Tall Genes: Thousands found responsible for height differences

Last month, a group of prominent researchers published work showing that three genes controlled the variation in human intelligence, but only up to 6 IQ points. That's a manageable number of genes leading to a relatively tiny proportion of "smarts." Compare that to a finding published earlier this week: Thousands of individual genetic differences account for less than a third of the variation in human height.

The results were found from genome wide association study on about 250,000 people. These researchers looked at height differences and differences in the genome and matched those up. Nearly 700 spots on the genome were identified, with more than 9,500 individual allele differences at those spots. Each of the spots of interest could be filled by either an A,T, C or G base pair and every person has two copies, leading to the 9,500 number. But even in the most thorough analysis, including those 9,500 individual possibilities, only one third of human height differential was explained.

Although the result was vast, it does show that genetics is finding finite boundaries of the genetics of really complex traits, the researchers said. Height is often used as a model for other complex traits like intelligence and for complicated diseases like diabetes and heart disease.

But not everyone agrees. Geneticist Ken Weiss argues that because the study only included people of European descent who were in 'normal' height range, meaning they had no known disorders that affect height, the study really only took into a account a small amount of human height variation.

Additionally, Weiss argues, the finding might narrow down potential height control genes, it doesn't eliminate the possibility that they are still infinite, the 'take home point' of the study:

> First, if by 'gene' the authors meant coding genes, then their 9500 is nearly half of all such genes in our genome. Of course the definition of 'gene' is vague and debatable these days so we'll let that problem pass. Still, 9500 is a lot, and it's just the proverbial tip… Not all genome sites need have an effect on stature, but we don't know that and the more we look the more we find, so in practice the number of genomic influences on stature, not counting environmental factors, is in fact not limited or countable: it can keep on growing indefinitely. It is literally not finite, but is infinite!

The environmental factors contributing to height are vast and have dramatic effect as shown by health economists for decades. The interaction between our genetic predispositions and those environmental affects could be astounding. And, in fact, continue to change:

> In the First World War, the average American soldier was still two inches taller than the average German. But sometime around 1955 the situation began to reverse. The Germans and other Europeans went on to grow an extra two centimetres a decade, and some Asian populations several times more, yet Americans haven't grown taller in fifty years. By now, even the Japanese—once the shortest industrialized people on earth—have nearly caught up with

> us, and Northern Europeans are three inches taller and rising.

Which bring us another of Weiss' points: Heights are still changing, so even robust genetics studies can really only take a snapshot of what's happening on both an individual or population level. For example, if you're a 65 year-old woman, you've likely already started losing height. If you're looking at height data from male draftees, many of them may still be growing.

Weiss and others argue that we need to start looking beyond these incredibly broad, genome wide association studies in order to find meaningful data that go beyond mere counting. How we do that is a challenge:

> So now, if the science is to advance beyond a pretense of causal enumerability, what we need to do is develop some new, quantitative rather than enumerative causal concepts. How we should do that is unknown, unclear, debatable,…. and in our business-as-usual environment, probably unfundable.

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Additional Resources:

- Genetics of intelligence: many, many genes with tiny effects, Genetic Literacy Project
- Mother's diet during conception may lead to epigenetic consequences and disease, Genetic Literacy Project
- Thousands of genes contribute to height, Reuters