers consumers reports on 21 traits, including everything from the chances of having a cleft chin to the likelihood of developing a bald spot. Of these trait reports, 16 are calculated employing polygenic scores.

But 23andMe doesn’t offer any reports about intellectual faculties. And that’s not because it doesn’t have the data. It does. Because it surveys customers on how long they stayed in school, a proxy for intelligence, the Google-backed company has been playing a supporting role in the search for intelligence genes by contributing its customers’ DNA data to the largest of the gene hunts.

So why not tell customers? In response to *MIT Technology Review*’s question, 23andMe gave us a

Eugenics 2.0: We’re at the Dawn of Choosing Embryos by Health, Height, and More
Will you be among the first to pick your kids’ IQ? As machine learning unlocks predictions from DNA databases, scientists say parents could have choices never before possible.

statement. “Educational attainment is something we have looked at previously but are not currently pursuing for our product for several reasons,” said Shirley Wu, director of product science for 23andMe. “One being the pitfalls of potential misinterpretation of such a report.”

Genotocracy

Although it’s still taboo to talk about, some medical scientists are trying to figure out how to use the polygenic intelligence scores to pick the smartest embryo from an IVF dish, choose the best sperm donor, or discover fetuses at high risk for an expanded menu of cognitive disorders, including autism.

Dalton Conley, a sociologist at Princeton University, says as soon as the IQ predictions reach the double digits—something that could occur very soon—we will need to have a “serious policy debate” about such “personal eugenics.” One concern is that IVF is expensive. That could lead to a situation in which the wealthy end up using IQ-test technology to pick kids with select genes while the poor don’t, leading to an unequal society that Conley calls a “genotocracy.”

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Forecasts of genetic fate just got a lot more accurate
DNA-based scores are getting better at predicting intelligence, risks for common diseases, and more.

Others suggest that genetic models of intelligence will be used to compare races, ethnic groups, or people from different parts of the world. In an editorial about the genetics of race published in the *New York Times* on March 23, Harvard University biologist David Reich cited the new genetic IQ predictors and cautioned that “all traits influenced by genetics are expected to differ across populations.”

The warning was implicit: differences in IQ could be due to genes, not circumstance, and polygenic scores might prove it.