

IN THE SUPREME COURT OF THE STATE OF NEW MEXICO

Opinion Number: 2021-NMSC-010

Filing Date: February 25, 2021

No. S-1-SC-37216

CONSOLIDATED WITH

No. S-1-SC-37217

STATE OF NEW MEXICO,

Plaintiff-Petitioner/Cross-Respondent,

v.

ANTHONY BLAS YEPEZ,

Defendant-Respondent/Cross-Petitioner.

ORIGINAL PROCEEDING ON CERTIORARI

Mary Marlowe Sommer, District Judge

Released for Publication April 6, 2021.

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OPINION

NAKAMURA, Justice.

{1} Defendant Anthony Blas Yopez (Yopez) was convicted of, among other crimes, second-degree murder. At issue before this Court is the district court's exclusion of proposed expert testimony concerning Yopez's alleged genetic predisposition to impulsive violence—testimony Yopez offered on the issue of whether he had the

deliberate intent to kill. We hold that the district court did not abuse its discretion by excluding the testimony. Accordingly, we reverse the Court of Appeals' holding on this issue, reject Yepez's cross-appeal, and affirm his conviction.

I. BACKGROUND

{2} The relevant facts are undisputed and correctly summarized in the Court of Appeals' opinion, so we need not repeat them in detail here. *State v. Yepez*, 2018-NMCA-062, ¶¶ 2-6, 428 P.3d 301. Yepez and his girlfriend, Jeannie Sandoval (Sandoval), lived with George Ortiz (Ortiz), the boyfriend of Sandoval's adoptive mother. On October 29, 2012, Yepez killed Ortiz during an argument, after which Yepez and Sandoval set fire to Ortiz's body. *Id.* ¶¶ 3-4. Ortiz's autopsy concluded that his cause of death was homicidal violence and thermal injuries, and that the manner of death was homicide. *Id.* ¶ 6. The State charged Yepez with (1) first-degree murder, (2) conspiracy to commit first-degree murder, (3) tampering with evidence, and (4) unlawful taking of a motor vehicle.

A. The Defense's Proffered Expert Testimony

1. Pretrial motions

{3} Before trial, Yepez filed a motion in limine to admit expert testimony to the effect that Yepez "experienced maltreatment in childhood" and has a genotype¹ that confers low levels of monoamine oxidase A (MAOA)² activity, which in combination produce "maladaptive[] or violent[] behavior." He emphasized that "[t]his testimony will serve as almost the entire basis of [his] defense" to first-degree murder. One month later, Yepez filed a so-called "Notice of Incapacity to Form Specific Intent," stating his plan to call an expert "on the issue of whether [Yepez] was incapable of forming the specific intent required as an element of the crime charged," namely, first-degree murder, and referring to the proposed expert testimony on Yepez's genetic predisposition to violence. Yepez also filed an amended motion in limine clarifying that he was requesting a hearing on the admissibility of this genetic evidence. Yepez identified a number of potential experts in the foregoing motions, including a neuropsychologist, James S. Walker, Ph.D., and a geneticist, David A. Lightfoot, Ph.D., whose report on Yepez's MAOA genotype was appended to the original motion in limine.

{4} The State then filed its own motion in limine seeking to exclude the defense's proposed expert testimony. The State did not dispute the qualifications of the proffered

¹A genotype is an individual's collection of genes. The term also can refer to the two alleles inherited for a particular gene. The genotype is expressed when the information encoded in the genes' DNA is used to make protein and RNA molecules." Nat'l Insts. of Health, Nat'l Human Genome Research Inst., *Genotype* (Nov. 5, 2020), available at <https://www.genome.gov/genetics-glossary/genotype> (last visited Nov. 25, 2020).

²MAOA is an enzyme that exerts an effect on the metabolism of various neurotransmitters in the brain. Avshalom Caspi et al., *Role of Genotype in the Cycle of Violence in Maltreated Children*, 297 *Science* 851, 851-54 (2002) (hereinafter the "Caspi study"), available at http://local.psy.miami.edu/faculty/dmessenger/c_c/rsrscs/rdgs/temperament/caspi2002.maltreatedgenotype.pdf (last visited Nov. 25, 2020).

experts but argued that the proposed evidence was not relevant or reliable under Rule 11-702 NMRA, *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), and *State v. Alberico*, 1993-NMSC-047, 116 N.M. 156, 861 P.2d 192. Specifically, the State contended that the alleged predisposition to violence resulting from a low-activity MAOA genotype and childhood maltreatment is not yet understood with sufficient precision to be reliable or relevant as a predictor of violence in individuals. The State further argued that Yepez's self-reported childhood maltreatment was uncorroborated and self-serving. Finally, the State contended that the proposed expert testimony would mislead and confuse the jury due to the complexity of the testimony and the jury's susceptibility to a deterministic interpretation.

2. *Daubert/Alberico* hearing

{5} At the *Daubert/Alberico* hearing, Yepez presented the testimony of Walker, Rose McDermott, Ph.D., a political scientist and psychologist with expertise in the behavioral sciences, and Adrian Raine, Ph.D., a psychologist. All three witnesses based their opinions on research purportedly supporting a relationship between childhood maltreatment combined with low MAOA activity and predisposition to antisocial aggressive behavior. Among the earliest research is a 1993 study from the Netherlands, focusing on a family in which a genetic mutation resulted in a complete deficiency of MAOA in certain males. H.G. Brunner et al., *Abnormal Behavior Associated with a Point Mutation in the Structural Gene for [MAOA]*, 262 *Science* 578, 578-80 (1993) (hereinafter the "Brunner study").³ The study found a relationship between "isolated complete deficiency of MAOA activity and abnormal aggressive behavior in affected males." *Id.* at 579-80. This complete deficiency of MAOA, characterized by impulsive aggressive behavior, is known as "Brunner syndrome."

{6} This study was followed by the "classic" Caspi study in 2002, finding that maltreated male children with a genotype conferring low levels of MAOA expression were predisposed to develop antisocial behavior. See Caspi study, *supra*, at 851, 853. Raine and Walker both testified that the Caspi findings have now been replicated in numerous studies, citing a then-recent meta-analysis of twenty-seven peer-reviewed studies by Amy L. Byrd and Stephen B. Manuck, *MAOA, Childhood Maltreatment, and Anti-Social Behavior: Meta-analysis of a Gene-Environment Interaction*, 75 *Biological Psychiatry* 9, 9-17 (2014) (hereinafter the "Byrd and Manuck study").⁴ The meta-analysis included a number of studies which had failed to replicate Caspi's findings, but concluded that the twenty-seven showed, "[a]cross male cohorts," a "moderately reliable interaction of MAOA variation and environmental risk factors, with childhood adversity presaging antisocial outcomes more strongly in persons of low-activity, compared with high-activity, MAOA genotype." *Id.* at 14. McDermott also testified regarding her recent

³Available at <https://ncbs.res.in/sitefiles/gb2012/Abnormal%20behavior%20associated%20with%20a%20point%20mutation%20in%20the%20structural%20gene%20for%20monoamine%20oxidase%20A.pdf> (last visited Nov. 25, 2020).

⁴Available at https://www.researchgate.net/publication/240308439_MAOA_Childhood_Maltreatment_and_Antisocial_Behavior_Meta-analysis_of_a_Gene-Environment_Interaction (last visited Nov. 30, 2020).

experiment and report thereon, finding that participants maltreated as children who had low-activity MAOA were more likely to want to punish a perceived aggressor relative to participants with high-activity MAOA.

{7} Walker conducted a forensic neuropsychological examination of Yepez and requested genetic testing of Yepez as an aspect of that examination. In the *Daubert/Alberico* hearing, Walker explained that he asked Lightfoot to look at Yepez's MAOA gene expression and "tell [him] whether or not Mr. Yepez had a low or high activity of that gene." Lightfoot's report concluded that

the deletion of the MAOA allele in [Yepez] encompasses one or both of the amplification sites. The size of the deletion cannot be determined without further experimentation. However, there can be no doubt that [Yepez] carries a rare mutation in the MAOA gene on [his] single X chromosome. . . . Outcomes to be predicted from an MAOA deletion would include aggressive behavior as characterized for Brunner's syndrome

{8} Walker opined, based on this report, that Yepez has "an extremely low function of the [MAOA] gene," though he conceded that "[w]e don't know if Mr. Yepez really has the Brunner syndrome, if he really has a no[-]activity gene." Walker also testified that Yepez credibly reported experiencing a "pretty horrific childhood" characterized by significant abuse. When asked his opinion as to the implications of these findings, Walker responded that Yepez "committed an act of impulsive, senseless violence in this particular case," and that Yepez's "history of childhood abuse and . . . this low MAOA activity gene made him exceptionally predisposed to committing violent behavior."

{9} After receiving evidence at the *Daubert/Alberico* hearing, the district court identified the question it was being asked to decide as follows: "whether to allow [Walker] to testify before the jury that—that [Yepez]—the fact that he has a history of child abuse, a low MAOA activity gene made him exceptionally predisposed to committing violent behavior." The district court concluded—with respect to the underlying science drawing connections between childhood maltreatment of males having low levels of MAOA and increased violent behavior—that "in this case, the *Daubert* factors were met." The court went on, however, emphasizing that, under Rule 11-702 and *Alberico*, an expert opinion is not of assistance to the jury unless the scientific technique or method upon which it is premised is reliable. Applying this standard, the court stated, "I'm really kind of iffy on whether—whether we've satisfied—whether it's a scientific technique that's reliable enough to prove what it [purports] to prove," observing that the thirty-year longitudinal study referenced in periodicals that the defense provided to the court was "inconclusive" and that there is still "work to be done."

{10} The district court then came to its overall conclusion and said, "here's where I find that the testimony is not going to be admitted." The court explained that no expert had interpreted, or demonstrated his or her qualifications to interpret, Lightfoot's report on Yepez's MAOA genotype. The court noted the statement in Lightfoot's report that

“the size of the deletion cannot be determined without further experimentation” and found this to be significant, explaining that

I don't know how low—I didn't hear any testimony educating me on—that this was a low MAOA, and I think what was missing was that you failed to call Dr. Lightfoot. . . . I can't find that Dr. Walker's testimony is going to be helpful to the trier of fact because I . . . don't have any evidence before me from the person that did the testing that the result was a low MAOA.

3. Motion for reconsideration

{11} Yepez filed a motion for reconsideration of the district court's ruling excluding the proffered expert testimony. He pointed out that the court had “seemingly determined that the proposed testimony meets the requirements of *Daubert* and *Alberico*” yet also that “the evidence would not be helpful to the trier of fact because . . . there was no testimony from . . . Lightfoot that the test results indicated [Yepez] had a low functioning MAOA gene.” Yepez argued that Rule 11-703 NMRA “allows an expert to base his opinions on facts and data that he is aware of or has personally observed” and therefore that the “separate admission of the laboratory results” is not required. Yepez attached an affidavit from Raine, stating that Lightfoot's report documenting a “rare” mutation on the MAOA gene—namely, a deletion in the promoter region of that allele—“is consistent with very low levels” of MAOA activity. An affidavit from Lightfoot confirmed this interpretation. Yepez also submitted an affidavit from Walker, in which Walker stated that he reviews reports like the one Lightfoot produced with some regularity and that the report showed that Yepez has a low-activity MAOA genotype. Walker added that “Yepez, due to his genetic characteristics and childhood maltreatment, is predisposed to acts of impulsive violence and is substantially more likely to engage in acts of impulsive violence than the ordinary person.”

{12} The district court denied Yepez's motion. In its written order, the court impliedly accepted the experts' interpretations of Lightfoot's report but found the proffered testimony to be insufficiently reliable or relevant on the issue of whether Yepez formed the specific intent to kill Ortiz. First, having explicitly identified Yepez's recent filing of a “notice of incapacity to form specific intent,” the court found that Yepez's alleged predisposition to violence did not meet the definition (provided in UJI 14-5101 NMRA) of a mental disease or disorder which might render a person incapable of forming the specific intent to kill. Second, as to whether Yepez's alleged predisposition to violence tended to show that, at the time of the murder, he did not have the specific intent to kill, the district court concluded that Walker's proffered opinion was not reliable or relevant. Specifically, the consensus of the experts was that Yepez had low MAOA activity, but not a complete deficiency of activity. And while the Brunner study found impulsive violence to be a characteristic of a *complete* deficiency of MAOA activity, studies regarding *low* MAOA activity combined with childhood maltreatment documented increased outcomes of aggressive and antisocial behavior—not impulsive behavior or impulsive violence as such. The district court determined that while the broad scientific findings of the Caspi study and progeny met the *Daubert* factors, “Walker's testimony d[id] not meet the *Daubert* factors” and was “not grounded in established scientific

methods or principles” because it “misstate[s] . . . *the results of the studies Dr. Walker relies upon for his opinion.*” (Emphasis added.)

B. Trial and Sentencing

{13} After trial, the jury received instructions on conspiracy to commit murder; first-degree murder; the lesser included offenses of second-degree murder, voluntary manslaughter, and involuntary manslaughter; tampering with the evidence; and unlawful taking of a motor vehicle. The jury found Yepez guilty of (1) second-degree murder, (2) tampering with evidence, and (3) unlawful taking of a motor vehicle. The district court sentenced Yepez to twenty-two and one half years in prison.

C. Opinion of the Court of Appeals

{14} Yepez appealed his conviction for second-degree murder, arguing that “the district court improperly excluded expert opinion testimony related to his ability to form deliberate intent and as a result, his conviction for second-degree murder should be reversed and remanded for a new trial.” *Yepez*, 2018-NMCA-062, ¶ 1. Yepez also argued that the proposed testimony would have constituted a defense to second-degree murder, voluntary manslaughter, and involuntary manslaughter. *Id.* ¶ 35.

{15} In evaluating the admissibility of the expert testimony, the Court of Appeals did not address the qualifications of the proffered experts because the State did not raise the issue in the proceedings below. *Yepez*, 2018-NMCA-062, ¶ 24. The Court of Appeals also assumed but did not decide that the underlying science supporting a relationship between low MAOA activity accompanied by childhood maltreatment and predisposition to antisocial and aggressive behavior was reliable. *Id.* ¶¶ 24, 31. It then interpreted the district court’s basis for excluding the expert testimony as follows: “In essence, the district court determined that there was an analytical gap between the reliable scientific knowledge presented, including the Caspi study and the meta-study, and . . . Walker’s affidavit testimony that [Yepez] is ‘predisposed to acts of impulsive violence and is substantially more likely to engage in acts of impulsive violence than the ordinary person.’” *Id.* ¶¶ 28-29 (concluding that the district court “believed that . . . Walker’s testimony with respect to [Yepez’s] impulsivity *went beyond the underlying science*” (emphasis added)).

{16} The Court of Appeals held that the district court’s exclusion of the testimony based on an “analytical gap” was error and that the strength of the experts’ conclusions based on the underlying MAOA science ought to have been left to the jury, relying on this Court’s opinion in *Acosta v. Shell Western Exploration & Production, Inc.*, 2016-NMSC-012, ¶¶ 26-28, 370 P.3d. 761. *Yepez*, 2018-NMCA-062, ¶¶ 28-29. However, the Court of Appeals also held that the error was harmless. *Id.* ¶¶ 32-36. It reasoned that the expert testimony was only offered to “establish an impulsiveness” on Yepez’s part; therefore, the testimony was pertinent to disproving that Yepez deliberated before killing Ortiz but was not pertinent to any element of the lesser-included offenses—general intent crimes for which no showing of deliberation was required. *Id.*

II. DISCUSSION

{17} Both the State and Yopez seek this Court's review of the Court of Appeals' holdings. The State argues, consistent with the special concurrence of Judge Emil Kiehne in the Court of Appeals, *id.* ¶¶ 38-41, that the Court of Appeals "improperly reached out to decide that the district court abused its discretion," given that any abuse of discretion was harmless error. Therefore, the State urges, this Court ought to vacate the portion of the Court of Appeals' opinion dealing with the admissibility of the expert testimony. Yopez, in turn, argues on cross-appeal that the district court indeed erred but that the error was prejudicial and affected his constitutional rights. Yopez contends that the proffered testimony was relevant not only to the first-degree murder charge but also to the jury's deliberation between second-degree murder and the lesser-included charges of voluntary and involuntary manslaughter. For the reasons set forth below, we hold that the district court did not abuse its discretion by excluding Yopez's expert testimony. For the same reasons, and because Yopez did not offer expert testimony on any issue except the question of deliberate or specific intent to kill, we reject Yopez's cross-appeal.

A. Standard of Review

{18} We review a district court's admission or exclusion of evidence for an abuse of discretion. *State v. Downey*, 2008-NMSC-061, ¶ 24, 145 N.M. 232, 195 P.3d 1244; *State v. Torres*, 1999-NMSC-010, ¶ 27, 127 N.M. 20, 976 P.2d 20. An abuse of discretion occurs when the district court's ruling "is clearly against the logic and effects of the facts and circumstances of the case, is clearly untenable, or is not justified by reason." *State v. Balderama*, 2004-NMSC-008, ¶ 22, 135 N.M. 329, 88 P.3d 845; see also *Alberico*, 1993-NMSC-047, ¶ 63 (defining an abuse of discretion as a ruling that is "obviously erroneous, arbitrary, or unwarranted"). Thus, while an appellate court should not "rubber stamp[]" the district court's admission of expert testimony, it should likewise "be wary of substituting its judgment for that of the [district] court." *Alberico*, 1993-NMSC-047, ¶ 63 (explaining that the appellate court's task is to conduct a "meaningful analysis of the admission [of] scientific testimony to ensure that the [district] judge's decision was in accordance with the Rules of Evidence and the evidence in the case").

B. Admissibility of Expert Testimony on Yopez's Alleged Predisposition to Impulsive Violence

{19} Admission of expert testimony in New Mexico is governed by Rule 11-702 and by Rules 11-401 and 11-403 NMRA. Rule 11-702 provides that "if the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue," a "witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise." We have interpreted this rule to predicate the admissibility of expert testimony "on the satisfaction of three requirements: (1) that the expert be qualified; (2) that the testimony be of assistance to the trier of fact; and (3) that the expert's testimony be about scientific, technical, or other specialized knowledge with a reliable basis." *Downey*, 2008-NMSC-061, ¶ 25 (citing *Alberico*, 1993-NMSC-047, ¶¶ 43-45). Rule 11-

401 also requires that expert testimony be relevant—that is, probative and “material to the particular case.” *Alberico*, 1993-NMSC-047, ¶¶ 53, 55. However, if the prejudicial effect of expert testimony substantially outweighs its probative value, Rule 11-403 allows a court to exclude such testimony. *Id.* ¶ 55. The district court’s role is to ensure that the proffered expert evidence meets the foregoing requirements. See *Parkhill v. Alderman-Cave Milling & Grain Co. of N.M.*, 2010-NMCA-110, ¶ 12, 149 N.M. 140, 245 P.3d 585 (holding that the district court must “ensure that an expert’s testimony rests on . . . a reliable foundation and is relevant to the task at hand so that speculative and unfounded opinions do not reach the jury”).

1. Expert qualifications

{20} Because the State did not contest the qualifications of Yopez’s expert witnesses, we assume without deciding that Walker and Raine are qualified by “knowledge, skill, experience, training, or education” to testify about the relationship between certain genotypes and behavioral traits, given the experts’ backgrounds in neuropsychology and psychology and their knowledge in the area of behavioral genetics. See *Downey*, 2008-NMSC-061, ¶¶ 26-27. We therefore turn our attention to the remaining two, interrelated requirements under Rule 11-702—that expert testimony assist the trier of fact and have a reliable basis “in the knowledge and experience” of the expert’s discipline. *Alberico*, 1993-NMSC-047, ¶ 45.

2. Assistance to the trier of fact

{21} Whether expert evidence will assist the trier of fact is primarily a question of relevance. *Downey*, 2008-NMSC-061, ¶ 30 (citing *Daubert*, 509 U.S. at 591). Relevance has two important aspects for our purposes. The first is reliability—also the heart of the third requirement under Rule 11-702. See *Alberico*, 1993-NMSC-047, ¶ 53 (explaining that only reliable evidence has probative value). The second is “fit” between the expert evidence and the facts of the case. *Downey*, 2008-NMSC-061, ¶¶ 30, 34. These two considerations together determine whether expert evidence is capable of “prov[ing] what it purports to prove.” *Id.*; *Alberico*, 1993-NMSC-047, ¶ 53.

a. Reliability of the scientific methodology

{22} Where an expert’s testimony is based on scientific knowledge, as in this case, the proponent of the expert testimony must furnish “proof of [the] reliability of the scientific technique or method upon which the expert testimony is premised.” *Alberico*, 1993-NMSC-047, ¶ 53; see also *Torres*, 1999-NMSC-010, ¶ 24 (“[I]t is error to admit expert testimony involving scientific knowledge unless the party offering such testimony first establishes the evidentiary reliability of the scientific knowledge.”). When determining whether scientific evidence is reliable, the district court should consider the *Daubert* factors, summarized by this Court in *Torres*:

- (1) whether a theory or technique can be (and has been) tested;
- (2) whether the theory or technique has been subjected to peer review and publication;
- (3) the known or potential rate of error in using a particular

scientific technique and the existence and maintenance of standards controlling the technique's operation; and (4) whether the theory or technique has been generally accepted in the particular scientific field.

1999-NMSC-010, ¶ 25 (brackets omitted) (internal quotation marks and citation omitted). Additionally, the district court should “determine whether the scientific technique is . . . capable of supporting opinions based upon reasonable probability rather than conjecture.” *Alberico*, 1993-NMSC-047, ¶ 47.

{23} Here, the district court concluded that the scientific findings of low-activity MAOA genotypes moderating the effects of childhood maltreatment to increase the likelihood of antisocial and aggressive behavior in males satisfied the *Daubert* reliability factors. The district court did not abuse its discretion in this regard, because both Raine and Walker testified regarding the replication of studies supporting this relationship, the publication of these studies in peer-reviewed journals, and the general acceptance of the findings in the relevant scientific communities. The district court also recognized the Brunner study's finding that the rarer no-activity MAOA genotype was predictive of impulsive aggressive behavior (i.e., Brunner syndrome). However, the district court concluded that since Yepez has a low-activity MAOA genotype, not a no-activity MAOA genotype, Walker's testimony that Yepez is predisposed to *impulsive* violence was not based on reliable scientific knowledge.

{24} The district court's determination had a clear basis in the evidence before it. The classic finding in the Caspi study was that low MAOA activity “moderates the impact of early childhood maltreatment on the development of antisocial behavior in males,” acknowledging that “[a]ntisocial behavior is a complicated phenotype.”⁵ Caspi, *supra*, at 852-53. The various indicators of antisocial behavior in the Caspi study were not exclusive to impulsive violence; they included adolescent conduct disorder, convictions for violent crimes, personality disposition toward violence, and antisocial personality disorder. *Id.* at 852. Likewise, neither the 2014 Byrd and Manuck meta-analysis nor an earlier meta-analysis referenced by the experts, J. Kim-Cohen et al., *MAOA, Maltreatment, and Gene-Environment Interaction Predicting Children's Mental Health: New Evidence and a Meta-Analysis*, 11 *Molecular Psychiatry* 903, 903-13 (2006),⁶ identified increased outcomes of *impulsive* violence in males with low MAOA activity and a history of childhood maltreatment. Instead, these studies identified outcomes of antisocial behavior, generally. *Id.* at 910-11; Byrd and Manuck, *supra*, at 14-15 (noting that the “moderately reliable interaction” of low MAOA activity and childhood maltreatment “predict[ed] outcomes . . . of . . . both violent and non-violent antisocial behaviors,” suggesting that “the low-activity MAOA genotype heightens maltreatment-

⁵“Phenotype” is “an individual's observable traits, such as height, eye color, and blood type. The genetic contribution to the phenotype is called the genotype.” See Nat'l Insts. of Health, Nat'l Human Genome Research Inst., *Talking Glossary of Genetic Terms: Phenotype*, available at <https://www.genome.gov/genetics-glossary/Phenotype> (last visited Nov. 25, 2020).

⁶Available at https://www.researchgate.net/publication/6982612_MAOA_Maltreatment_and_Gene-Environment_Interaction_Predicting_Children's_Mental_Health_New_Evidence_and_a_Meta-Analysis/link/5402fd010cf2c48563afc517/download (last visited Nov. 30, 2020).

dependent risk for a range of conduct problems and not aggression or criminal violence specifically”).

{25} While some studies speculate that MAOA may be involved in regulating impulse control, others hypothesize that impulse control is a separate variable dependent largely on frontal lobe brain function. Compare Byrd and Manuck, *supra*, at 15 (“It is possible that [childhood] maltreatment . . . engenders antagonistic and antisocial motivations that are abetted by MAOA-modulated impairments in inhibitory control.”), with C.J. Ferguson, *An Evolutionary Approach to Understanding Violent Antisocial Behavior: Diagnostic Implications for a Dual-Process Etiology*, 8 *Journal of Forensic Psychology Practice* 321, 322-25, 335-36 (2008) (hypothesizing that the genetically-influenced development of an antisocial personality and a deficiency in impulse control due to, for example, frontal lobe brain injuries are separate variables influencing the ultimate outcome of violent behavior).⁷ These differences illustrate that it is not yet understood *how* MAOA activity and childhood maltreatment increase the likelihood of antisocial behavior. See, e.g., Kim-Cohen, *supra*, at 911 (“[A] statistical interaction between a genotype and an environmental risk factor requires further research to uncover the biological mechanisms involved in the interaction . . . [and] represents an important launching pad for developmental neuroscience research into the underlying causal mechanisms involved in the etiology of psychopathology.”).

{26} Indeed, Walker testified that the mechanism by which a low-activity MAOA genotype increases the risk for violence is unknown and that there are “lots of different theories,” some of which suggest the involvement of impulse-control functions and some of which do not. Although Walker answered leading questions regarding “impulsive violence” and characterized Yopez’s murder of Ortiz as “an act of impulsive, senseless violence,” he expressed his own opinion during his testimony without reference to impulsivity. More importantly, Walker did not explain or even assert in his testimony or subsequent affidavit that the relevant body of research establishes a link between low MAOA activity and impulsive violence. Similarly, Raine testified that the combination of low MAOA activity and childhood maltreatment “is associated with antisocial aggressive behavior, and a number of people think it’s especially with respect to impulsive aggressive behavior.” He later stated that low MAOA activity and childhood maltreatment “contribute to, for example, impulse control” and doing things without planning, and “can affect cognition, also emotion.” But Raine did not explain the foregoing opinions, or how he arrived at them, and the referenced studies furnish no explanation.

{27} Accordingly, the district court was within its discretion to exclude as lacking in scientific reliability an opinion that Yopez is predisposed to impulsive violent behavior. The Court of Appeals held otherwise through a misinterpretation of our holding in *Acosta*, 2016-NMSC-012. *Yopez*, 2018-NMCA-062, ¶¶ 28-29.

⁷Available for purchase at <https://www.tandfonline.com/doi/full/10.1080/15228930802199168> (last visited Nov. 25, 2020).

{28} In *Acosta*, a toxic tort case, the plaintiffs offered the expert testimony of Dr. James Dahlgren, who was of the opinion that the plaintiffs' exposures to certain toxic chemicals produced by the defendants had caused the plaintiffs' autoimmune diseases. 2016-NMSC-012, ¶¶ 1, 6. Dahlgren's opinion was based on a number of animal and human studies, including a study conducted by Dahlgren himself on the plaintiffs, all of which linked the toxic agents to autoimmune diseases in humans. *Id.* ¶¶ 6-16. The district court excluded the testimony for lack of relevance to the issue of general causation—that is, whether the toxic agents were capable of causing autoimmune diseases in humans. *Id.* ¶ 29. Citing the United States Supreme Court's opinion in *General Electric Co. v. Joiner*, 522 U.S. 136, 146 (1997), the district court explained that there was too great an "analytical gap" between the underlying data and the inference drawn on causation. *Acosta*, 2016-NMSC-012, ¶ 26. Specifically, the district court found that the study conducted by Dahlgren had failed "to bridge the gap from association to causation," and that Dahlgren's extrapolation from the animal studies was insufficient to establish causation in humans. *Id.* ¶¶ 18, 39 (internal quotation marks omitted). The plaintiffs appealed the district court's grant of summary judgment based in part on the exclusion of Dahlgren's opinion, and the Court of Appeals affirmed the district court. *Id.* ¶¶ 18-19.

{29} This Court reversed, holding that Dahlgren's testimony should have been admitted. *Id.* ¶ 2. We observed that New Mexico has never adopted the *Joiner* rule that a judge may reject expert testimony where the "analytical gap" between the underlying evidence and the expert's conclusions is too great. *Acosta*, 2016-NMSC-012, ¶ 27. Indeed, we concluded that a rule is "inconsistent with longstanding New Mexico law that leaves credibility determinations and weighing of the evidence to the trier of fact." *Id.* ¶ 28 (citation omitted). We held that, in the context of first-exposure toxic tort cases, where scientific analysis on a particular causal relationship may not be fully developed, expert testimony on general causation may nevertheless be reliable and admissible when it is based on appropriate methodology. *Id.* ¶¶ 30-34. We noted that Dahlgren had given an explanation, utilizing such widely accepted scientific guidelines for the interpretation of epidemiological studies, as to why the association found in his study was causal. *Id.* ¶¶ 32-35, 40-42. He also offered a scientific basis for his extrapolation from the various animal studies to humans, accounting for the differing dose response relationship as between mice and humans. *Id.* ¶¶ 37-38. We therefore concluded that Dahlgren's methodology supported a valid scientific inference that was probative of causation, and that the district court had "improperly blurred the line between [its] province to evaluate the reliability of Dahlgren's methodology and the jury's province to weigh the strength of Dahlgren's conclusions." *Id.* ¶ 41.

{30} In contrast to Dahlgren, who explained the methodology behind his interpretation of his own study and his extrapolation from animal studies, *see id.* ¶ 42, neither Walker nor Raine set forth the steps they took, methodologically speaking, from the research to their conclusions. Specifically, neither Walker nor Raine explained how they arrived at an opinion that low MAOA activity and childhood maltreatment predispose males to *impulsive* violence when the studies upon which they relied documented increased outcomes of antisocial aggressive behavior without reference to impulsivity. Accordingly, their opinions were properly excluded not because they made a novel

extrapolation across an analytical gap but because of the absence of scientific methodology in support of the specific conclusion reached.

b. Whether the scientific methodology was properly applied to the facts

i. Fit between Brunner syndrome and Yepez's genotype

{31} Another way of understanding the district court's order is that it found a lack of "fit" between the proffered expert testimony and the facts of the case. Specifically, the court found no fit between the experts' apparent reliance on the findings of the Brunner study and Yepez's genotype.

{32} To explore this issue, we first consider whether the findings of the Brunner study would be "directly related" to the theory of Yepez's case. See *Balderama*, 2004-NMSC-008, ¶ 24. Here, Yepez was charged with first-degree murder, a crime requiring the State to prove that Yepez had the specific or deliberate intent to kill the victim. See NMSA 1978, § 30-2-1(A)(1) (1994) (defining first-degree murder as "any kind of willful, deliberate and premeditated killing"). The deliberate intent to kill another person is defined in UJI 14-201 NMRA, in part, as follows:

The word deliberate means arrived at or determined upon as a result of careful thought and the weighing of the consideration for and against the proposed course of action. A calculated judgment and decision may be arrived at in a short period of time. A mere unconsidered and rash impulse, even though it includes an intent to kill, is not a deliberate intention to kill. To constitute a deliberate killing, the slayer must weigh and consider the question of killing and his reasons for and against such a choice.

One defense to a first-degree murder charge is that, due to a mental disease or disorder, the defendant was *incapable* of forming the deliberate intent to kill. See UJI 14-5110 NMRA; *State v. Boyett*, 2008-NMSC-030, ¶ 29, 144 N.M. 184, 185 P.3d 355 (holding that expert testimony would have been required to show that the defendant's alleged "organic brain damage caused his inability to form specific intent"). An alternative approach is for the defendant to submit evidence with a tendency "to make the existence of deliberation . . . less probable," or in other words, evidence tending to negate the element of deliberate intent. *Balderama*, 2004-NMSC-008, ¶¶ 25-27 (holding that expert testimony that the defendant had neurological deficits and multiple psychiatric diagnoses resulting in difficulty planning or controlling angry impulses was evidence "tending, to some degree, to refute the element of deliberation necessary for first-degree murder").

{33} The purpose of the expert testimony tendered by Yepez clearly focused on whether Yepez formed the specific or deliberate intent to kill Ortiz. However, it is somewhat unclear whether the purpose was to show an *incapacity* to form such intent due to a mental disease or disorder or to show a low probability that Yepez did, in fact, form the specific intent to kill Ortiz. Despite Yepez's arguments to the contrary, we

conclude that both Yepez’s arguments in motion practice and the experts’ opinions themselves point to the latter purpose. The Court of Appeals reached the same conclusion. *Yepez*, 2018-NMCA-062, ¶¶ 30-31. Even if Yepez advanced both theories, there was no evidence that Yepez’s alleged predisposition was a mental disease or disorder or that any disease or disorder rendered him *incapable* of deliberating and planning—and indeed, the testimony was to the contrary. For instance, Walker testified that Yepez has some capacity to act intentionally and to consider the consequences of his actions. Walker also testified that he can make no “clear connection” between Yepez’s genetic predisposition and what happened on the night of Ortiz’s death since a predisposition does “[n]ot directly” cause a person to behave in a certain way. Thus, we consider only whether the proffered expert testimony tended to negate the element of deliberate intent.

{34} The finding of the Brunner study was that those with a no-activity MAOA genotype are impulsively aggressive. Brunner study, *supra*, at 578-79. If Yepez had this characteristic of impulsive aggression, it would tend to negate the element of deliberate intent. But for the findings of the Brunner study to be applicable, the record would have to show that Yepez in fact has the rare no-activity MAOA genotype. *Downey*, 2008-NMSC-061, ¶ 34 (holding that scientific knowledge must be properly applied and that, while an expert may base his or her opinion on factual assumptions, those assumptions “must find evidentiary foundation in the record”). The record contains no such evidence; further tests would have been required to ascertain this information. Nevertheless, Walker and Raine seemingly imported the findings scientifically attributable to Brunner syndrome and concluded, on the basis of Yepez’s low-activity MAOA genotype, that Yepez was predisposed to impulsive aggression. We agree with the district court that this apparently unfounded reliance on the Brunner study renders the proffered expert opinions merely speculative and therefore irrelevant. *See Downey*, 2008-NMSC-061, ¶ 32 (“Expert testimony may be received if, and only if, the expert possesses such facts as would enable him to express a reasonably accurate conclusion as distinguished from mere conjecture.” (internal quotation marks and citation omitted)); *see also Christopherson v. St. Vincent Hosp.*, 2016-NMCA-097, ¶ 54, 384 P.3d 1098 (holding that, if a scientific technique requires certain data in order to render the expert’s opinion relevant, “the district court acts within its discretion to exclude testimony not based on such data”).

ii. Fit between low-activity MAOA genotype and Yepez’s behavior

{35} We are also persuaded by the district court’s broader finding, set forth in its initial order following the *Daubert/Alberico* hearing, regarding a lack of fit between the science and the facts of Yepez’s case. The district court observed that there still was “work to be done” in the field of MAOA research, taking up the State’s contention that the alleged predisposition to violence resulting from a low-activity MAOA genotype and childhood maltreatment is not yet understood with sufficient precision to be reliable or relevant as a predictor of violence in individuals. Assuming for the sake of argument that a predisposition to antisocial aggressive behavior in maltreated children with low MAOA activity includes at least some statistically significant predisposition to impulsive violent

behavior, is such scientific knowledge, as presented in this case, relevant to whether Yopez formed the specific intent to kill Ortiz? We think not, and we explain why.

{36} The Caspi study notes that the environmental factor of childhood maltreatment alone increases an individual's risk of criminality in adulthood by fifty percent. Caspi study, *supra*, at 851. Raine and Walker testified that other environmental risk factors for antisocial aggressive behavior include poor parenting, poor nutrition, presence of drug or alcohol abuse in the home, and bad neighborhoods. Raine and Walker also testified to the "wide array of biological risk factors that can be associated with increased violence" such as "poor functioning in the frontal region of the brain," low resting heart rate, (high) testosterone levels, low IQ, antisocial personality, and psychopathic personality. Raine could not say what percentage of those with a low-MAOA genotype in fact go on to commit violent behavior. Although Walker testified that low MAOA activity plus childhood maltreatment increases the risk of committing a violent act to 85% (the source of that figure is unclear), he acknowledged that "we don't know in any given individual exactly how factors interact to produce a certain set of behavior" and that there was no "clear connection" between Yopez's MAOA variant and what happened when Yopez killed Ortiz.

{37} Ambiguity surrounding the significance of the MAOA genotype to a complex and multivariable behavioral phenotype is acknowledged in the 2006 meta-analysis by Kim-Cohen et al., which noted that the statistical interaction between low MAOA and childhood maltreatment is "likely to be one of myriad factors involved in the development of biological sensitivity to stress and . . . social context." Kim-Cohen, *supra*, at 911. Likewise, a 2011 meta-analysis concluded that, although many studies had produced statistically significant results consistent with those of the Caspi study, the observed interactions between low-activity MAOA and childhood maltreatment

tended to be limited in magnitude, accounting for only a small portion of the variance in the models. The small magnitude of the interaction effects suggests that the contribution of these interactions to antisocial [behavior], over and above the main effect of maltreatment exposure, may be somewhat limited in scope.

D.M. Fergusson et al., *MAOA, Abuse Exposure and Antisocial [Behavior]: 30-Year Longitudinal Study*, 198 *The British Journal of Psychiatry* 457, 462-63 (2011) (also observing that further research is required "to validate the role of MAOA genotype in antisocial behavior" since at least one study found no link between MAOA genotypes and MAO levels in the brain).⁸

{38} These uncertainties and the introduction of so-called genetic susceptibility testimony (regarding MAOA and other genes linked to increased risk of aggression) in the sentencing phase of a murder case in Italy caused a group of clinical geneticists,

⁸Available at https://www.cambridge.org/core/services/aop-cambridge-core/content/view/B32E1FFD94CA5CB43EFFE9039536D4BB/S0007125000255438a.pdf/maoa_abuse_exposure_and_antisocial_behaviour_30year_longitudinal_study.pdf (last visited December 22, 2020).

bioethicists, and others to express concern that “[g]iven the state of the art in genetics, the possibility of using genetic variants to evaluate the actual mental capacity of a person at a given time is far from being established.” Francesca Forzano et al., *Italian Appeal Court: A Genetic Predisposition to Commit Murder?*, 18 *European Journal of Human Genetics*, 519, 519 (2010).⁹ This article, cited by the State in motion practice before the district court, questions the use of such “susceptibility testing” in legal proceedings, noting that

[t]he vast majority of these tests, if not all, are still purely research-based and have not received any formal evaluation in terms of clinical validity and utility. In our opinion, no susceptibility test should as yet be used in forensic or . . . judicial settings. The use of genetic tests in forensic contexts should be restricted to tests with proven clinical utility for the diagnosis of a disease relevant to the case judged.

Id. at 519-20. The State also cited psychology literature indicating that genetic tests for genotypes “predictive of antisocial behavior and violence are not yet widely employed” because they have not yet been shown to meet validity requirements applicable to forensic psychological tests. See C.J. Ferguson, *supra*, at 335. A validity coefficient (an index that “reflects how well an assessment instrument predicts a well-accepted indicator of a given . . . criterion”)¹⁰ of 0.4 or greater is generally required for psychological tests. See C. J. Ferguson, *supra*, at 336.

{39} This issue raises a still broader point. The question, it seems to us, is whether a person *has* the phenotype, or trait, of impulsive antisocial behavior, not whether that person is *at risk* for developing the phenotype. We acknowledge the probabilistic nature of proof tending to negate the element of deliberate intent; in *Balderama*, we expressed the relevance of testimony about the defendant’s mental condition as tending “to some degree, to refute the element of deliberation necessary for first-degree murder.” 2004-NMSC-008, ¶ 27. But there, the defendant’s likelihood of having deliberated or planned the killing could be weighed based on an objective diagnosis of “neurological deficits,” “impulse-control disorder, polysubstance abuse, and antisocial personality disorder” and the known effects of these conditions. *Id.* Here, Walker diagnosed Yopez with depression and addiction but offered no testimony that the symptoms of these conditions include increased impulsive aggression. Walker also testified that Yopez has an IQ within the low-average range and that he performed well on tests designed to rule out brain injury and measure higher order reasoning and problem-solving. He did not testify that Yopez had any neural deficits or other symptoms or signs consistent with impulsivity or impulsive aggression. Walker apparently identified the killing of Ortiz as *the* evidence that Yopez had the relevant impulsive antisocial phenotype. The problems with such a circular opinion are obvious. As the scientists in the Forzano article stated,

⁹Available at

https://www.researchgate.net/publication/41849562_Italian_appeal_court_A_genetic_predisposition_to_commit_murder (last visited Nov. 25, 2020).

¹⁰American Psychological Association, *Dictionary of Psychology*, validity coefficient (2020), available at <https://dictionary.apa.org/validity-coefficient> (last visited Nov. 25, 2020).

“[a] person should be judged on the basis of his actual condition and mental capacity at the moment of the act, independent of any theoretical predisposition to develop some disease or inappropriate [behavior].” Forzano, *supra*, at 520. We are also wary of the risks of stigmatization associated with simplistic interpretations of the “causal relations between genetic variants associated with violence or aggression and actual violent or aggressive [behavior].” *Id.* (warning that overemphasis on genetic susceptibility might inappropriately justify labeling an individual as more prone to recurrent crime).

{40} We hold that evidence of mere genetic susceptibility to a given mental condition is not relevant on the issue of deliberate intent, at least in the absence of evidence that such susceptibility is so well understood and has such strong predictive value as to be clinically validated as an indicator of the mental condition.

C. Yepez’s Cross-Appeal Alleging Prejudicial and Constitutional Error

{41} Yepez contends that the district court erred in excluding the proffered testimony because it was relevant not only to the first-degree murder charge but also to the jury’s consideration of whether to convict Yepez for second-degree murder, voluntary manslaughter, or involuntary manslaughter. We agree with the Court of Appeals that Yepez offered expert testimony only on the issue of whether Yepez deliberated before killing Ortiz. *Yepez*, 2018-NMCA-062, ¶¶ 35-36. The issue of deliberation was irrelevant to the lesser included offenses—general intent crimes requiring no proof of deliberation. *Id.* To the extent Yepez now claims that the expert testimony was relevant on an issue other than deliberate intent, that claim was not presented to the district court and was therefore not preserved for appeal. *State v. Lopez*, 2007-NMSC-037, ¶ 15, 142 N.M. 138, 164 P.3d 19. This Court reviews an unpreserved claim on appeal only for fundamental or jurisdictional error. “The doctrine of fundamental error applies only under exceptional circumstances and only to prevent a miscarriage of justice.” *State v. Barber*, 2004-NMSC-019, ¶ 8, 135 N.M. 621, 92 P.3d 633. This Court need only correct errors that “shock the conscience,” a phrase used regarding “cases with defendants who are indisputably innocent, and cases in which a mistake in the process makes a conviction fundamentally unfair notwithstanding the apparent guilt of the accused.” *Id.* ¶ 17 (internal quotation marks and citation omitted). Given our holding that the district court did not abuse its discretion in finding the proffered expert testimony unreliable and inadmissible, the exclusion of the testimony did not render Yepez’s conviction for second-degree murder fundamentally unfair. We therefore deny Yepez’s request for a new trial.

III. CONCLUSION

{42} For the reasons set forth hereinabove, we reverse the Court of Appeals’ determination on the admissibility of Yepez’s proffered expert testimony, reject Yepez’s cross-appeal requesting a new trial, and affirm Yepez’s conviction for second-degree murder.

{43} IT IS SO ORDERED.

**JUDITH K. NAKAMURA, Justice,
Retired, Sitting by Designation**

WE CONCUR:

MICHAEL E. VIGIL, Chief Justice

BARBARA J. VIGIL, Justice

C. SHANNON BACON, Justice

DAVID K. THOMSON, Justice