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Decades of College Dreams

Five Genes Help Form a Face

By Elizabeth Pennisi

Here's an advance that may have cops smiling from ear to ear: Researchers have now teased out five genes that help control the width of the human face. Though hundreds of genes involved in face shape remain to be identified, the findings represent an early step toward facial reconstruction with DNA.

Crime labs see a bright future for forensic genomics; they're already moving toward predicting hair and eye color based on genetic information. But the ultimate goal is to reconstruct the full visage of a criminal from his DNA, which might be found at a crime scene.

But the face is a very complex structure, requiring much genetic input to be put together. Eight years ago, Manfred Kayser, a geneticist at Erasmus MC in Rotterdam, the Netherlands, wondered whether it would even be possible to tease out which versions of a gene would lead to a broad nose or a wide forehead. If it were, he reasoned, then eventually a computer program could build a composite of a perpetrator's face based on DNA_much as a sketch artist today combines the recollections of eyewitnesses to help an investigation. "If you can get into the shape of the nose, the eyes, the lips, that can be of a lot of value," says Bruce Budowle, a geneticist at the University of North Texas Health Science Center in Fort Worth who was not involved in the work.

Before Kayser and his colleagues could start to identify those genes, they needed to break down the face into discrete, measurable features that could be assessed in each individual. Looking at MRI images, they picked out nine landmarks on the face. The distances between different pairs of landmarks in a given face were traits for the team to evaluate-for example, the spacing between the eyes or the distance from the tip of the nose to its base.

As part of the International Visible Trait Genetics Consortium, he and his colleagues examined the DNA of five groups of people to see whether any particular variants of a gene were associated with each trait. Each group contained between 545 and 2470 individuals. Three other groups of people were subsequently evaluated as well, as a way to independently test the genetic correlations derived from the first five groups.

Five genes emerged as important to facial features, Kayser and his colleagues report today in PLoS Genetics. The genes influenced traits such as the width of the face, the distance between the eyes, and how far the nose sticks out. One gene, called PAX3, had already been linked to the shape of the face in children, giving Kayser confidence that his approach to finding relevant genes worked. Other researchers had previously tied two of the other genes, one on chromosome 2 and one on chromosome 3, to facial problems such as a cleft lip or misformed jaws. The final two genes were newly connected to facial development, he notes. "That we were able to find these genes was a surprise," he adds.

On the downside, the work confirms what many had suspected. "There are no common variants with large effects," says Lavinia Paternoster, a geneticist at the University of Bristol in the United Kingdom, who plans to work with Kayser in the future on finding more facial genes. "It is likely that there are many hundreds or thousands of these variants," each having a small influence on the face, she says.

That many more genes are involved, each contributing a little bit toward building the face, means that "this is just the first step in a long journey," Budowle says. Kayser's team plans to hunt for other genes, by increasing the number

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of landmarks they evaluate and acquiring MRIs of more people. Finding genes with small effects requires that a lot of people be studied, Paternoster points out, and that could be hard to do because there aren't many studies where DNA was collected and MRIs were done.

Budowle is optimistic that within 2 to 5 years, some form of facial reconstruction with DNA will be possible. But that certainly is not possible now, Paternoster says: "The variability in this study only explains a very tiny proportion of the variability in face shape, and so cannot be used to predict the face shape."

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Elizabeth Pennisi is a Staff Writer for Science*. She writes about biology, focusing primarily on genomics, evolution, microbiology, and organismal biology, with a smattering of ecology and behavior thrown in. She joined the staff of* Science *in 1996 and added editing to her job duties in 2007. She has an undergraduate degree in biology from Cornell University and a master's degree in science writing from Boston University. In addition to* Science*, her byline has appeared in* Science News*--where she won the James T. Grady-James H. Stack Award for Interpreting Chemistry for the Public—*The Scientist*, and United Press International.*