

MAOA Genetics in the Courtroom: The Last Legacy of *State v. Waldroup*

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Abstract: *The developing scientific world has uncovered critical information that will continuously correlate with the criminal justice system. More specifically, genetic evidence has been at the forefront of criminal court cases in recent years. The monoamine oxidase-A (MAOA) gene has been scientifically linked to aggressive and antisocial behavior in people. Individuals who have been found guilty of a violent crime have been found to be carriers of the MAOA gene. In response, defense attorneys have started using the MAOA gene to lessen the culpability of criminal defendants, which has ultimately raised a number of concerns within the criminal justice system. A key case that proved the genetic defense to be successful was *State v. Waldroup* in 2009. The defense's triumph contributed to both ethical and moral questions amongst scientists, courtroom officials, and other members of the criminal justice system.*

Keywords: Genetic predisposition, monoamine oxidase-A (MAOA) gene, neurotransmitters, point mutation, phenotype, cadherin 13 (CHD13), prosecution, defense

The combination of mental illnesses, childhood trauma, and a genetic predisposition can ultimately result in the violent tendencies of an individual. What should jurors consider when sentencing perpetrators for their violent crimes? Rose McDermott, Professor in Brown University's Watson School for International and Public Affairs, and Peter Hatemi, Distinguished Professor at Pennsylvania State University, recently discovered that deficiencies in the monoamine oxidase-A (MAOA) gene can lead to aggressive and antisocial behavior (2118). This gene, popularized as the "warrior gene," has been linked to forty percent of violent crimes in the United States (Wiberg 509). Defense attorneys have started using the warrior gene to lessen the culpability of criminal defendants, which has ultimately raised questions and concerns within the criminal justice system. Those opposed to the defense argue that MAOA evidence distracts jurors from the hard-core evidence provided during a tri-

al. Jurors can feel conflicted, concluding that perpetrators could not control themselves from committing crimes. This reduced verdict then opens unsuspecting communities to future violent crimes when an offender re-enters society early and unrehabilitated. Is the MAOA gene a credible form of defense? Should it allow violent and dangerous offenders to get a lighter sentence than what they would otherwise receive? Can those carrying the gene be rehabilitated? I contend that the court system must carefully consider the powerful effect genetic evidence has on jurors and the consequential danger to communities as offenders are released without adequate rehabilitation, and I point out the need for early MAOA interventions and the ethical challenges associated with these mediations.

The National Institutes of Health (NIH) suggests that the “MAOA gene provides [the] instructions for breaking down chemicals that act as neurotransmitters, which transmit signals between nerve cells in the brain” (“MAOA Gene”). This gene regulates “serotonin, epinephrine, and dopamine,” which effects peoples “mood, emotion, sleep, and appetite” (“MAOA Gene”). Scholars McDermott and Hatemi reported that thirty percent of the population are carriers of the MAOA gene. These experts found that the MAOA gene improperly breaks down important neurotransmitters in the brain, precisely serotonin and dopamine. McDermott and Hatemi indicated that “MAOA is a key enzyme in the catabolism of serotonin and in the regulation of adrenergic activity, such as norepinephrine” (1045). The resulting lower levels of serotonin, dopamine, and norepinephrine causes the alleles to stop functioning normally. As a result, the body fails to properly regulate its behavior.

In the first study linking the MAOA gene with aggression, researchers Han Brunner et al. at the department of Human Genetics at University Hospital Nijmegen in the Netherlands identified a point mutation in the eighth exon of the MAOA structural gene in 1993 (1032). In their study, they found that an isolated complete MAOA deficiency in the given population sample resulted in a distinguishable phenotype in which the individual behaved in an impulsive and aggressive manner. Furthermore, Brunner et al. suggests, “[t]he behavioral phenotype

in this family is characterized by borderline mental retardation and a tendency toward aggressive outbursts, often in response to fear, anger, or frustration" (1032). Of the individuals studied, many of them committed crimes such as arson, attempted rape, and exhibitionism. Brunner et al.'s study may have been the first to examine the parallels between genetics and deviant behavior, but it certainly was not the last.

Dolores Garcia-Arocena, Technical Information Scientist at the Jackson Laboratory, addresses the biological importance of the MAOA gene in her 2015 research article for the Jackson Laboratory entitled, "The Genetics of Violent Behavior." Garcia-Arocena suggests that the heavy prevalence of violent behavior in humans can be predicted by genetic markers. Changes in the expression of the MAOA gene, located on the X chromosome in position 11.3, have been found to correlate directly with aggression (Garcia-Arocena). Furthermore, mutations in the warrior gene can lead to hostility in not only humans, but animals as well. According to Garcia-Arocena, MAOA mutant mice are more prone to have a negative reaction to stress and subsequent high levels of aggression to intruder mice compared to normal mice. As for humans, Garcia-Arocena contends that "[n]ormal individuals carry MAO variants that express high levels of neuronal MAO-A, a small subset of patients carry MAO variants that result in the absence of functional MAO-A, while other people carry variants that result in low levels of MAO-A expression in the brain." Thus, the defined presence of the MAOA gene plays a fundamental role in the function of one's mood, impulse control, and fight-or-flight reactivity.

Likewise, in a 2019 study, Martin Klasen et al. in the Department of Psychiatry, Psychotherapy and Psychosomatics at RWTH Aachen University in Aachen, Germany, found that brain aggression networks depend on MAOA genotypes. More specifically, they studied a group of 32 Caucasian men between the ages of 16 and 33, all of whom had no prior history of neurological or psychological illnesses. Participants were asked to take part in violent video games. The way they behaved while they played was analyzed, and certain areas on the brain were subsequently studied. Klasen and his colleagues found that

“serotonergic projections connecting limbic areas (amygdala) to empathy networks may influence emotional assessment of aggressive actions... Enhanced vulnerability of this system may foster aggression in MAOA risk allele carriers.” Klasen et al. also contended that people who carry a mutated version of the MAOA gene could potentially exhibit hostile behavior when provoked.

Moreover, continued research suggests that when the MAOA gene combines with other genotypes, violent tendencies are amplified. More specifically, the cadherin 13 (CDH13) genotype combined with the MAOA gene appears often in violent offenders and has also been linked with ADHD and substance abuse. A 2014 study conducted in Finland, a country with one of the lowest crime rates in the world, found that those with the MAOA and CDH13 gene are thirteen times more likely to have a history of repeated violent behavior (Tiihonen et al. 786). Additionally, Jari Tiihonen et al. at Karolinska Institute in Stockholm, Sweden found that “about 5-10% of all severe violent crime in Finland is attributable to the aforementioned MAOA and CDH13 genotypes” (786). Likewise, forensic psychiatrist William Bernet of Vanderbilt University and his colleagues found that convicted criminals who carry the MAOA gene and who have experienced stressful life events were far more likely to exhibit serious depression and commit suicide (1362). These scholars raise the question of whether the abuse the defendants suffered as children, or the genetic variations found in their DNA, is what caused them to commit violent acts. Bernet has since become a key expert witness for the defense regarding the MAOA gene for perpetrators who have also experienced some form of childhood maltreatment or abuse and antisocial behavior.

Bernet’s research suggests a correlation between MAOA and aggression, yet how does it play out in the court system, and is it always reliable? How should jurors consider this evidence in criminal cases involving violent crimes, and what is the history of DNA evidence in the courtroom? The 1993 U.S. Supreme Court decision in *Daubert v. Merrell Dow Pharmaceuticals* set the stage for the use of scientific evidence in federal

court. Prior to this case, the court system required that scientific evidence be established and accepted in the scientific community before it is presented in the courtroom. Subsequently, "... the *Daubert* decision only required that the evidence be 'relevant to the task at hand' and rest 'on a reliable foundation'... the *Daubert* decision also empowered judges to determine the validity and admissibility of scientific evidence in court" (Sabatello and Appelbaum). This decision left a malleable standard of admissibility and granted judges a higher degree of power regarding the use of scientific evidence.

The notorious 1995 O.J. Simpson trial was a landmark criminal court case that brought additional attention to the importance of DNA evidence, expert testimony, and the accreditation of laboratories. Gina Kolata, a visiting professor at Princeton University and a long-time science journalist, interviewed jurors and experts following the trial. Randolph Jonakait, a professor in the Law department at New York Law School, stated that the O.J. verdict should "force labs to think a whole lot more carefully about the procedures they use to collect, preserve and test any kind of evidence, especially DNA evidence" (qtd. in Kolata). Likewise, Dr. Paul Ferrara, the president of the American Society of Crime Directors Laboratory Accreditation Board at the time of the O.J. Simpson verdict, suggested "[i]f you have accreditation, then the jury, the judge, the public has some measure, some demonstration to make them feel better about the lab -- that it's not just some wild, unregulated field" (qtd. in Kolata). Although lab regulations tightened after this landmark case, many of the same concerns about how judges and jurors should weigh expert testimony have remained unresolved.

During the O.J. trial judges and jurors were more skeptical about DNA evidence, but in recent years the pendulum has shifted in the opposite direction. The evidence and information about the MAOA gene deficiencies and the consequences of mutations create grounds for careful consideration, much like how one's mental health is adequately contemplated in today's society. Deborah Denno, Ph. D, J.D., the Arthur A. McGivney Professor of Law and Founding Director of the Neuroscience and Law Center at Fordham Law School, studies the correlation

among biology, neuroscience, and criminal law. In her analysis in the *Michigan State Law Review*, Denno examined 48 criminal court cases and discovered that the defense commonly used behavioral genetic evidence in a few distinct ways (317). For one, the MAOA gene was used to support a claim that was stated by counsel (Denno 317). Additionally, it provided proof and diagnosis of a defendant's mitigating condition (Denno 317). In other words, it lessened their culpability.

Although Denno vehemently questions the use of behavioral genetics, it continues to be a commonly used defense tactic in the criminal courtroom. As such, the legal world should question how much weight this mitigating factor should be granted. With a developing scientific world, Denno points to several powerful reasons as to why genetic evidence should be minimized in the court system, including the undue influence of DNA evidence balanced against other artifacts, the uncertainty of validity and reliability of lab results, and the limits of juror expertise regarding DNA evidence (44). Accordingly, Professor of Law and Philosophy at Duke University School of Law Nita Farahany and Professor of the Practice of Law and Director of the Center for Criminal Justice and Professional Responsibility at the Duke University School of Law James Coleman note concern for the fact that genetics has been an important and deciding factor for many juries. Farahany and Coleman note, "[r]ecent research findings... suggest that behavioral genetics may be the next frontier for the world of criminal justice, and mental health professionals are likely to play a critical role in helping the courts make sense of the new data" (77-78). As science continues to evolve, genetic evidence will be used more frequently to explain why certain people break the law.

Yet, this behavioral genetic defense strategy is quite controversial. Experts worry that it is not sufficient or strong enough to mitigate a defendant's sentence, and the genetic knowledge of twelve everyday people chosen at random is not adequate when deciding a person's culpability, as seen in the aforementioned study (Farahany and Coleman 77). More specifically, in capital cases where the defendant has been sentenced to the death penalty, defense attorneys scramble for anything in their

client's mental history and genetic makeup that may grant them clemency. However, because of the severity of the crime being tried, courts should question the plausibility of gene defenses and whether they should free a convicted, violent offender from death row. Even with such strong evidence-based concerns against the use of genetics as a defense, there has been a significant uptick in the number of new cases employing this defense (Farahany and Coleman 78). Despite these doubts, this gene and this defense strategy is likely to become widely used.

A key example of judge and juror bias toward the MAOA genetic defense is the infamous 2009 trial, *State v. Waldroup*. The defense claimed that because Bradley "Brad" Davis Waldroup Jr. was a carrier of the MAOA gene, was severely abused as a child, and had recently encountered stressful life experiences, he was unable to control himself from committing violent crimes. In this case, the jurors saw the victim, Penny Waldroup, take the witness stand with visible, deep scars, as she told the story of what happened on October 13, 2006 (Court of Appeals, State of Tennessee). She told the court about her fear and uncertainty as she brought her children for the court-appointed, joint custody to stay with her estranged husband, Brad Waldroup, in his trailer on Kimsey Mountain in Polk County, Tennessee. She trembled as she told how she brought her best friend, Leslie Bradshaw, with her for support and protection.

In the end, Brad Waldroup murdered Bradshaw and then proceeded to attack and viciously beat Penny before he held her and their children against their will (Court of Appeals, State of Tennessee). The testimony, trial, and subsequent verdict would not only haunt Penny Waldroup, but also the prosecution for the Waldroup case. Given the murder of Leslie Bradshaw and attempted murder of Penny Waldroup, the prosecution thought that the case was open-and-shut. Brad Waldroup's deadly actions appeared intentional and premeditated, a common characteristic found among violent criminals.

Author and National Public Radio correspondent Barbara Bradley Hagerty explored the effect the outcome of the trial had on the prosecution, the defense, experts, and the jurors. Hagerty interviewed Cynthia Lecroy-Schemel, the lead prosecutor

in the Waldroup case who noted that the bloodshed found at the crime scene was unlike something the prosecution had ever seen before. Waldroup's planning was premediated, meaning the evidence suggested that he intended to commit the crimes. Lecroy-Schemel claimed, "[t]here were numerous things he did around the crime scene that were conscious choices. One of them was [that] he told his children to 'come tell your mama goodbye,' because he was going to kill her. And he had the gun, and he had the machete" (qtd. in Hagerty). As for the warrior gene defense, the prosecution in the Waldroup case believed the complex, scientific evidence was introduced purposely to confuse the jury and divert their attention from other evidence presented in the case. Lecroy-Schemel stated, "[a]nything that defense attorneys can have to latch onto to save their client's life or to lessen their client's culpability, they will do it" (qtd. in Hagerty). As such, the prosecution opposed the psychiatric testimony, yet Judge Carroll Ross allowed it. Lecroy-Schemel's prosecution team found it baffling that Waldroup's genes and past experiences distracted the jury from the gruesome crime scene photos presented during trial, as Waldroup received a lighter sentence than what had been originally suggested. Criminal prosecutors worry that the success of this defense in the case of *State v. Waldroup* will negatively affect future cases. According to Lecroy-Schemel, defense attorneys have no qualms about utilizing such "sophistries" in the defense of their clients, as they justify their actions as being a part of the job (qtd. in Hagerty).

The defense, on the other hand, supported evidence that Brad Waldroup's actions were out of his control because he was a carrier of the MAOA gene and suffered childhood abuse. They portrayed Waldroup as the victim, putting well-known forensic psychiatrist Bernet on the stand. The defense used Bernet's testimony as a key tool to influence the jury. Bernet's research analyzed those who were both carriers of the gene and were maltreated as children and concluded that because of the combination, they should not be sentenced to the death penalty. He suggested that the death penalty is unethical because the defendants had suffered abuse and were carriers of the war-

rior gene, which led directly to their uncontrollable and violent behavior (Bernet 1362). In fact, during the trial, Bernet testified that, “[Brad Waldroup’s] genetic makeup, combined with his history of child abuse, together created a vulnerability that he would be a violent adult” (Court of Appeals, State of Tennessee). The strategic use of genetic evidence became a powerful tool in providing a broader picture for the jury and worked to mitigate Brad Waldroup’s sentence. Bernet urged, “[a] person doesn’t choose to have this particular gene or this particular genetic makeup. A person doesn’t choose to be abused as a child. So, I think that should be taken into consideration when we’re talking about criminal responsibility” (qtd. in Hagerty). Bernet’s testimony was the tipping point for many jurors.

Bernet’s scientific evidence persuaded most of the jurors that Waldroup was not completely in control of his actions and that he deserved reduced charges from murder to manslaughter. It was almost as if the jurors felt they now understood the reasoning behind Brad Waldroup’s heinous actions. One of the jurors suggested that if he were in Waldroup’s shoes and had experienced the same traumatic experience, he too, would have snapped. Debbie Beaty, another juror claimed, “[e]vidently, it’s just something that doesn’t tick right. Some people without this would react totally different than he would. A diagnosis is a diagnosis, it’s there. A bad gene is a bad gene” (qtd. in Hagerty). Despite the mounting evidence against him and the sheer violence of the crime, the MAOA genetic evidence weighed heavily on the jurors. Without it, they would have likely convicted Brad Waldroup of the death penalty (Hagerty). Although Waldroup was originally charged with two counts of aggravated kidnapping, one count of first-degree murder, and one count of attempted first-degree murder, the jury convicted him of a far lesser sentence. After eleven hours of deliberation, the jury convicted him of voluntary manslaughter instead of murder, and they sentenced him for second-degree attempted murder, instead of first-degree attempted murder (Court of Appeals, State of Tennessee). Evidently, a group of twelve unbiased adults could lose sight of the images of an extraordinarily bloody crime scene and be swayed by expert genetic evidence.

Nevertheless, the MAOA genetic defense was proven successful in this case.

Ultimately, Judge Carroll Ross sentenced Brad Waldroup to 32 years in prison. Even the judge was surprised with the outcome of the trial, stating "...[Brad Waldroup] should think twice about appealing. The state might not mind trying this again and asking for the death penalty. You might not be as fortunate with a jury next time" (Court of Appeals, State of Tennessee). The successful use of genetics as a defense clearly surprised this judge and left a questionable precedent within the court system. The MAOA criminal defense worked in favor of Brad Waldroup. He will be eligible for parole in 2026 at the age of 52 (Court of Appeals, State of Tennessee).

This decision also came as a shock to legal scholars, Leslie Bradshaw's family, and the public alike. It is almost unfathomable that the sheer, chilling violence of the crime the jurors heard in the courtroom in 2009 became so quickly overshadowed by the testimony of expert witnesses. Sally McSwiggan et al. at the Institute for Biomedical Ethics at Basel University in Basel, Switzerland, urged "[t]o negate criminal responsibility, legal decision-makers must be convinced that the accused was unable to form the necessary mental state (e.g., intent) required for the commission of the particular offense (e.g., first-degree murder), or that there was a justification or another legally defensible excuse for the act" (19). The *State v. Waldroup* decision played a monumental role in the future of genetic evidence in the criminal justice system .

Many scholars disagree with Judge Carroll's decision to allow the MAOA evidence and expert witness given the hints of premeditation and violence of the crime. Duke Law Professors Farahany and Coleman contend that it is imperative that judges employ the prerequisites for criminal liability—*mens rea* and *actus reus*—when genetics becomes involved (115). Judges often dismiss the idea of using the MAOA gene as a defense because of the high likelihood that a defendant already had a mental intent to commit a crime. Farahany and Coleman believe that the use of behavioral genetics in the courtroom requires a renewing of laws within the criminal justice system as these sci-

entific advancements challenge the courts' validity (115). Additionally, “[s]uch arguments ignore that the criminal law does not depend on individual capabilities: ‘Acts are judged by their tendency under known circumstances, not by the actual intent which accompanies them’” (Farahany and Coleman 134-135). Therefore, the criminal justice system needs to keep focused on law, rather than individual circumstances.

Furthermore, when judges do allow MAOA evidence, it becomes a monumental, mitigating factor in sentencing. Lisa Aspinwall et al. in the Department of Psychology at the University of Utah conducted an extensive study and came to the following conclusion: “[e]vidence presented at sentencing in support of a biomechanical cause of the convict's psychopathy significantly reduced the extent to which psychopathy was rated as aggravating and significantly reduced sentencing (from 13.93 years to 12.83 years)” (846). The members of a jury are ordinary civilians, picked strategically out of society, and they are persuaded by this form of scientific evidence, considerably reducing the original charges of violent offenders. Aspinwall et al.'s conclusions matched with the Waldroup case, where Judge Carroll Ross deemed the use of genetic evidence admissible, and Brad Waldroup received a notably lesser sentence from jurors.

After the *State v. Waldroup* verdict set a debatable precedent, the MAOA defense has become much more prominent in courtrooms worldwide. Italy saw a similar case to that of *State v. Waldroup* in 2007. Dr. Emiliano Feresin, the Press and Outreach officer of RESOLV, at Ruhr University in Bochum, describes the infamous Italian case in a 2009 Nature Journal article. The defendant, Abdelmalek Bayout, fatally stabbed Walter Felipe Novoa Perez on March 10, 2007. The defense attorney, Tania Cattarossi, argued that Bayout may have been mentally ill at the time of the crime based on three psychiatric reports. The Italian court reduced his sentence by nearly three years because of the MAOA gene he carried. Abdelmalek Bayout's case was the first time that the use of behavioral genetics as a defense affected a defendant's sentence in a European court. At an appeal hearing in May 2009, a judge asked forensic scientists for

a new psychiatric report. Pietro Pietrini and Giuseppe Sartori “...conducted a series of tests and found abnormalities in brain-imaging scans and in five genes that have been linked to violent behavior – including the gene encoding neurotransmitter-metabolizing enzyme monoamine oxidase A (MAOA)” (Feresin). The forensic scientists agreed with the previous research and concluded that Bayout's genes would make him more inclined to becoming violent if provoked, as he claimed he was in the deadly altercation with Perez. The jury agreed, and he received a reduced sentence.

Likewise, the 2012 court case of *State v. Bourassa* involved a MAOA-carrying male who broke into a church and murdered an elderly female. According to McSwiggan et al. who conducted a study of MAOA criminal court cases from 1995 to 2016, the defense in *State v. Bourassa* argued that the accused suffered from sexual abuse as a child and carried the warrior gene, which led to his antisocial behavior. Therefore, “[t]he defense team argued that the accused should be spared the death penalty given his genetic vulnerability” (McSwiggan et al. 19). The jurors agreed and gave Bourassa a reduced sentence.

In the aftermath of the courtroom decisions for *Waldroup*, *Bayout*, and *Bourassa*, many law enforcement officials, prosecution attorneys, criminologists, and scientists have questioned the validity of the genetic defense (See Table 1).

Table 1: Cases with Reduced Sentences Due to the MAOA Defense

Case (Year) Country	Original Charges	Outcome After MAOA Defene
Waldroup (2009), U.S.A.	Murder; Attempted murder	Charge reduction; first-degree murder reduced to voluntary manslaughter
Bayout (2009), Italy	Murder	Appeal upheld; nine years reduced to eight years
Bourassa (2012), U.S.A.	Murder	Sentenced to life, spared the death penalty

Each of these cases ended with a reduced sentence, suggesting

that jurors may struggle with how to weigh the MAOA genetic evidence and expert testimony against other mitigating factors in these criminal cases. These court precedents leave the public with several lingering questions, including whether offenders will recommit similar crimes upon release .

One danger of the MAOA sentence reduction is that offenders will leave prison only to re-commit the same violent crimes once they are released. The high likelihood of recidivism in offenders with this specific genetic predisposition directly correlates with the need for early MAOA interventions. John Nally et al. conducted a study on the recidivism rates of different types of criminal offenders in the United States between the years of 2005 and 2009. More specifically, they found, “[t]he recidivism rate was 46.6 percent among violent offenders” (16). In other words, nearly half of all violent offenders would re-offend upon release from prison. This is an alarming issue as incarceration fails to rehabilitate a vast majority of inmates, and this shocking percentage also begs the question: how many of those re-offending are carriers of the MAOA gene?

To answer this question, Roope Tikkanen et al. at the University of Helsinki's Institute of Clinical Medicine conducted a study of 167 MAOA-genotyped alcoholic offenders. They used regression analysis to examine the alcohol exposure, and the age-adjusted effect of the Revised Psychopathy Checklist score (PCL-R) and psychopathy on the risk for reconvictions among carriers of the MAOA genotype (Tikkanen et al). Furthermore, Tikkanen et al. found that the PCL-R total score is predictive of impetuous reconvictions among prominent MAOA offenders. More specifically, there is a “6.8% risk increase for every one-point increase in PCL-R total score” (Tikkanen et al.). In other words, these individuals scientifically qualify as psychopathic, and their imprisonment does not guarantee that they will be free of a criminal lifestyle post release. In fact, once they have completed their sentence and are back in a familiar environment they may be tempted by old habits, such as alcoholism and violent crime. They are likely to continue deviant behavior as such conduct is dictated, in part, by their MAOA genes. For convicted MAOA offenders, re-entry to society will not be trou-

ble-free. Given this extreme concern, what can be done? What other solutions exist to mitigate MAOA offenders?

As a preventative solution to MAOA aggression, some scholars suggest screening for the gene at a young age and organizing rehabilitation programs to prevent deviant behavior. Jennifer Brooks-Crozier, an associate in Weil's Complex Commercial Litigation practice suggests screening for early detection to mitigate at-risk behavior. She argues, "[t]he screening test would allow states to target a population of children at risk of criminal behavior. The intervention services: family education and counseling, home visits, parent support groups, and psychological and social work services, would prevent those at-risk children from suffering the maltreatment that would cause them to later develop aggressive, antisocial behavior" (531). Similarly, Debra Wilson, Associate Professor in the School of Law at the University of Canterbury in New Zealand, contends in her book, *Crime, Genetics and Justice*, that an MAOA test should be added to newborn screening (194). As part of standard care, all newborns are already screened for conditions such as cystic fibrosis, sickle cell disease, and hearing loss through a blood test. It would be relatively easy to add an MAOA test to that list. Since males carrying this gene are responsible for about forty percent of all violent crime in the U.S., this solution seems important to implement and may reduce the overall crime rate, but it is actually quite complex (Wiberg 509).

Wilson, Wiberg, and other MAOA experts understand that newborn screenings pose complex privacy and ethical issues. Wilson notes:

The detriments relate to discrimination. A child with Low MAOA may be treated differently, either by his parents or by society. Any behavioral issues will be viewed through an MAOA lens, rather than seen as typical childhood behavior... knowledge of their MAOA status, and any other subsequent monitoring could easily lead to the test results becoming a self-fulfilling prophecy. (Wilson 194)

The labels from these tests may lead to an undesired increased perception of dangerousness both within the individual and

with those around them. In addition to being discriminated against, the children carrying the gene could lose their right of privacy because of required intervention services. Are the privacy and ethical concerns enough to prevent the screening? What are the success rates of these interventions? How many lives would be saved? This debate will amplify as the development of MAOA genetic information improves, and it will become a balancing act between privacy for youths and public safety for the community.

Overall, the *State v. Waldroup* case proved that this new and developing form of MAOA genetic testing could potentially affect the criminal justice system in its entirety. From the prosecution to the defense and to the jury, the use of genetic evidence now serves as an ameliorating factor in sentencing. For many violent convicted offenders, that means their genes and past traumatic experiences may significantly reduce their prison sentences. *State v. Waldroup* certainly paved the way for this defense to become more prominent in courtrooms across the world. Without intervention from legal scholars and practitioners, MAOA exceptions in criminal cases will continue, lessening sentences and potentially allowing unrehabilitated individuals to recommit the same level of violent crimes. As a potential solution, debates about MAOA gene screening will continue in the future, challenging legal scholars, geneticists, and ethicists alike. Clearly, the monumental, unprecedented court case of *State v. Waldroup* had a direct and lasting impact on the future of the criminal MAOA genetic defense.

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