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### Exploring links between genes, violence, environment

#### As science looks at possible links and treatments, critics warn of overzealous intervention

By Trine Tsouderos, Tribune reporter

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Serving nine years for fatally stabbing a man who had ridiculed his appearance, Abdelmalek Bayout was just another convict in an Italian prison until his attorney made a unique plea to have his sentence reduced.

Bayout was born with genes for violence, his lawyer argued, marshaling lab reports and expert testimony. In 2009, an appeals judge in Trieste lopped a year off Bayout's sentence.

The case was the first known practical application of new research that aims to shed light on the connections between genetics and violent behavior.

Scientists have not found a "violence gene" dooming its unlucky owners to a life of mayhem. Nor do they expect to unearth one.

Instead they are attempting to tease out the complex interactions among genetics, environmental influences and violence — the idea that certain genetic traits, when combined with life experiences, can help propel a person toward a life of crime.

The research that has been done is preliminary and needs to be replicated, the scientists emphasize, and much remains unknown. But if they are right, they say, their work could lead to the development of biologically targeted social programs or even drugs that could neutralize the mix of genes and a toxic environment.

"Ideally, you want to have markers in blood or saliva that could identify populations at risk for aggression," said McGill University pharmacologist [Moshe Szyf](#).

But some scientists and ethicists worry that a focus on the genetics of violence will oversimplify the complex factors that lead to crime and result in overzealous interventions the nation will come to regret. And even as these concepts begin to trickle into courtrooms, they say the existing research in the field is too preliminary to be applied in the real world.

"It is not clear what to do with this information," said Harvard University geneticist [Jon Beckwith](#), an expert on the ethics of genetic research. "It's not clear what is going on."

Our enormously complex set of genes is like a blueprint for our bodies. But although that blueprint is set at



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conception, scientists are learning that the way genes operate — how they are "expressed" — can change.

Another system called the epigenome turns genes on and off, regulating their expression. It operates like an engineer who interprets the blueprints and makes changes based on the environment.

Researchers are investigating whether factors in early development can lead to epigenetic changes that might predispose a person to violence later.

Szyf and colleagues have written several papers on the epigenetics of maternal behavior in rats. In 2004 in the journal *Nature Neuroscience*, they reported that the amount of nurturing a mother rat gave her pups changed the way those pups' genes were expressed and helped determine whether the pup was anxious or calm.

The researchers also showed that the anxiety-producing effect could be reversed with an antifungal antibiotic known as trichostatin A.

But Szyf said interventions of the future, if applied to humans, wouldn't have to be pharmacological. "Maybe you identify these kids when they are very young and expose them to a very rich day care environment," he said.

In 2002, Duke University psychologist [Terrie Moffitt](#) co-authored a paper in *Science* about the MAOA gene, which helps regulate key brain chemicals like dopamine. The study found that males with one common form of the gene who had been severely mistreated in childhood were more likely to engage in antisocial behavior than mistreated males with the other common form.

Other scientists have linked violent behavior, variations of the MAOA gene and social factors that may indicate family stability, such as eating together as a family.

Moffitt cautioned that the work is preliminary: "I am careful about how the public engages with the science and how slowly and cautiously we go before even considering applying any of that."

"The prominent mood in genetic studies is cautious," said University of North Carolina sociologist Guang Guo, who did a [study](#) of 1,000 men that found that several genetic variations were linked to delinquency and social factors. The study was published in 2008 in the journal *American Sociological Review*.

Already, however, work on the genetics of violence is making its way into courtrooms.

A group of scientists at [Vanderbilt University](#) is offering genetic testing to lawyers working on criminal cases. Genotyping for the MAOA gene and one associated with anxiety and depression is \$500 and is sometimes paid out of court funds, said [Nita Farahany](#), an associate professor at Vanderbilt Law School who has been tracking cases of behavioral genetics in the courtroom.

Last year, nearly a dozen lawyers ordered testing from the Vanderbilt lab, a sharp increase over the previous three or four years, Farahany said. Information on the MAOA gene also was presented in Bayout's court hearing.

Farahany predicted that the use of genetic testing in legal cases will keep increasing as juries come to expect scientific-seeming proof that a defendant is or is not predisposed to violence.

"Given that there is genetic testing available, courts and jurors are less likely to take a claim of biological predisposition to violence without supporting tests at face value," Farahany said.

As the research continues, critics warn that society has a long, tragic history of using poorly understood genetic science to justify social policies designed to get rid of classes of people deemed unwanted, dangerous

or inferior.

For decades, some American women were forcibly sterilized as part of the [eugenics](#) movement.

"Three generations of imbeciles are enough," wrote Supreme Court Justice Oliver Wendell Holmes in an infamous [1927 decision](#) that upheld the involuntary sterilization of Carrie Buck, a Virginia woman judged to be the "feeble-minded" daughter of a "feeble-minded" woman and the mother of a "feeble-minded" baby girl.

New York University sociologist [Troy Duster](#) worries about the potential applications of today's research.

"Once we begin to screen for gene disorders, we open a door to making an assessment of what is normal," Duster said. "When that door is opened, when do you close it?"

The clear story behind the research is that genes, except for the few diseases caused by single genetic mutations, don't determine your future, he said.

"If you screen at a genetic level, you miss this complex interaction" between genes and environment, he said. "That is behind this whole issue, the subterranean eugenics of screening. It is presuming a precision that is not there."

Northeastern University criminologist [Nicole Rafter](#) said it is a mistake to ignore biology and solely focus on environment when attempting to deal with violence.

"Modern genetics does not point in an all-nurture direction," said Rafter, author of a book about misguided and tragic attempts to use genetics to prevent crime.

Moffitt said her work on the MAOA gene was a clear example of a more nuanced understanding of the interplay between genes and the environment.

"This was a case where you could see quite clearly, the gene was doing nothing on its own," she said. "In the absence of a person's lifestyle and social relationships, the gene was not a powerful force. And I would hope that the public get that message that a lot of what genes do is under human control."

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