



# Invoking Behavioral Genetics in Criminal Mitigation: What Can Experts Reasonably Say?

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## Abstract

Legal arguments, in criminal trials, the sentencing phase of capital trials, or in post-conviction proceedings in American courts, may incorporate family history, environment, and other presumed nonculpable influences on the development and predispositions of defendants. Attorneys may also proffer expert testimony to enhance a defense claim that the defendant was less culpable for the behavior charged; for example, inherited traits. The terms *heredity* and *genetics*, however, have various meanings and implications for responsibility. This report tracks arguments and testimony cited in American appellate cases in which genetics appeared within mitigation arguments or claims of ineffective assistance of counsel. The results indicate general lack of scientific detail from expert witnesses and poor results in achieving habeas corpus hearings or new trials. Difficulties included demonstrating a scientific basis for genetics claims, separating biological from family/environmental factors, the high threshold for habeas corpus and ineffective assistance of counsel certification, and the group-to-individual inferences drawn from research. The article concludes with two suggestions for expert witnesses: 1) that mere inclusion of hereditary or genetic influences tends to be insufficient to reduce criminal culpability and 2) that invoking genetics or heredity is more effective when bundled with mitigating factors describing the defendant's life experiences.

**Keywords:** Genetics; Heredity; Criminal; Post-conviction relief; Habeas corpus; Mitigation; Ineffective assistance

## Abbreviations

IAC: Ineffective Assistance of Counsel; AEDPA: Antiterrorism and Effective Death Penalty Act; CNV: Copy Number Variation; MAOA: Monoamine Oxidase-A

## Introduction

For expert witnesses, mitigation evidence to reduce defendants' culpability (or to refute such claims) should be a robust area of practice. Yet, outside of death penalty cases, neuroscience usually is not brought to bear on sentencing. Mitigation is often packaged within expert reports, explaining behavior or suggesting that unlawful conduct was partially determined by forces outside the defendant's control—genes and development. Failing resolution at the guilt phase, the sentencing phase of capital trials is a platform for experts to educate jurors on scientific dynamics, or at least correlates, of violence. For a variety of reasons, including expense and lack of expertise by court-appointed lawyers, the science behind behavior may be overlooked. This raises a question of how to repair flawed trials by raising new evidence or citing the trial attorney's ineffectiveness.

In this article, we focus on the invocation of behavioral genetics in arguments about overlooked evidence or in which appellate attorneys believed that trial counsel made material errors. The issues include inadequate presentation of genetic information, legal thresholds for presenting scientific information post-conviction, and resistance from juries and judges to give weight to mitigating factors.

## Sentencing trends

Because the current climate in criminal justice in America militates against a rehabilitation model of sentencing [1], there are fewer opportunities for defendants to express individual qualities that distinguish them from other defendants. As such, sentencing tends to be retributive, not therapeutic. For the defendant with a mental illness or a developmental disorder, presumably mitigating conditions can aggravate punishment when courts focus on permanence, implying risk [2,3]. There is fear on both sides of criminal cases: that scientific evidence will unduly influence jurors either to excuse or mitigate, on the one hand, or focus on future danger, on the other [2]. This is in contrast to the trend in juvenile cases to employ lenience, because adolescent immaturity is transitory [4]. Nevertheless, the introduction of neurobiological evidence has been closely watched since 2005 [5] and has been called "a mainstay of our criminal justice system" [6, p 508].

In American death penalty litigation, wherein all influences on behavior can be examined, attorneys engage expert witnesses in the guilt phase to raise affirmative defenses of insanity, where applicable, or, in the penalty (sentencing) phase to humanize defendants by presenting narratives that stand between the culpable act and death worthiness. Popular tropes include mental disorders generally, head injuries, adverse childhood experiences, environmental factors, and genetic influences on behavior. Denno [7,8], reviewing 800 cases involving neuroscience evidence reports that mitigation evidence, especially in capital cases, has gained traction since 1992.

**Submitted:** 14 January 2020 | **Accepted:** 19 February, 2020 | **Published:** 21 February, 2020

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**Citation:** Weiss KJ, Gutman AR, Berrettini WH (2020) Invoking Behavioral Genetics in Criminal Mitigation: What Can Experts Reasonably Say? SM J Forensic Res Criminol 4: 7. doi: <https://dx.doi.org/10.36876/smjfr945423>



## Post-conviction Proceedings

Unless the scientific evidence is used at trial, it is difficult for convicts to utilize post-conviction avenues such as habeas corpus and ineffective assistance of counsel (IAC). The Writ of Habeas Corpus, a traditional way for a death-row inmate to transcend lower-court rulings, has been out of reach for many [9,10]. The predominant reason is the effect of the Antiterrorism and Effective Death Penalty Act (AEDPA) [11], coupled with Supreme Court affirmations, that emphasize deference to state courts' rulings [7,12]. There is no automatic right to an appeal; a district or circuit judge may issue a Certificate of Appealability if there is a "substantial showing" that a constitutional right has been denied.

Like the high threshold for post-AEDPA habeas petitions, IAC claims encounter resistance. Deference goes to the trial attorney, whose omissions are usually considered harmless (immaterial to the outcome). Counsel's failing to invoke genetic factors predisposing the defendant to violence is often insignificant against the evidence linking the defendant to the crime. The invocation of traits, inborn or learned, tends not to persuade, and has the potential to backfire.

All told, both the AEDPA and the high threshold for IAC claims constitute formidable barriers to the use of scientific testimony in post-conviction matters. Testimony is clearer when it includes a psychiatric diagnosis, but what do we mean when we state that a condition is *hereditary* or *genetically determined*? Given the often-vague nature of such claims and the current gaps in our understanding of genetic underpinnings of behavior, there are mixed results after using this argument in court. We explore such efforts in our discussion here.

## Heritability of psychiatric disorders

In the tactical use of behavioral genetics, most claims do not exceed mere association, although most psychiatric disorders demonstrate heritability (that fraction of risk attributable to genetic factors) [13]. For violence risk and adult criminality, parsing genetic and environmental factors on an individual basis is not practicable. There are few, if any, common DNA variations (alleles) of large effect for psychiatric disorders (including intellectual disabilities) which are of interest in law. Nearly all common alleles that increase risk for psychiatric disorders have small effect sizes (explain less than 1% of the variance in risk). Even aggregated, such small genetic contributions do little to persuade judges and juries to distinguish a person from the general population, since defendants made their own decisions to offend versus being controlled by their genes.

Estimates of the influence on risk for a particular psychiatric disorder (e.g., schizophrenia) for all relevant common alleles (the polygenic risk score) explain less than 30% of risk. Thus, common alleles, including the polygenic risk score, are of limited interest in legal proceedings, since the result would not reach reasonable scientific certainty.

## Copy number variation

Rare alleles can have large effects on risk and strong

associations with aberrant behavior. Such alleles are often copy number variations (CNVs). CNVs are cytogenetic abnormalities that are too small to resolve by microscopic examination of the chromosomes, but still large enough to involve hundreds or thousands of DNA base pairs. They are, therefore, mini-duplications or deletions of genetic material. Studies of CNVs in neuropsychiatric disorders have been ongoing for several years. CNVs have been found to be widespread in healthy individuals, reportedly concentrated in areas of possible significance for autism [14], intellectual disability [15], and schizophrenia [16]. They may be either inherited or *de novo*, with *de novo* events more important, at least for the childhood-onset disorders. *De novo* status is demonstrated by absence of the variation in the parents' genomes. Evidence of CNVs would add to the potency of a mitigation argument. Even so, there is no causal relationship implied between the condition and the criminal act, thus lessening the possibility of post-conviction relief.

## Neurotransmitter variability

The 1993 reports by Brunner and colleagues [17,18] of a rare familial mutation involving a genetic knockout causing the absence of monoamine oxidase-A (MAOA), focused attention on a strong link between a mutation and severely disturbed behavior. A Dutch family included 14 men with intellectual deficiency and impulsive/violent behavior, 5 of whom were studied by the authors. The findings, often cited, leave little doubt about an association between the absence of MAOA and the phenotype, without invoking gene-environment interaction.

An early attempt to use Brunner's findings at sentencing failed in a post-conviction motion to obtain funding for genetic testing for MAOA absence. In *Mobley v. State* [19,20], the petitioner, citing Brunner's research, believed it was his right to have testing that could disclose a condition material to culpability. Mobley himself was not related to the Dutch family, and there was no indication that the genetic defect was distributed in the population. The divided Georgia appeals court said: "[After acknowledging] that evidence in mitigation in the sentencing phase of a capital case may not have to have reached a scientific stage of verifiable certainty normally required for the introduction of scientific evidence. We find no error in the trial court's ruling" [16, p 293].

There is no reason to suspect the MAOA-related mutation in criminal defendants, though variability in their neurotransmitter availability and metabolism may suggest a heritable contribution to behavior. Defense experts, nevertheless, have cited the MAOA literature as well as deficient serotonin in support of legal arguments negating *mens rea* or in mitigation. This is generally overreaching. A series of cases discussed by Bernet and colleagues [21,22] displays various tactics in cases from 1994 to 2007. The principal ones are that deficient MAOA and/or serotonin may be associated with lowered impulse control, that the defendant acted in a state of rage, and that the defendant did not possess the requisite mental capacity for murder. The authors cited that arguments based on the effects of neurotransmitter variability, overall at that time, have had little impact on outcomes, observing that testimony is enhanced when childhood abuse is cited, but that risk of violence, by any dynamic, is not typically mitigating.



The authors, referencing the work of Caspi and colleagues [23], noted the moderating effects of abundant MAOA on aggression in children. In at least two of their cited cases, jurisdictions permitting the evidence in support of diminished capacity (low-serotonin cases), leading to convictions of second-degree, instead of first-degree murder. Citing the Caspi article and others, Bernet and colleagues [17] asserted that genotype, coupled with childhood maltreatment, and predicted violence more robustly than the genetic variant alone (gene-by-environment or GxE interaction). As Dr. Bernet said after the 2009 trial of Bradley Waldroup in Tennessee, “We didn’t say these things made him violent, but they certainly constituted a risk factor or a vulnerability” [24]. Waldroup was convicted not of murder, but of voluntary manslaughter [25,26], and sentenced to 32 years in prison. This outcome has been considered a positive signal in the application of neurochemistry to the analysis of criminal culpability.

Even with Waldroup’s outcome, it is difficult for defense attorneys to link predispositions, on the one hand, with capacity for criminal intent, on the other [27,28]. There must be more, as Morse observed: “It must be shown how, precisely, the genetic data are relevant to whether a defendant acted, whether he or she possessed a particular mens rea, and whether the mental states relevant to defenses were present” [21, p 379]. While it may not be realistic to apply genetic data in pursuit of negating an element of intent or an insanity acquittal, the information can be the basis for sentencing arguments or plea negotiations [20]. When proffered at trial, expert testimony may or may not be admitted under gatekeeping rules. Walker and Bernet suggest operational factors: “the thoroughness of the expert witness in explaining the scientific basis for the testimony; the nature of the underlying science regarding the particular test or tests that have been performed; and the relevance of the tests to the issues being addressed at each specific trial” [20, p 244].

### Case review: Methods

Using the Nexis Uni® database of federal and state decisions, we queried the terms “genetic AND criminal AND mitigation AND NOT DNA.” The results returned 436 hits on August 7, 2017, from which we gathered 268 decisions in death penalty appeals. We chose this group of cases for two reasons: that we did not have access to trial-court decisions that were not appealed and that there is liberal acceptance of scientific testimony in the sentencing phase. Many of them merely mentioned genetics, added to a list of alleged trial-attorney omissions. Thus, our method is not necessarily a reflection of how mitigation evidence has been used in trials. A fuller discussion of the methodology involved in cataloguing use of scientific testimony can be found in an article by Denno [29,30]. We did not undertake a statistical analysis, since there is no reliable method to assess the impact of genetics-based testimony in the context of legal arguments. Instead, we will illustrate expert testimony and legal arguments and make recommendations for strengthening genetics-based testimony.

## Results

### Evidence and post-conviction arguments

The cases reviewed involved appeals arguing that genetic evidence had not adequately been explored at trial. Approximately 90% of the death penalty appeals did not result in reconsideration of verdict or sentence, mostly because they failed to reach thresholds for appealability. Aside from procedural issues barring further proceedings, courts regarded, as too weak, arguments involving the use of scientific testimony on family history or biological predispositions; there would have been no difference in the verdict or sentence. In the following sections, we illustrate types of statements made by expert witnesses, typical arguments by counsel, and several comments by judges.

### Positive outcomes for petitioners

Approximately 10% of the death penalty appeals reviewed resulted in resentencing or remands to the trial court. Several involved *Atkins* [31] claims, that the defendant had intellectual disability and was improperly sentenced to death. Often, when appellants argued IAC, they cited attorneys’ failure to obtain genetic testing, but were more likely to state that jurors did not hear a developmental history. The following are examples of death penalty reversals on which courts based, to one degree or another, on the right of a defendant to proffer scientific evidence.

#### Caro v. Woodford (2002)

There were many attempts to implicate substances in our sample. In most of them, there was a presumption that a family history of substance use was relevant, as if to suggest a causal link to the behavior in question. Evidence of a damaged brain, not due to intoxication alone, however, was more persuasive. In *Caro v. Woodford* [32,33], the appellant, whose habeas relief was granted, claimed toxic exposure as well. Genetic influences are mentioned, but do not play a central role:

“Dr. Bear concluded that Caro suffered from both structural and functional brain damage based on: his chronic and acute exposure to cholinesterase inhibitors; his exhibition of many of the autonomic symptoms of such exposure; indicators of depression, including suicide threats; memory loss and other disassociative [sic] events; his mother’s anemia; poverty-stricken childhood; history of physical, sexual, and emotional abuse; and childhood injuries. He also opined that Caro suffered from a genetic abnormality, reflected in his family’s history of alcoholism and depression, which interacted with his exposure to neurotoxins to increase the risk of brain dysfunction” [24, pp 1252–1253].

#### Pinholster v. Ayers (2009)

In a Ninth Circuit appeal from Pennsylvania [34,35], because trial counsel had been ineffective, the court felt the need to protect the defendant from the double-edged-sword effect [6] of developmental evidence sounding aggravating to jurors. Here, the appellant’s death sentence was vacated because the jury was not availed of detailed evidence of possible genetic factors: “Having learned that all of his siblings and his biological father suffered



from mental problems, [the jury] might well have concluded that Pinholster was a bad apple from a bad tree and there was no hope for rehabilitation or redemption" [25, p 715]. The same court, however, took a dim view of mitigation evidence of substance use, allegedly having a genetic basis: "Telling the jury a lot more about what a druggie Pinholster was would probably have hurt him rather than helped him" [25, p 715, internal citations omitted.].

### **Weik v. State (2014)**

The Supreme Court of South Carolina [36,37] overturned a post-conviction ruling against Mr. Weik. Here we see a reversal of a cynical lower-court decision: The court stated that "testimony would have demonstrated Petitioner's genetic predisposition to schizophrenia and helped explain his auditory and visual hallucinations at the time of the shooting. Given that ... testimony presented no meaningful evidence of Petitioner's social history, we reject the PCR judge's conclusion that Petitioner merely seeks a "'fancier' mitigation case" [26, p 238]. Citing ineffective assistance of counsel, the matter was remanded for resentencing.

### **Delgado v. State (2015)**

This was an appeal in a Florida case in which a police officer was killed [38,39]. The defense provided mitigation evidence such as "had a long standing, potentially genetic, psychiatric illness," and "the disease is outside of his control" [27, p 983]. All told, Mr. Delgado had 3 statutory and 41 nonstatutory mitigators. The jury voted 8 to 4 in favor of death, and Mr. Delgado was sentenced accordingly. The appellate decision, however, cited disproportion between the facts of the crime and the sentence, upholding the conviction but reversing the sentence. The genetics argument, most likely, was a minor factor.

### **Nonspecific references to inheritance**

Most references to genetics were vague descriptions suggesting heritability: genetic determinants or loading, predisposition, background, chemistry, risk, vulnerability, influences, factors, transmission, and history. Some of the references used in legal arguments were overly broad; for example, that the appellant's personality testing indicated "a long-standing psychotic disturbance, [which was] a biological problem with the brain [that could be] either genetic or due to brain damage" [40, p 1306]. In a similar argument: "[The appellant's] intellectual disability could have been caused, in part, by 'genetics or intrauterine developmental problems' that a childhood head injury 'could have worsened'" [41, p 1250]. In a failed IAC claim, an expert witness said that "poor development of the brain...[could be due to] a genetic code [or] something he acquired, something in the environment, we don't know" [42, p 223].

When familial substance use was argued, it was not persuasive. For example:

As stated by one of Petitioner's experts, the significance of the family history is that Petitioner may have had little control over his substance abuse based on his genetics. Although Petitioner's genetic predisposition to alcoholism may be sympathetic, it is not much more so than the fact that his family encouraged him

to abuse substances at a young age, a fact that was considered at sentencing" [43, pp 43–44].

### **Waiver of mitigation evidence in *Schriro v. Landrigan* (2007)**

Attributing causality to genetic influences raises philosophical, evidentiary, and practical considerations [44]. The U.S. Supreme Court decision in *Schriro v. Landrigan* [45,46] discusses habeas corpus relief due to alleged IAC, providing us with an overview of similar cases to date. Mr. Landrigan instructed trial counsel not to employ mitigation evidence in his capital case. Later, he argued that his refusal was incompetent and that he should be permitted to argue that he was genetically predisposed to violence. The Court ruled that a knowing and intelligent decision to waive evidence is not required, and Mr. Landrigan could not shift blame to counsel [47]. He was executed in 2010 [48]. The Court observed the damaging rhetorical effects of a defense argument taken too far: "On this record, assuring the court that genetics made him the way he is could not have been very helpful. There was no prejudice" [32, p 481].

### **References to mental disorders**

References to psychiatric conditions included schizophrenia, essential tremor, bipolar, fragile-X, dissociative disorder, psychosis, Klinefelter's, low serotonin, psychopathy, XYY, personality disorder, and fetal alcohol spectrum. There were several mentions of heritable factors in intellectual disability claims. For example: "Genetically, it appears several of Brumfield's family members also suffer from mental retardation, including a wheelchair-bound first cousin with moderate to severe retardation" [49, p 405, citing medical evidence]. In one case, the decision cited sloppy logic: "Although Beckworth alleged ... that '[s]ome forms of mental retardation are genetic,' he failed to allege that the form of mental retardation from which he or his family members allegedly suffered was one of those genetic forms" [50, p 567]. Many other cases included weak claims that the defendant's condition was genetically determined or that failure to bring out genetics at trial harmed the defendant. For example: "Darryl's medical records were relevant, since they show that he suffered from paranoid schizophrenia. That condition has a genetic component, so the fact that Sheppard's uncle was schizophrenic makes it somewhat more likely that Sheppard is too" [51, p 345].

### **Judicial responses**

Courts often were unsympathetic to genetics-based arguments. A few examples highlight this point:

"The Court notes that Hardy has now had years to assess whether he suffers from any 'serious affective or psychotic mental disorders,' including 'mental illness with a significant genetic component.' The Court assumes that counsel, clearly experienced and competent, has long ago investigated and assessed Hardy for this level and type of disability" [52, pp 4–5].

"Dr. Cunningham faults counsel for, among other things, not presenting evidence related to adverse developmental factors experienced by Sherman, such as trans-generational and genetic





influences... In this court's view, the report amounts to little more than Monday-morning quarterbacking and is relatively benign when compared to expert opinions in cases where prejudice has been found" [53, pp 15–16].

"In denying this claim, the Supreme Court [in *Schriro v. Landrigan*, (32)] said that the proposed 'mitigation evidence was weak' and that any showing 'that genetics made [the petitioner] the way he is could not have been very helpful. There was no prejudice.' Given such declarations by the Supreme Court, this Court cannot conclude that the state superior court made an unreasonable decision when it did not find prejudice from the absence of an ARND [alcohol-related neurodevelopmental disorder]-based mitigation defense" [40 pp 72–73].

In an Alabama appeal, the court cited how glib use of "genetics" can undermine a claim: "The court simply observed, with citation to relevant Eleventh Circuit authority that petitioner has ignored, that his claim of prejudice was undercut because his two younger siblings grew up in the same circumstances [which he stridently described as 'nightmarish'] and are not alleged to have resorted to similar criminal behavior, or even to have succumbed to the substance abuse which he has described as essentially an inevitable consequence of genetics and environment in his family." [41, pp 97–98].

Finally, a colloquy in a Pennsylvania post-conviction case [42] illustrates judicial resistance to genetics claims:

THE COURT: Now, the history of his family life under the mitigating circumstances, true, but has to be timely towards sometime toward the time when this event occurred that would somehow have affected his conduct. You have not shown that at all.

COUNSEL: I would need to call Dr. Maher and Dr. Larson to show to you the genetic predisposition.

THE COURT: Are you saying that people who are genetically predisposed, for example, Indians who are high on drugs all the time have more rights in this country than everybody else? Do they have a right to go around killing people because they can't get the death penalty because of their background and their drug abuse, but people who are straight and honest and law abiding and they do the shooting, they have to get the death penalty? Is that what you're saying?

COUNSEL: No, Judge

THE COURT: That's what it sounds like to me. It sounds like you're trying to somehow classify this case by saying this defendant did not get a fair trial because A, B, C, D, all of the things that you have gone through, which are meaningless in my view.

COUNSEL: Well, Judge, I'm trying to say that --

DISTRICT ATTORNEY: We have no objection to counsel calling these witnesses, Judge, if he thinks this somehow is going to change [42, p 358].

## Discussion

Expert testimony is essential to mitigation arguments

invoking genetic influences. Although knowledge of behavioral genetics can inform our overall understanding of the dynamics of violence, evidentiary, statutory, and attitudinal barriers militate against its practical use. But there is a problem: the mistake of treating genetics as causation for legal purposes. It is what Morse has termed the *fundamental psycholegal error*: "Believing that causation per se mitigates or excuses responsibility is the most pernicious confusion bedeviling the attempt to relate scientific findings to criminal responsibility" [21, p 379]. Beyond this logical error is the uncertainty over how jurors will interpret testimony on genetics, including rejecting it based on their predispositions [43,44].

We have illustrated how expert witnesses have fashioned testimony intended to render defendants less blameworthy. When the thrust of the argument is failure to investigate genetic factors, the petition is nearly always doomed. The principal reason is that the testimony is devoid of science, invoking "bad influences," that fails to distinguish genetics from environment. There are several components to the problem: attorneys' lack of awareness of principles of genetics, inadequate funding of laboratory tests, expert witnesses' lack of preparedness, jurors' lack of interest, and appellate attorneys' simply jumping on the bandwagon of mitigation through science [45].

The substantial legal barriers to post-conviction arguments (habeas corpus and IAC) suggest that defense attorneys and mental health experts working within mitigation teams focus on stronger presentations in jury trials. If genetics is to be invoked, there must be competent expert testimony on how hereditary factors reduce culpability, and how they are distinguishable from environmental ones. "Blame heredity" arguments, masquerading as genetics, are unlikely to prevail. Expert witnesses must be mindful not to conflate explanations and excuses or effect and causation [46].

Currently, behavioral genetics is a science with the promise of a robust forensic application [47]. Will its use grow as knowledge advances or recede as jurimetrics suggests lack of rhetorical power? We agree with Appelbaum and Scurich [48] that time will tell whether, for example, the coupling of genetics with neuroimaging or quantification of effect size, offers judges and juries a nuanced view of biological factors in culpability. If so, fact finders may be more likely to accept science in acceptable dosages, when packaged with other mitigators rather than categorically; that is, GxE arguments. However, recent jury-simulation research suggests little overall effect when genetic dynamics are introduced [47,50]. Denno [51] argued that scientific testimony is often used in sentencing "as part of a defendant's mitigation story" [51, p 974] and that the argument is best used when woven into a comprehensive narrative of the defendant (for more detailed review, see [6,22,51,52]. In a differently designed survey of over 10,000 respondents [53], over half endorsed the use of evidence "genetic disadvantage" in determining degree of punishment, but about 70% said that genetics would not negate responsibility. We agree that there is potential in credibly presented genetics evidence, with the understanding that expectations be realistic, not overreach, and do not tread on traditional legal views of



determinism (that persons have agency).

## Conclusions

Despite the intuitive allure of linking medical facts to specific behaviors, a robust scientific approach is lacking. Aside from the philosophical problems introduced by determinism, which would interfere with the duties of jurors and judges, human behavior is too complex to be subjected to precise determination of causality. The principal issue is that, despite genetic endowment, individuals have agency and make decisions that have consequences. Therefore, accountability will persist despite scientific explanations. This does not mean that juries, hearing testimony about heredity, neurochemistry, and behavior, should be deprived of an opportunity to weigh the evidence. The state of the art, however, does not support statements about causality of behavior, only correlations of behavior with known genetic or biochemical conditions that juries can consider.

Testifying experts must resist overly broad claims and blanket statements about a defendant's genetic endowment. At the moment, leading candidates for evidence include allelic variations associated with violence, demonstrable neurotransmitter aberrations, and rare conditions such as CNVs and missing enzymes. We conclude that mitigation evidence of behavioral genetics, appropriately embedded within a broader approach, has an enduring role in criminal mitigation. As developments in neuroimaging, neuropathology, and clinical psychiatry deepen our understanding of the basis for a person's characteristics and decision making, there will be an expanded role for testimony that will inform the analysis of criminal responsibility. Until then, our claims should be modest.

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