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**THE ADMISSIBILITY OF EXPERT WITNESS TESTIMONY BASED ON
ADOLESCENT BRAIN IMAGING TECHNOLOGY IN THE
PROSECUTION OF JUVENILES: HOW FAIRNESS AND
NEUROSCIENCE OVERCOME THE EVIDENTIARY OBSTACLES TO
ALLOW FOR APPLICATION OF A MODIFIED COMMON LAW
INFANCY DEFENSE**

*Sally Terry Green**

Adolescent brain imaging technology is an evolving area of science that reveals levels of maturity in the adolescent brain. Its potential effect on criminally culpable behavior is the source of extensive debate. The technology can inform judges and jurors on essential differences between how adults make decisions regarding their conduct as distinct from adolescents. United States Supreme Court precedence provides a relevant framework from which we can extrapolate fairness principles and their operation in developing a meaningful juvenile defense under which the technology can be considered. These principles should guide decisions made by the trial courts under the states' applicable rules of evidence regarding the admissibility of scientific data like adolescent brain imaging technology. Admitting the technology and expert witness testimony in the context of an Infancy Defense model provides the fact finder with the data necessary to make a more in depth determination of adolescent criminal capacity.

Most Infancy Defense statutes currently implemented by the states create a gap comprised of fourteen to eighteen-year-olds by failing to address this population of adolescents whose deficiencies in judgment and decision-making pose the most credible argument

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for criminal exoneration. Offering adolescent brain research as part of an Infancy Defense model provides juveniles with an opportunity to combat harsher penalties imposed by the states and facilitates imposition of legal standards that require consideration of the differences between children and adults. If juvenile offenders are to be truly considered less blameworthy than adults, preservation of the Infancy Defense is crucial. This is true even when they should be held accountable for their actions. By allowing the juvenile offenders to offer expert witness testimony based on adolescent brain imaging as part of the meaningful defense, the fact-finder can more fairly assess adolescents' decision-making capacity. Consequently, we must allow the admissibility of adolescent brain imaging in order to guard against overestimation of an adolescents' criminal culpability.

I. INTRODUCTION

The morning and evening news is littered with news of adolescent casualties. Although not always the loss of life that we usually expect to hear on the news, oftentimes the stories involve extreme acts of violence committed by adolescents with ensuing outrage from the adult community. Consider when one adolescent's conduct incites the emotion and misjudgment of another. Wayne Treacy did not expect that his life would potentially come to an end when he received a nasty text message from his girlfriend's cohort.¹ After all, he was already trying to cope with and grieve the recent suicide of his older brother.² The nasty text message erupted an unmanageable and, arguably, untenable response in Wayne causing him to beat Josie Lou Ratley so horribly that she currently fights to regain normal daily function.³ Undoubtedly, Josie's adolescent years of life before the beating are immeasurably altered—adolescent casualty number

¹ Rafael A. Olmeda, *Teen charged as adult in beating of Deerfield girl*, THE PALM BEACH POST NEWS (Apr. 16, 2010, 11:18 AM), <http://www.palmbeachpost.com/news/crime/wayne-treacy-charged-as-an-adult-in-the-572696.html>.

² *Id.*

³ *Id.*

one.⁴

Wayne Treacy is being tried as an adult in a Florida criminal court on the charge of first degree attempted murder.⁵ The fifteen-year-old juvenile defendant faces the potential consequence of life without parole—adolescent casualty number two.⁶ While adolescents make poor decisions every day, rarely do their judgments amount to the events described in this recent Florida case. One psychologist compares the adolescent brain to that of a toddler—“unstable, dysfunctional and completely unpredictable.”⁷ In the face of impulsivity and poor judgment, our criminal justice system can address cases like the one in Florida by, first and foremost, considering the decision-making function of the juvenile defendants like Wayne Treacy as that of an adolescent.

No one truly knows whether Wayne Treacy intended to mercilessly beat Josie Lou Ratley. A child may intend to commit an act but is frequently not capable of grasping the consequences of his actions or differentiating between right and wrong behavior.⁸

⁴ *Id.*

⁵ *Id.*

⁶ FLA. STAT. ANN. § 782.051 (LexisNexis 2007) states:

Attempted felony murder. (1) Any person who perpetrates or attempts to perpetrate any felony enumerated in § 782.04(3) and who commits, aids, or abets an intentional act that is not an essential element of the felony and that could, but does not, cause the death of another commits a felony of the first degree, punishable by imprisonment for a term of years not exceeding life, or as provided in § 775.082, § 775.083, or § 775.084, which is an offense ranked in level 9 of the Criminal Punishment Code. Victim injury points shall be scored under this subsection.

Id.

⁷ MICHAEL J. BRADLEY, YES, YOUR TEEN IS CRAZY!: LOVING YOUR KID WITHOUT LOSING YOUR MIND 8 (2003) (attributing neurological deficiency as the cause for impulsivity and lack of appreciation for likely outcomes of their actions).

⁸ See Lara A. Bazelon, *Exploding the Superpredator Myth: Why Infancy is the Preadolescent's Best Defense in Juvenile Court*, 75 N.Y.U. L. REV. 159, 189 (2000) (discussing the undeveloped pre-adolescents' limited reasoning and inability to contemplate or appreciate the irreversibility of their potential criminal behavior).

Admitting expert witness testimony of adolescent brain imaging technology under a modified Infancy Defense allows for preventing more adolescent “casualties.”

A. *The “Meaningful” Infancy Defense Model*

Early in the fifth century, Roman law provided that children under seven could not form criminal intent or malice.⁹ English common law in the thirteenth century allowed a pardon for juvenile criminals which later evolved into a presumption against young offenders’ criminal liability.¹⁰ In the seventeenth century, the common law provided a rebuttable presumption of criminality for fourteen-year-olds.¹¹ Those older than fourteen were liable as adults.¹² By the eighteenth century, the prosecution had to prove that the accused understood the wrongfulness of his act in order to rebut the presumption of incapacity.¹³ The common law Infancy Defense erupted in the American colonies as a result.¹⁴

A few states codified the defense in their first penal codes.¹⁵ By the twentieth century, reformers were advocating for youngsters to be “treated” rather than punished.¹⁶ Even still, advocates in jurisdictions like California encourage progressive juvenile justice policies with an eye toward modern science that regards teenagers as less culpable than adults.¹⁷ The common law defense or a modified version is available in forty-five states.¹⁸ On the other hand, five states have modified the Infancy Defense by

⁹Barbara Kaban, *Revitalizing the Infancy Defense in the Contemporary Juvenile Court*, 60 RUTGERS L. REV. 33, 36 (2007).

¹⁰ *Id.*

¹¹ *Id.*

¹² *Id.*

¹³ Andrew M. Carter, *Age Matters: The Case for a Constitutionalized Infancy Defense*, 54 U. KAN. L. REV. 687, 711 (2006).

¹⁴ Kaban, *supra* note 9, at 37.

¹⁵ *Id.*

¹⁶ Kaban, *supra* note 9, at 37.

¹⁷ See Ashley N. Johndro, *Thwarting California’s Presumptive LWOP Penalty For Adolescents: Psychology’s and Neuroscience’s Message for the California Justice System*, 83 S. CAL. L. REV. 341, 360 (2009–2010).

¹⁸ Carter, *supra* note 13, at 733.

lowering the age of presumed incapacity from fourteen to twelve.¹⁹ Unfortunately, the desired rehabilitative models for juvenile dispositions have deteriorated in the face of harsher penalties imposed by the states.²⁰ A modified Infancy Defense model allows juvenile and adult courts to consider standards for imposing criminal culpability with comprehensive understanding of the cognitive context under which adolescents make decisions. For as long as we choose to prosecute juvenile offenders for their actions as if they are adults, we must allow adolescent brain imaging to be part of a meaningful defense so that we can fully comprehend the adolescent mind upon which criminal sanction is imposed.

B. The Infancy Defense, Adolescent Brain Technology and U.S. Supreme Court Precedence

Adolescent brain imaging technology is an evolving area of science that reveals levels of maturity in the adolescent brain and its effect on criminally culpable behavior.²¹ Under the law, we have historically treated children in our American criminal justice system differently than adults because they were viewed as cognitively and emotionally immature.²² The United States

¹⁹ *Id.*

²⁰ Sara Sun Beale, *You've Come a Long Way, Baby: Two Waves of Juvenile Justice Reforms as Seen from Jena, Louisiana*, 44 HARV. C.R.-C.L.L. REV. 511, 514 (2009) (describing one example of harsher penalties that was observed by the author when one of the Jena six was prosecuted by the Louisiana District Attorney's office as an adult for attempted second degree murder. The author reflects on this case as raising questions concerning the dwindling boundaries between the juvenile and adult criminal justice systems and the applicability of harsher sanctions to juvenile offenders especially when racial imagery and racially based politics led to enactment of the "tough on crime" legislation).

²¹ See generally Tracy Rightmer, *Arrested Development: Juveniles' Immature Brains Make Them Less Culpable Than Adults*, 9 QUINNIPIAC HEALTH L.J. 1 (2005).

²² See, e.g., *Roper v. Simmons*, 543 U.S. 551 (2005) (substantiating the argument made here in favor of the admissibility of adolescent brain imaging technology because the highest court continues to recognize the scientific conclusions made about the adolescent brain and to make rules of law accordingly. If the trend of the Supreme Court is to utilize the scientific conclusions from brain science as somewhat dispositive on the issue of legal

Supreme Court recently heard arguments made in two consolidated Florida cases challenging the sentencing of juveniles to life without parole.²³ In the past, juvenile offenders in some jurisdictions have been subject to imposition of life without parole.²⁴ The arguments put forth in the Florida cases refuted life without parole in non-homicide cases and highlighted arguments of diminished culpability and maturity which were successfully asserted in *Roper v. Simmons*.²⁵ Recently, on May 17, 2010, the Supreme Court determined that juvenile life without parole sentencing violated the Eighth Amendment to the U.S. Constitution.²⁶ The Court followed its reasoning in *Roper* closely and referenced the limited culpability of juveniles and how developments in brain science illustrate juveniles' continuous maturation process past adolescence.²⁷

Offering adolescent brain research as part of an Infancy Defense²⁸ model provides juveniles with an opportunity to combat

culpability for juveniles, then the admissibility of adolescent brain imaging becomes even more compelling. The Infancy Defense model discussed in this article provides a suggested framework for considering the evidence); *Kent v. United States*, 383 U.S. 541 (1966); *In re Gault*, 387 U.S. 1 (1967); *Haley v. Ohio*, 332 U.S. 596 (1948).

²³ *Graham v. Florida*, 982 So.2d 43 (Fla. App. 1 Dist. 2008), *cert. granted*, 129 S. Ct. 2157 (2009); *Sullivan v. Florida*, 987 So.2d 83 (Fla. App. 1 Dist. 2008), *cert. granted*, 129 S. Ct. 2157 (2009). Petitioners in the cases argue violation of their protection against cruel and unusual punishment under the Eighth Amendment to the Constitution.

²⁴ Juvenile offenders between the ages of thirteen and fifteen were subject to life without parole for first time criminal offenses. Lauren Fine, *Death Behind Bars: Examining Juvenile Life Without Parole in Sullivan v. Florida and Graham v. Florida*, 5 DUKE J. CONST. L & PUB. POL'Y SIDEBAR 24, 25-26 (2009).

²⁵ 543 U.S. at 552, 569-572. The court found that there are three general differences between juveniles and adults that establish the juvenile's diminished culpability: (1) a lack of maturity and an underdeveloped sense of responsibility, (2) a vulnerability or susceptibility to negative influences and outside pressures, (3) a transitory and less fixed personality. *Id.*

²⁶ *Graham v. Florida*, 130 S. Ct. 2011 (2010).

²⁷ *Id.*

²⁸ See *Kaban*, *supra* note 9, at 35 (explaining the history of societal treatment of children as thinking and acting differently than adults, thereby justifying a

harsher penalties imposed by the states and facilitates imposition of legal standards that require consideration of the differences between children and adults in making moral judgments.²⁹ Our criminal law system considers whether the accused acted out of free will and whether the punishment is legitimate.³⁰ We punish individuals for wrongful acts if they understand the nature of their conduct, and in many states, if they are capable of controlling their impulses.³¹ When punishing adolescents, we must consider developmental research studies that identify three stages of child development and capacity: (1) children under seven who lack capacities to be culpable, (2) mid-childhood children who are unlikely to have that capacity, and (3) adolescents who are usually regarded as having less capacity than adults.³² This article asserts that the Infancy Defense provides a legal framework for considering the relevant scientific data and the graduated model of capacity under which children make decisions. The defense allows for an adjudicatory and prosecutorial process that reflects our knowledge of childhood development.

Information provided by brain imaging technology on the juvenile offenders' brain function can be offered through use of expert witness testimony, which should be admitted to establish the juvenile's inability to cognitively appreciate and process the wrongfulness of juveniles' conduct. Expert testimony is necessary to bolster juvenile defendants' arguments that the normal genetic structure of their adolescent brains supports exculpation over contrary arguments asserted by the prosecution. Such testimony would corroborate already existing evidence in support of the juvenile's defense by showing deficient judgment, decision making, and irresponsibility—all relevant evidence to a modified Infancy Defense asserted by a juvenile defendant.

presumption of incapacity in order to avoid punishing children because of their youth).

²⁹ Andrew Walkover, *The Infancy Defense in the New Juvenile Court*, 31 U.C.L.A. L. REV. 503, 539 (1984).

³⁰ *Id.*

³¹ *Id.*

³² *Id.* at 543.

During the past decade, several commentators have examined the progression of scientific brain imaging technology and its use in the courtroom.³³ Quite expectedly, critics have identified specific problems with using this technology under our current legal standards.³⁴ While the technology evolves, it appears that the current state of brain imaging has limited utility in the courtroom in light of deep concerns regarding the complexities of the brain and qualitative conclusions asserted by litigants during the adversarial process.³⁵ Nevertheless, the U. S. Supreme Court made specific conclusions about the underdevelopment of the adolescent brain in the landmark *Roper* decision that provides constitutional protection from execution for those under the age of eighteen.³⁶ This population of juvenile offenders is still subjected to prosecution in adult criminal courts where harsh sentencing schemes can result.³⁷ Unfortunately, most Infancy Defense statutes

³³ See Kristen Gartman Rogers & Alan DuBois, *The Present and Future Impact of Neuroscience Evidence on Criminal Law*, THE CHAMPION, Apr. 2009, at 18; See generally Stephen J. Morse, *Brain Overclaim Syndrome and Criminal Responsibility: A Diagnostic Note*, 3 OHIO ST. J. CRIM. L. 397 (2006); Terry A. Maroney, *The False Promise of Adolescent Brain Science in Juvenile Justice*, 85 NOTRE DAME L. REV. 89 (2009).

³⁴ See Jay D. Aronson, *Neuroscience and Juvenile Justice*, 42 AKRON L. REV. 917, 921 (2009). The author chronicles problems with case precedent like *Roper*, but argues that despite the tentative nature and unsettled meaning of adolescent brain research, “a new standard of the ‘reasonable adolescent’ should be created on the basis of the scientific and sociological understanding of teen brain anatomy and behavior.” *Id.* at 921. See also Jay D. Aronson, *Brain Imaging, Culpability and the Juvenile Death Penalty*, 13 PSYCH. PUB. POL. AND L. 115, 134 (2007) (identifying critics’ attacks on the lack of knowledge about normal brain structure and flawed experiments and concludes that the technology fails to offer strong enough evidence).

³⁵ Aronson, *supra* note 34, at 134.

³⁶ See *Roper*, 543 U.S. 551.

³⁷ See FLA. STAT. ANN. § 985.556 (LexisNexis 2007) (allowing the court to exercise an involuntary mandatory waiver if the child was fourteen years of age or older and the adjudication was for the commission of, attempt to commit, or conspiracy to commit crimes such as murder, carjacking, or aggravated assault); OHIO REV. CODE ANN. § 2152.10 (LexisNexis 2002) (requiring a transfer to adult criminal courts if the child was fourteen-years-old at the time of the act, was previously adjudicated delinquent, and remained in the custody of the

currently implemented by the states create a gap comprised of fourteen to eighteen year olds by failing to address this population of adolescents whose deficiencies in judgment and decision making pose the most credible argument for criminal exoneration.³⁸

A modified Infancy Defense model proposed here does *not* presume the incapacity of the juvenile defendant, thereby eliminating the burden of proof on the prosecution to establish that the juvenile cognitively understood the wrongfulness of his actions. Instead, the juvenile defendant can offer expert witness testimony based on adolescent brain imaging technology³⁹ to inform the trier of fact as to the *extent and function of the brain* on the issue of cognitive awareness of wrongful activity. The expert witness testimony would be subject to cross-examination by the prosecution, thereby subjecting the conclusions to the adversarial process. The goal of the adversarial process in this context would be to seek truth about the adolescent's conduct and to decide what levels of culpability apply. The testimony allows for fair consideration of the developmental deficiencies under which the adolescent offender operates.

U.S. Supreme Court jurisprudence on principles of fairness, its opinions that set forth methods for admitting expert witness testimony, and relevant state court decisions illustrate how the proposed Infancy Defense model can operate. The time has come

department of youth services); TENN. CODE ANN. § 37-1-134 (2006) (allowing the transfer of children sixteen years of age and younger if the child was charged with crimes such as first degree murder, rape, aggravated robbery, or kidnapping); TEX. FAM. CODE ANN. § 54.02 (West 1999) (giving the court discretion to transfer a child fourteen years of age or older if the alleged crime committed was a felony, but requires a transfer if the child had been transferred previously and the alleged crime was a felony).

³⁸ See Kaban, *supra* note 9, at 50.

³⁹ See C. Antoinette Clarke, *The Baby and the Bathwater: Adolescent Offending and Punitive Juvenile Justice Reform*, 53 U. KAN. L. REV. 659, 709 (2005). Neuroscientific research supports the decreased frontal lobe brain development associated with critical judgment. Additional factors such as the surge of hormonal development that takes place in adolescence and increased levels of excitability in the brain are relevant to adolescent function. *Id.*

where science and the law converge at a place where the issue of preservation and investment in our “most valuable natural resource”⁴⁰ is becoming increasingly crucial. This article suggests that the evolution of scientific methodologies should sculpt the lens through which we view children’s legal culpability and permissible means of exoneration. It seeks to challenge the legal system to expand its examination of children’s mental capacity through the admissibility of adolescent neuroscience and its technologies during trials.

Accordingly, Part II provides an introduction to the Infancy Defense, adolescent brain imaging, and the U.S. Supreme Court precedence in support of its admissibility. Part III discusses the historical treatment of children in our criminal justice system to illustrate how principles of fairness have established a trend that acknowledges the significant differences between adults and children. This Part ultimately establishes the foundation for an argument in favor of admitting adolescent brain technology as required under principles of fundamental fairness. Part IV briefly explains the adolescent brain imaging technology and its conclusions. Part V examines the existing evidentiary rule standard for the admissibility of scientific data as put forth under the U.S. Supreme Court’s decision in *Daubert v. Merrell Dow Pharmaceuticals*⁴¹ and the states’ analogous application of the standard.⁴² Finally, Part VI sets forth a model of operation of the modified Infancy Defense in the context of recent state Infancy Defense case law.

II. UNITED STATES SUPREME COURT JURISPRUDENCE AND PRINCIPLES OF FUNDAMENTAL FAIRNESS

Supreme Court precedence spanning three decades reflects a trend toward differing treatment of children under the law, as

⁴⁰ Herbert Hoover Quotes, THINKEXIST.COM, http://thinkexist.com/quotation/children_are_our_most_valuable_natural/185122.html (last visited Nov. 21, 2010).

⁴¹ 509 U.S. 579 (1993).

⁴² *Id.* at 588.

indicated by principles of fundamental fairness and due process.⁴³ Concepts of fundamental fairness in offering expert witness testimony as part of a criminal defense also pervade the U.S. Supreme Court jurisprudence where an indigent defendant must be provided with expert psychiatrist assistance.⁴⁴ In the landmark *Ake v. Oklahoma* opinion, the Court held that “fundamental fairness entitles indigent defendants to an adequate opportunity to present their claims fairly within the adversary system.”⁴⁵ The same

⁴³ See *Kent v. United States*, 383 U.S. 541, 553 (1966) (holding that the D.C. juvenile court statutory waiver process required a “full investigation” by the judge must include a hearing whereby specific determinative factors are reviewed and listed as a statement of reasons for why the juvenile is transferred into adult criminal court); *In re Gault*, 387 U.S. 1, 33 (1967) (holding, one year after *Kent*, that juveniles who are prosecuted in state criminal court are entitled to due process rights, which include notice of charges, legal representation, confrontation and cross-examination of witnesses, and the privilege against self-incrimination). Similarly, in cases involving issues of voluntariness of a juvenile’s confession, the Court has applied Fourteenth Amendment protections. See *Haley v. Ohio*, 332 U.S. 596, 599 (1948) (reversing the conviction based on the professed confession by a fifteen-year-old Negro boy). The Court stated:

What transpired would make us pause for careful inquiry if a mature man were involved. And when, as here, a mere child—an easy victim of the law—is before us, special care in scrutinizing the record must be used. Age 15 is a tender and difficult age for a boy of any race. He cannot be judged by the more exacting standards of maturity.

Id.

⁴⁴ *Ake v. Oklahoma*, 470 U.S. 68, 72 (1985). The trial judge rejected the defense counsel’s argument that the Constitution requires assistance of an indigent in preparation of his defense. *Id.* There was no testimony on either side about Ake’s sanity at the time of the offense because no one had examined him at that point. *Id.* The jury was instructed to presume Ake was sane at the time of the offense unless he presented sufficient evidence to raise a reasonable doubt about his sanity at that time. *Id.*

⁴⁵ *Id.* at 77 (quoting *Ross v. Moffitt*, 417 U.S. 600, 612 (1974)). The Court considered three factors in determining whether the participation of a psychiatrist is important enough that the State should be required to provide a defendant with adequate psychiatrist assistance. *Id.* The first compelling factor is the private interest which, in this case, is Ake’s life or liberty. *Id.* The next factor is the interest of the State in providing a psychiatrist, which is compelling because both the defendant and the State have an interest in accurate dispositions. *Id.* The last factor the court considered is the value of psychiatric assistance, which is crucial to the defendant’s ability to prepare his defense. *Id.*

principles of fundamental fairness that govern the *Ake* criminal defendant's meaningful defense also apply to the juvenile defendant seeking to admit expert witness testimony based on adolescent brain development.

The expert's testimony informs the trier of fact as to the operation of the adolescent brain and its capacity to calibrate appropriate behavior with judgment.⁴⁶ A defendant must be allowed to present his defense through introduction of hard and soft science⁴⁷ that contradicts and explains complicated evidence to

Because psychiatrists conduct professional examinations, gather facts, analyze the information, and draw conclusions about a defendant's mental condition, the Court determined that their expert assistance was *meaningful* in assisting the trier of fact. *Id.* at 81. The psychiatrist could offer manageable evidence that would help the trier of fact make an educated decision about the mental condition of the defendant at the time of the offense. *Id.*

⁴⁶ Cases following the *Ake* decision upheld appointment of experts in order to ensure fundamental fairness where appointment of the experts was based on "substantial need" and supported the position that due process principles should govern decisions involving testimony of experts on adolescent brain maturity as part of a juvenile defense. *See* *Rey v. Texas*, 897 S.W.2d 333, 338 (Tex. Crim. App. 1995) (holding that pathology, in general, and psychiatry are both subspecialties of medicine that are not exact science like mathematics and therefore, there is a need for a "second opinion"). If experts are allowed to testify regarding areas of medicine where the science may not be completely established or exact and a "second opinion" is indicated, then expert testimony regarding the breadth of knowledge learned about the adolescent brain through evolving neuroscience should also be considered as part of a meaningful criminal defense. *Id.* *See also* *State v. Johnson*, 344 S.E.2d 775, 779 (N.C. 1986) (finding contrary to the cases that held indigent criminal defendants have the right to an expert's assistance. Instead, no expert will be appointed if the defendant fails to show "facts evidencing a specific or particularized need for a medical expert."); *Kinley v. Smith*, 838 F.2d 1524, 1528–29 (11th Cir. 1988) (holding that defendant can only show that his due process rights were violated if he can show that he made a timely request for expert assistance, which was denied by the court, and that the denial led to an unfair trial); *McBride v. State*, 838 S.W.2d 248, 252 (Tex. Crim. App. 1992) (holding that an indigent defendant was entitled to appointment of an investigator/chemist and was entitled to have appointed counsel reimbursed for expenses incurred for the purpose of investigation and expert testimony).

⁴⁷ Tamara F. Lawson, *Can Fingerprints Lie?: Re-Weighing Fingerprint Evidence in Criminal Jury Trials*, 31 AM. J. CRIM. L. 1, 15 (2003); *see* Emily

the jury.⁴⁸ Notions of fundamental fairness must, therefore, prevail in order to allow the adolescent's right to offer all relevant information in his defense. If the Supreme Court is willing to consider the aspects of a child's nature that make him, in fact, an adolescent when applying constitutional protections, then the rules of evidence should likewise incorporate the same considerations for admitting adolescent brain imaging technology.

In two landmark U.S. Supreme Court cases, *Kent v. U.S.* and *In re Gault*, the Court laid a foundation for interpreting the process by which children in our legal system confront the consequences of their behavior. It was then that the U.S. Supreme Court first determined that juveniles are entitled to fundamental fairness in a juvenile transfer proceeding.⁴⁹ In addition, the most recent U.S. Supreme Court jurisprudence supports arguments in favor of expanding the evidentiary rules to allow for expert witness testimony offered on the issue of the adolescent's cognitive capacity and judgment.⁵⁰ The Supreme Court in *Roper* addressed arguments in favor of differing treatment being accorded to

Buss, *Rethinking the Connection Between Developmental Science and Juvenile Justice*, 76 U. CHI. L. REV. 493, 510 (2009) (arguing that culpability or blameworthiness is not an assessment that can be made through examination of developmental science, but should be determined based on the law).

⁴⁸ See *Ake*, 470 U.S. at 83–84. In the analogous area of indigent defense, the U.S. Supreme Court has long recognized that a State must ensure that an indigent criminal defendant has a “fair opportunity to present his defense.” *Id.* at 76. Juvenile offenders also should be entitled to the full benefit of a criminal defense. If a person's liberty is at stake, and that person cannot “participate meaningfully in a judicial proceeding,” then there is a violation of the Fourteenth Amendment's due process guarantee of fundamental fairness. *Id.* See also *Johnson*, 344 S.E.2d at 775; *McBride*, 838 S.W.2d at 251; *Rey*, 897 S.W.2d at 338.

⁴⁹ See *Kent*, 383 U.S. 541. The Court emphasized that while juvenile court proceedings enjoy considerable latitude, the process for waiver of juvenile court jurisdiction must still comport with basic requirements of due process. *Id.* at 553.

⁵⁰ See generally *Roper v. Simmons*, 543 U.S. 551 (holding that the death penalty may not be imposed on juveniles under the age of eighteen, reasoning that the punishment is reserved for a narrow category of crimes and offenders).

children under the age of eighteen who commit crimes.⁵¹ In essence, the Court concluded that children function under a diminished capacity that makes them less culpable than their adult counterparts.⁵² The *Roper* decision effectively anoints consideration of relevant adolescent brain imaging data on issues concerning an adolescent's culpable capacity. One commentator wrote, "[a]lthough one cannot assume that brain imaging had anything to do with the result in this case, it is notable that brain imaging was knocking on the door of the highest court in our country."⁵³

A closer reading of *Roper* in conjunction with prior U.S. Supreme Court jurisprudence,⁵⁴ where juveniles are afforded due process, further supports the argument that adolescent brain imaging technology must be considered in the adjudication and prosecution of juveniles, as required by the principles of fairness.⁵⁵

⁵¹ *Id.* In response to perceptions of increased juvenile crime and the abolition of the death penalty for juveniles in the *Roper* decision, many states, like Texas, have enacted criminal statutes that allow harsh irrevocable punishments for children under the age of eighteen.

⁵² *Id.* at 594. In its 2005 opinion in *Roper*, the U.S. Supreme Court reevaluated its constitutional interpretation made seventeen years earlier when considering what society's evolving standard of decency coupled with the justices' own independent judgment of what the Eighth Amendment to the Bill of Rights intended.

⁵³ Mark Pettit, Jr., *fMRI and BF Meet FRE: Brain Imaging and The Federal Rules of Evidence*, 33 AM J. L. & MED. 319, 335 (2007) (referring to *Roper*, 543 U.S. at 551).

⁵⁴ See generally *Kent*, 383 U.S. 541 (finding that a waiver hearing held under state statute "must measure up to the essentials of due process and fair treatment"). *Id.* at 562. See generally *In re Gault*, 387 U.S. 1 (holding that juveniles are entitled to principles of fundamental fairness and due process, which includes a right to notice of charges, to counsel, to confrontation and cross-examination, and to privilege against self-incrimination).

⁵⁵ Bazelon, *supra* note 8, at 190. The author critiques three theoretical justifications for rejecting the Infancy Defense in the Juvenile Courts, noting that the defense safeguards due process rights of adolescents. Bazelon further suggests that the standard of proof to overcome the presumption of incapacity is insufficient and vague. *Id.* at 193. Accordingly, the author proposes a model statute that would involve evaluations from mental health professionals and educators. *Id.* at 194.

Specifically, juvenile defendants must be able to offer brain imaging data as scientific evidence to establish how their diminished capacity reflects their inherent maturity and unreliable decision-making processes that ultimately lead to criminal activity.⁵⁶

The Court's conclusions in *Roper* provide a relevant framework from which we can extrapolate fairness principles and their operation in determining the admissibility of scientific data under the rules of evidence.⁵⁷ The Court decided that execution of offenders under the age of eighteen was constitutionally impermissible because children differ significantly from adults in their underdeveloped sense of responsibility, their impetuosity, and most importantly, their inability to make well-considered decisions.⁵⁸

The scientific data considered in *Roper* was not offered as evidence or made part of the trial record.⁵⁹ In fact, neither the *Roper* court nor any of the lower courts in this matter heard

⁵⁶ See Elizabeth Cauffman & Laurence Steinberg, *The Cognitive and Affective Influences on Adolescent Decision-Making*, 68 TEMP. L. REV. 1763, 1765 (1995) (explaining the developmental approach to the definition of maturity of judgment and its legal implications).

⁵⁷ Under *Roper*, juveniles function under a level of maturity and under developed sense of responsibility that the Court found entitles them to be forgiven for their misconduct. 543 U.S. at 570. Other commentators who have studied neurobiological data and its impact on juvenile justice believe that the *Roper* court's ruling buttresses consideration of other factors in the treatment of juveniles under the law such as, "[c]ognitive function, psychiatric status, and drug and alcohol use have all been linked to the ability to make decisions. . . ." Staci A. Gruber & Deborah A. Yurgelun-Todd, *The Mind of a Child: The Relationship between Brain Development, Cognitive Functioning and Accountability under the Law*, 3 OHIO ST. J. CRIM. L. 321, 322 (2006).

⁵⁸ *Roper*, 543 U.S. at 569.

⁵⁹ Justice Thomas cites in his dissent to scientific evidence included in Amicus briefs submitted by several professional associations. The Justice references the limitations on use of scientific methodology in the courts and concludes that the legislatures should weigh conflicting views generated by the psychological studies, because they can determine "a flexibility of approach that is not available to the courts." *Id.* at 617–18 (quoting *McCleskey v. Kemp*, 481 U.S. 279, 319 (1987)).

evidence during the adversarial process regarding the scientific and social studies upon which the ruling depends.⁶⁰ Accordingly, critics will argue that the scientific evidence referred to as the basis for the Court's decision regarding juveniles as less mature and less culpable was not credibly siphoned through the legal process.⁶¹ Nevertheless, the Court considered the data relevant when interpreting an adolescent's constitutional protection from the gravest punishment inflicted by the law—death.⁶² If an adolescent's maturity is relevant to his constitutionally protected rights under the Eighth Amendment, then adolescent brain imaging technology should be offered under the states' evidentiary rules to inform triers of fact on the impact that adolescence has on his culpability. The *Roper* decision provides a pivotal turn toward future jurisprudence that should encourage state courts to acknowledge those characteristics inherent to adolescents, which justify their differing treatment under the law.⁶³ If the Supreme

⁶⁰ See generally *Roper*, 543 U.S. 551.

⁶¹ Justice Scalia, in his dissent in *Roper*, joined by Justice Thomas, stated, "the Court looks to scientific and sociological studies. . . . [I]t never explains why those particular studies are methodologically sound; none was ever entered into evidence or tested in an adversarial proceeding." *Id.* at 617 (Scalia, J., dissenting). The dissenting Justices further comment on the existence of studies that take contrary views from those endorsed by the majority regarding the maturity levels of juveniles. *Id.* at 617–18.

⁶² Prior to *Roper*, the existing rule for seventeen years allowed execution of juvenile offenders who were sixteen or seventeen years of age at the commission of the crime. See *Stanford v. Kentucky*, 492 U.S. 361, 361 (1989). In *Stanford*, the majority required a more "individualized consideration" under an Eighth Amendment analysis. *Id.* The Court rejected arguments that other state laws where children under the age of eighteen were barred from assuming responsibility for drinking or driving, for example, were reflective of society's views towards not executing children within this age group. *Id.* at 362.

⁶³ In fact, the U. S. Supreme Court has recently considered different treatment of children for purposes of applying search and seizure protections. Specifically, the Court in *Redding* required school officials to possess "reasonable suspicion" before conducting strip searches. *Safford Unified Sch. Dist. No. 1 v. Redding*, 129 S. Ct. 2633, 2635 (2009). A standard emerges that considers the age and sex of the student and the nature of the infraction. *Id.* at 2639. Ultimately, social and developmental differences of children permeate the Court's decisions when setting forth different standards to be applied for not

Court is willing to consider the aspects of a child's nature that make him, in fact, an adolescent when applying constitutional protections, then the rules of evidence should likewise incorporate the same considerations for admitting adolescent brain imaging technology.

While the states' evidentiary laws currently set forth the standards under which most defendants present scientific evidence for consideration by the trier of fact,⁶⁴ those rules must be applied by the trier of fact to fairly include brain imaging technology as a basis for asserting "infancy" and deficient cognitive capacity when adjudicating or prosecuting juveniles. U.S. Supreme Court precedent guides the states in application of the evidentiary rules through its thoughtful evolution about the way our legal system should view children and, specifically, what kind of information is relevant to the determinations made about their treatment under the law.⁶⁵ Consider the compelling language in the *Stanford* opinion discounting the type of evidence relied on in *Roper*.⁶⁶ Justice Scalia stated:

[T]he views of interest groups, and the positions of professional associations are too uncertain a foundation for constitutional law. Also insufficient is socioscientific or ethicoscience evidence tending to show that capital punishment . . . fails to exact just retribution because juveniles, being less mature and responsible, are less morally blameworthy.⁶⁷

Seventeen years later, after being charged with analyzing the objective indicia of consensus and determining its own independent judgment, the Supreme Court has evolved to consider "the scientific and sociological studies" cited by respondent and his amici.⁶⁸ Like the U.S. Supreme Court, individual states must evolve in their application of the evidentiary rules by applying a

only Fourth Amendment protections, but also Fifth Amendment protections against self-incrimination.

⁶⁴ FLA. STAT. § 90.702 (2000); ME. R. EVID. 701–706; TEX. R. EVID. 701–706.

⁶⁵ See generally *Roper*; *Stanford*; *In re Gault*, 387 U.S. 1 (1967); *Kent v. United States*, 383 U.S. 541 (1966).

⁶⁶ See generally *Roper*, 543 U.S. 551.

⁶⁷ *Stanford*, 492 U.S. at 363.

⁶⁸ *Roper*, 543 U.S. at 569.

modified Infancy Defense in which expert witness testimony on adolescent brain imaging would be recognized through liberal application of the evidentiary rule put forth in *Daubert*.⁶⁹ If a child's immaturity makes imposition of death constitutionally impermissible, then notions of fundamental fairness should, arguably, require application of evidentiary laws that allow for admitting testimony that is relevant to the issue of cognitive capacity and judgment.

The question becomes, to what extent the rules of evidence, as applied to juvenile defendants, should reflect a "process" that is fair, yet differs from the standards applied to their adult counterparts. If decisions regarding a child's constitutional protection under the Fourth,⁷⁰ Fifth,⁷¹ Eighth,⁷² and Fourteenth⁷³ Amendments are made by the U.S. Supreme Court based on factors specifically pertaining to the child's adolescence, then the Rules of Evidence must fairly afford him the opportunity to offer expert witness testimony based on adolescent brain imaging technology as justification for their differing treatment under the law.

The courts must synthesize the body of jurisprudence articulating principles of fundamental fairness in a meaningful criminal defense with the jurisprudence that treats children differently. The result is the proper interplay of fundamental fairness concepts and the standards for admissibility of expert witness testimony. The synthesized law then allows for a juvenile offender's meaningful defense that is bolstered by adolescent brain

⁶⁹ See *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 597 (1992) ("'General acceptance' is not a necessary precondition to the admissibility of scientific evidence under the Federal Rules of Evidence, but the Rules of Evidence—especially Rule 702—do assign to the trial judge the task of ensuring that an expert's testimony both rests on a reliable foundation and is relevant to the task at hand."); see also Lawson, *supra* note 46, at 56 (discussing how the exclusion of fingerprinting evidence is contrary to the spirit of *Daubert* and also curtails the due process rights of the defendant).

⁷⁰ *Safford Unified Sch. Dist. No. 1 v. Redding*, 129 S. Ct. 2633, 2644. (2009)

⁷¹ *Fare v. Michael C.*, 442 U.S. 707, 722 (1979).

⁷² *Roper*, 543 U.S. at 568; *Stanford*, 492 U.S. at 380.

⁷³ *In re Gault*, 387 U.S. 1, 41 (1966).

technology. In order to fully appreciate arguments in favor of admitting expert witness testimony of adolescent brain imaging, we must first understand the technology as an integral part of the argument.

III. ADOLESCENT BRAIN IMAGING—THE TECHNOLOGY AND ITS CONCLUSIONS

A juvenile's meaningful defense specifically involves use of adolescent brain imaging and expert witness testimony in a modified Infancy Defense model. We must, therefore, examine how the nature of neuroscience has advanced in order to appreciate the way this evolving discipline impacts the evidentiary rules.

A. *The Nature of Neuroimaging*

Scientists have historically studied brain function as it relates to specific behavioral responses relevant to criminal activity.⁷⁴ The study of neuroimages comprises structural and functional images of the brain.⁷⁵ The computerized tomography ("CT scan") and the magnetic resonance imaging ("MRI") produce pictures of the soft tissue structure of the brain.⁷⁶ On the other hand, functional neuroimages, such as positron emission tomography ("PET")⁷⁷

⁷⁴ One relevant area of study involves Evolutionary Neuroandrogenic Theory ("ENA"). Lee Ellis, *A Theory Explaining Biological Correlates of Criminality*, 2 EUR. J. CRIMINOLOGY 287, 288 (2005). The ENA theory proposes that aggressive behavior is an aspect of human evolution and that neurochemistry is responsible for increased criminal behavior in males compared to females. *Id.* at 292. The theory maintains that brain functioning is affected by hormones and can lead to criminal behavior. ENA theory associates biological factors with criminal behavior and predicts that most offenders are males between thirteen and thirty years old. *Id.* at 305. Hormones affect changes in the structure and function of the brain and influence behavior. *See also* Jennifer Kulynych, *Psychiatric Neuroimaging Evidence: A High-Tech Crystal Ball?* 49 STAN. L. REV. 1249, 1255 (1996–1997).

⁷⁵ Kulynych, *supra* note 74, at 1254 (stating that while the pictures look similar to images of an individual's brain, they are more similar to charts or bar graphs).

⁷⁶ *Id.* at 1255.

⁷⁷ PET scans are a relatively new diagnostic tool that neuroscientists use to measure the glucose metabolic rates of different parts of the brain. DAN J.

measure differences in metabolic rate and relative changes in the physiological state of the brain.⁷⁸ This technique is limited to measuring cognitive activity indirectly.⁷⁹

The optimal studies of cognitive brain function would derive from a hybrid image of functional and structural scans. The functional MRI (“fMRI”) involves measuring functional changes in blood oxygenation (an index of metabolic activity) and superimposing the changes upon a static structural MRI image of the brain.⁸⁰ The fMRI provides a neuroimage that shows the structure and the activity of the brain⁸¹ by producing a tri-dimensional view of internal biological processes.⁸² With the fMRI, scientists make inferences regarding the relationship

TENNENHOUSE, ATTORNEYS MEDICAL DESKBOOK § 21:12 (4th ed. 2007). The process involves the introduction of radioactive isotopes that are attached to a tagged compound. Alan C. Hoffman, *The Standard for Admissibility of Evidence: Yesterday and Today*, 19 ANNALS HEALTH L. 161, 162 (2009–2010). Researchers analyze brain function by measuring how “area[s] of the brain demonstrate the uptake of the isotope. . . .” *Id.* Patients are injected with a solution which is mixed with trace amounts of radioactivity. *See* Pettit, *supra* note 53, at 320 n.4; *United States v. Mezinsky*, 206 F.Supp. 2d 661, 674 (E.D. Pa. 2002). The scan takes axial slice images at six millimeter intervals and reconstructs those images with the aid of a computer. *Id.* A computer also takes the numerical data and converts them into pixels to make colors. *Id.* The data from the individual patient’s scan is then superimposed onto a brain imaging template of a patient without abnormalities for comparison. *Id.* When a case uses this technology to establish the defendant’s diminished capacity, experts in the area agreed that the PET scan is limited when used to establish a link between the defendant’s diminished capacity. *Id.* Experts in the area have also agreed that the PET scan is limited when used to establish a link between the defendant’s brain and the legal element. *Id.* at 675. What the PET scan showed was, “only a ‘snapshot’ of [the defendant’s] brain.” *Id.*

⁷⁸Kulynych, *supra* note 74, at 1256. The patient performs a cognitive task during a PET scan and the scientists make inferences that correlate high metabolic rates and underlying cognitive process. *Id.*; *see also* Jennifer Kulynych, *Brain, Mind, and Criminal Behavior: Neuroimages as Scientific Evidence*, 36 JURIMETRICS J. 235, 238 (1995–1996).

⁷⁹Kulynych, *supra* note 74, at 1256.

⁸⁰*Id.* at 1256.

⁸¹*Id.*

⁸²*Id.* at 1257.

between changes in the brain and mental events.⁸³ Specific problems arise, however, that are endemic to the technology. The fMRI facilitates inferences that can be drawn from changes occurring in the brain. One problem involves the functional delay in times between the nerve impulses and fluctuation in blood oxygenation. These problems make the inferences drawn from the technology weaker and arguably less valuable.⁸⁴ Regardless, functional brain imaging studies have been shown to be more sensitive for the detection of abnormalities when compared with MRI or CAT scans.⁸⁵ Even the critics of the technology acknowledge that the neurological research sheds light on an individual's capacity when assessing the relevant issue of blameworthiness.⁸⁶

Because neuroimages are digital representations of computer generated numerical measurements, the brain scan that is constructed may vary based on the technical parameters set by the researcher.⁸⁷ Even further, the individual scanners do not produce identical imaging despite input of identical parameters.⁸⁸ Consequently, variations in mechanical, mathematical, and computer software versions will influence the construction of a neuroimage and the results recorded by different laboratories.⁸⁹ This means that if, hypothetically, a prosecutor and defense attorney obtain separate images from two different hospitals they might receive different results. While the variability in

⁸³ Rogers & DuBois, *supra* note 33, at 18–19.

⁸⁴ Kulynych, *supra* note 74, at 1256–57. *See generally* Rogers & DuBois, *supra* note 33, at 18 (analyzing “the hurdles defense attorneys might have to overcome to successfully put fMRI evidence into service for their clients”).

⁸⁵ STUART YUDOFKY & ROBERT E. HALES., *THE AMERICAN PSYCHIATRIC PUBLISHING TEXTBOOK OF NEUROPSYCHIATRY AND BEHAVIORAL NEUROSCIENCES* 604 (5th ed. 2008).

⁸⁶ Peggy Sasso, *Criminal Responsibility in the Age of “Mind-Reading,”* 46 AM. CRIM. L. REV. 1191, 1193 (2009).

⁸⁷ Kulynych, *supra* note 74, at 1254.

⁸⁸ Teneille Brown & Emily Murphy, *Through A Scanner Darkly: Functional Neuroimaging As Evidence of A Criminal Defendant's Past Mental States*, 62 STAN. L. REV. 1119, 1144 (2009–2010).

⁸⁹ Kulynych, *supra* note 74, at 1254–55.

neuroimaging might present evidentiary challenges, efforts to minimize these issues are being addressed through the National Institutes of Health (“NIH”) that spearheaded a collective study by researchers called The Biomedical Information Network (“BIRN”).⁹⁰ The future utility of neuroimaging in the courtroom is, therefore, being refined to address evidentiary concerns.

B. *The Technology Informs Us: Prefrontal Cortex⁹¹ and Frontal Lobe⁹² Development—The Adolescent’s Journey from Emotion to Cognition*

Initially, scientists examined the adolescent brain to discover the causes for autism and hyperactivity disorder.⁹³ More recently, longitudinal studies indicate that the frontal lobes are the last parts of the brain to reach maturity.⁹⁴ These studies provide an important basis for comparison to studies performed by a Harvard neuropsychologist showing that adults use their frontal lobes for

⁹⁰ Laurence R. Tancredi & Jonathan D. Brodie, *The Brain and Behavior: Limitations in the Legal Use of Functional Magnetic Resonance Imaging*, 33 AM. J.L. & MED. 271, 281 (2007). The outcome of the BIRN project promises standardization of the procedures assisting in future application of the technology in the area of lie detection. *Id.* at 290.

⁹¹ The prefrontal cortex is located in the front of the brain that is divided into three areas: the dorsolateral, orbitofrontal and mesial. Gruber & Yurgelun-Todd, *supra* note 57, at 322. It is the region of the brain involved in “planning complex cognitive behaviors, personality expression and moderating correct social behavior.” *Id.* Additionally, the prefrontal cortex plays a key role “in the development and execution of novel thoughts and behaviors.” *Id.* Researchers have identified continued development in the prefrontal cortex from the first year of an infant’s life, through post-adolescence, and into thirty years of age. *Id.* at 324.

⁹² Frontal lobe development during adolescence involves notable changes in the composition of this area of the brain where cognitive functioning occurs. Robert E. Shepherd, Jr., *The Relevance of Brain Research to Juvenile Defense*, CRIM. JUST., Winter 2005, at 51. One important change is referred to as “pruning” or thinning of gray matter, which strengthens the connections between the neurons. *Id.* at 52.

⁹³ *Id.* at 51.

⁹⁴ *Id.*

planning and judgment, while teenagers rely on their amygdala,⁹⁵ which is associated with emotional reactions,⁹⁶ to make decisions. Adolescent vulnerability stems from their inability to perceive the risks associated with their action to the same degree as their adult counterparts.⁹⁷ When analyzing issues of wrongful conduct, the trier of fact can be reliably informed by adolescent brain development.

For instance, adolescents are less able to make the moral judgments that directly influence the decision to commit a crime because certain regions of the brain, specifically the dorsolateral and ventromedial regions of the prefrontal cortex, have not yet fully developed until later in adolescence.⁹⁸ Studies have shown that certain regions in the prefrontal cortex of the brain are critical in the formation and application of socio-moral reasoning.⁹⁹ Specifically, deficits in the orbitofrontal cortex have been shown to

⁹⁵ This area of the brain is considered the most primitive area because it is responsible for processing our perceived fears and threatening circumstances. The amygdala also develops our responsive behaviors like gut-reactions, aggression, and impulsivity. Johndro, *supra* note 17, at 359–60. Unlike adults, adolescents process information through the amygdala primarily rather than through the frontal lobes where more complex planning occurs. *Id.*

⁹⁶ Shepherd, *supra* note 92, at 52.

⁹⁷ Ann E. Kelley, et al., *Risk Taking and Novelty Seeking in Adolescence*, 1021 ANNALS N.Y. ACAD. SCI. 27, 27–32 (2004) (discussing specific alterations in brain development that accompany neuroendocrine changes). *See also* Rightmer, *supra* note 21, at 27–28 (advocating for consideration of all relevant information, including MRI technology, in making laws that would retain adolescents in the juvenile system until their brains fully mature).

⁹⁸ Clarke, *supra* note 39, at 709–10 (examining developmental realities about adolescent development and the punitive policies that have evolved over recent years).

⁹⁹ Oliver R. Goodenough & Kristen Prehn, *A Neuroscientific Approach to Normative Judgment in Law and Justice*, 359 PHIL. TRANSACTIONS ROYAL SOC'Y B: BIOLOGICAL SCI. 1709, 1718 (2004) (examining lesion studies conducted by researchers using data taken from patients with damage to the brain resulting from orbitofrontal injury of the brain, disease, and developmental problems. These studies determine corresponding deficits in making moral decisions and implementing appropriate behavior.).

cause problems in learning moral information and in “cuing morally appropriate behaviour.”¹⁰⁰

The changes in adolescent frontal brain lobes affect the adolescent’s emotions and their ability to control their thoughts and behavior.¹⁰¹ The prefrontal lobes have long been considered crucial to a variety of human thoughts and behaviors, including social behavior, self-evaluation, and prioritizing values.¹⁰² As a result, adolescents have the tendency to engage in risky behavior because they do not anticipate the negative outcomes.¹⁰³ When we see adolescents behaving impulsively and with frequent mood swings, this indicates immature prefrontal lobe development.¹⁰⁴ The same region of the brain has been shown to be involved in experiencing regret and anticipating consequences.¹⁰⁵ Individuals engage in higher mental abilities that rely on things like “understanding of a situation, appraising its emotional valence, activating norms from long-term memory, maintaining a norm in working memory, comparing the norm with the present behavior, and deciding if there is any transgression, all of which take place under the influence of emotional processes.”¹⁰⁶ In addition, an adolescent’s limbic system, though not fully developed, processes the emotion rather than their frontal lobe, which is the processing center for the brain when fully developed.¹⁰⁷

While logical reasoning abilities reach adult levels by age fifteen, psychosocial capacities continue to develop into young

¹⁰⁰ *Id.*

¹⁰¹ Kelly D. Schwartz, *Adolescent Brain Development: An Oxymoron No Longer*, J. YOUTH MINISTRY, Spring 2008, at 85, 88 (2008) (explaining studies conducted regarding the effect of prefrontal lobe changes in adolescents).

¹⁰² *Id.*

¹⁰³ *Id.* at 89.

¹⁰⁴ *Id.* at 90.

¹⁰⁵ *Id.* at 89. *See also* Goodenough & Prehn, *supra* note 99.

¹⁰⁶ *See also* Goodenough & Prehn, *supra* note 99, at 1717.

¹⁰⁷ NAT’L JUVENILE JUSTICE NETWORK, USING ADOLESCENT BRAIN RESEARCH TO INFORM POLICY: A GUIDE FOR JUVENILE JUSTICE ADVOCATES 1 (2008).

adulthood.¹⁰⁸ The increased risk taking during adolescence is the result of competition between socio-emotional and cognitive control networks.¹⁰⁹ The socio-emotional network is remodeled by hormonal changes during puberty and is located in the limbic and paralimbic areas of the brain.¹¹⁰ The cognitive-control network consists of outer regions of the brain.¹¹¹ When the socio-emotional network is not activated, the cognitive-control network imposes control over risky behavior.¹¹² Under emotional arousal, the socio-emotional network is activated and leads toward risk taking.¹¹³ The prefrontal cortex is responsible for higher order functions, which are all interrelated with our decisions to forego immediate rewards versus delayed ones.¹¹⁴ Studies have shown that neuropsychological deficits in children have a significant effect on levels of self-control and that low self-control is the result of biological and social factors.¹¹⁵

Furthermore, the significant increase in both the growth of the wiring between neurons and in the number of neurons is another factor affecting behavior (a newborn possess only slightly smaller

¹⁰⁸ Laurence Steinberg, *Risk Taking in Adolescence: New Perspectives from Brain and Behavioral Science*, 16 CURRENT DIRECTION PSYCHOL. SCI. 55, 56 (2007).

¹⁰⁹ *Id.*

¹¹⁰ *Id.*

¹¹¹ *Id.*

¹¹² *Id.*

¹¹³ *Id.*

¹¹⁴ *Id.* at 57.

¹¹⁵ See Joseph H. Baskin et. al., *Is A Picture Worth A Thousand Words? Neuroimaging in the Courtroom*, 33 AM. J.L. & MED. 239, 251 (2007) (presenting a case that establishes how adequate neuroimaging can contribute to resolution of criminal manslaughter charges.) In the case, repeat neuropsychological testing showed widespread cognitive deficits in her frontal systems impacting memory and information processing as well as poor self-control. *Id.* at 252; see also Marie Ratchford & Kevin M. Beaver, *Neuropsychological Deficits, Low Self-Control, and Delinquent Involvement Toward a Biosocial Explanation of Delinquency*, 36 CRIM. JUST. & BEHAV. 147, 149 (2009) (analyzing the correlation between self-control and biology on adolescent delinquent behavior).

amounts than in adulthood).¹¹⁶ In fact, Dr. Jay Giedd of the National Institute of Mental Health concluded that brain maturation continues into the twenties.¹¹⁷ Recently, studies have revealed that the brain matures far beyond the end of adolescence through developmental processes of synaptic pruning and myelination,¹¹⁸ and gray matter increases during pre-adolescence and decreases during post-adolescence.¹¹⁹

Synaptic pruning refers to the brain's growth process.¹²⁰ Here, an individual's brain increases in synaptic production with *reduction occurring after puberty*.¹²¹ This reduction of synapses, called pruning, improves higher cognitive functions like abstract

¹¹⁶Sarah-Jayne Blakemore & Suparna Choudhury, *Development of the Adolescent Brain: Implications for Executive Function and Social Cognition*, 47 J. CHILD PSYCH. & PSYCHIATRY 296, 297 (2006) (outlining how the brain changes between childhood and adulthood).

¹¹⁷ACT FOR YOUTH UPSTATE CTR. FOR EXCELLENCE, RESEARCH FACTS & FINDINGS: ADOLESCENT BRAIN DEVELOPMENT I (2002).

¹¹⁸In recent years, neuroscientists have named two key developmental processes: myelination and pruning of neural connections. Aronson, *Brain Imaging, Culpability and the Juvenile Death Penalty*, *supra* note 34, at 120. Myelination provides the insulation necessary to efficiently transmit electrical signals from one neuron to the next. *Id.* Pruning takes place during adolescence and well into adulthood. *Id.* In either case, regions of the brain responsible for basic life processes mature fastest, whereas the regions responsible for behavior inhibition, control, and decision making take longer. *Id.* The results of both of these processes can be seen with modern MRI technology. *Id.*; *see also* Maroney, *supra* note 33, at 98–99 (asserting that adolescent brain science shows how structural processes referred to as myelination and synaptical development occurs); Seymour Moskowitz, *Save the Children: The Legal Abandonment of American Youth in the Workplace*, 43 AKRON L. REV. 107, 150 (2010) (supporting the premise that neural maturation continues into our mid-twenties); Blakemore & Choudhury, *supra* note 116, at 300; Schwartz, *supra* note 101, at 86 (reviewing the research of developmental psychology with commentary on how it effects the community, parents, and adolescents).

¹¹⁹Jay N. Giedd et al., *Brain Development During Childhood and Adolescence: A Longitudinal MRI Study*, 2 NATURE NEUROSCIENCE 861, 862 (1999).

¹²⁰Emily Edwards, *But I'm Just a Kid: Juvenile Adjudications and Sentencing Enhancements*, 51 S. TEX. L. REV. 205, 224 (2009).

¹²¹*Id.*

thinking, language, and hypothetical thinking.¹²² The synaptic pruning in the adolescent brain leads to reduced use of the decision-making areas of the brain when making choices involving risk.¹²³ Therefore, adolescents can overstate rewards and not fully evaluate the risks or consequences of their acts. They may seek excitement through extremely risky behavior because the redistribution of dopamine raises their threshold for attaining pleasure.¹²⁴

An adolescent's poor decision-making, recklessness, and emotional outbursts might be due to immature areas of the brain that are responsible for self-control, judgment, and emotions.¹²⁵ Dr. Sarah-Jayne Blakemore from the Institute of Cognitive Neuroscience at the University College London, has concluded that adolescents use their prefrontal cortex to a greater extent than adults to achieve the same results during intentional causality.¹²⁶ This means that there is a higher demand on an adolescent's brain compared to that of an adult during mentalising. Also known as "[t]heory of mind . . . mentalising . . . refers to the inferences that we naturally make about other people's intentions, beliefs and desires, which we then use to predict their behaviour."¹²⁷

Given what scientists have learned about the adolescent's brain function, the courts must now interpret evidentiary rules in a fair manner as commanded by principles of fundamental fairness. A study of the evidentiary rules pertaining to expert witness testimony supports arguments for evolution of evidentiary rule standards in a similar manner to the evolution that has already occurred in the study of adolescent brain neuroscience.

¹²² Schwartz, *supra* note 101, at 87.

¹²³ Edwards, *supra* note 120, at 224.

¹²⁴ Maroney, *supra* note 33, at 110. Dopamine is a chemical produced by the brain that links action to sensation of pleasure.

¹²⁵ *Id.*

¹²⁶ Sarah-Jayne Blakemore, *The Social Brain of a Teenager*, 20 PSYCHOLOGIST 600, 602 (2007).

¹²⁷ *Id.* at 601.

IV. EVIDENTIARY RULE JURISPRUDENCE

Just as the development of adolescent brain technology informs the scientific world, the evidentiary rules must, likewise, develop by allowing for admissibility of new scientific data. Under the evidentiary standards set forth by the U.S. Supreme Court, trial court judges are anointed with discretion to incorporate adolescent brain imaging technology into the courtroom when offered as part of juvenile offenders' meaningful Infancy Defense.

Like any testimony offered by the parties in an adversarial process, expert witness testimony based on scientific data—in this case adolescent brain imaging technology—is subject to the evidentiary rules governing admissibility.¹²⁸ The rules of evidence set forth standards that are designed to aid the trial court judge in determining relevant and reliable information offered by the parties.¹²⁹ Principles of fairness are inherent to the rules governing the evidentiary process,¹³⁰ especially since all defendants have a constitutional right to put forth their best defense. In the adversarial process, this involves offering relevant and reliable information, which may sometimes include cutting edge scientific studies and research. As one commentator explains, “[d]ue process requires that a defendant be allowed to present his defense, and intertwined within the right to defend oneself is the ability to properly explain, as well as contradict, complicated evidence to the jury.”¹³¹

The expert testimony affords juvenile defendants the fullest opportunity to present information in support of the states' Infancy Defense laws¹³² that not only explains but also contradicts their legal culpability as a function of their deficiencies. The law must necessarily accommodate interdisciplinary progression in the areas of neuroscience that serves to inform us as society constantly

¹²⁸ Pettit, *supra* note 53, at 324.

¹²⁹ Lawson, *supra* note 47, at 14.

¹³⁰ *Id.* at 15.

¹³¹ *Id.* at 14.

¹³² See discussion *infra* Part V.

develops normative standards under which individuals are criminally responsible.

A. *Frye and Daubert: The Evolution of Evidentiary Norms*

The U.S. Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*¹³³ reviewed the long-standing “general acceptance”¹³⁴ evidentiary standard for admitting expert witness testimony after a period of division among the circuits.¹³⁵ Under the “general acceptance” *Frye* standard, an expert’s opinion based on a scientific technique is inadmissible unless it is generally

¹³³ See generally *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579 (1993) (holding that the “general acceptance” test was superseded by the enactment of the Federal Rules of Evidence and provided specific guidance for admitting expert testimony). The *Daubert* Court regards enactment of the Federal Rules of Evidence (FRE), Pub. L. No. 93-595 (1975), as an annulment of the prior “general acceptance” standard and based its decision on their interpretation of the legislation. *Id.* In *Daubert*, the parents of two boys sued Merrell Dow Pharmaceuticals to recover damages for birth defects that they asserted were caused when the mother ingested the prescription antinausea drug, Benedectin. *Id.* Both plaintiff and defendant offered experts who testified to whether Benedectin was a cause of the birth defects. A battle of the experts ensued ending in the District Court’s excluding expert opinion testimony that was not based on the large volume of epidemiological data addressing Benedectin and its side effects. Since the epidemiological analysis was not based on published works, nor was it subjected to peer review, the District Court excluded the evidence as inadmissible reasoning that there was no causal link between Benedectin and the birth defects. *Id.* at 584. The Ninth Circuit Court of Appeals affirmed the lower court’s decision stating that expert opinion testimony cannot be “generally accepted” if the methodology testified to “diverges significantly from procedures accepted by recognized authorities in the field.” *Id.*

¹³⁴ *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923). For seventy years, the general acceptance test articulated in *Frye* was the prevailing standard for determining the admissibility of scientific evidence. The Court of Appeals for the District of Columbia Circuit determined that a polygraph test was inadmissible because it was not sufficiently accepted among experts in the field. Edward R. Becker & Aviva Orenstein, *The Federal Rules of Evidence After Sixteen Years—The Effect of “Plain Meaning” Jurisprudence, The Need for An Advisory Committee on the Rules of Evidence, and Suggestions for Selective Revision of the Rules*, 60 GEO. WASH. L. REV. 857, 877 (1992).

¹³⁵ *Daubert*, 509 U.S. at 579.

accepted as reliable in the relevant scientific community.¹³⁶ After contemplating congressional drafting history, which failed to mention the common law *Frye* standard, the Court found “a rigid ‘general acceptance’ requirement would be at odds with the ‘liberal thrust’ of the Federal Rules and their ‘general approach of relaxing the traditional barriers to “opinion” testimony.”¹³⁷

Specifically, the Court in *Daubert* found that the governing Federal Rule 702, while placing limits on the admissibility of scientific evidence, still allows for the administrator of the proceedings—the trial court judge—to ultimately determine relevance and reliability.¹³⁸ Once the trial court judge is named as the final arbiter, the Court directs his role in the necessary regulation of theories and methodologies that impact the decision making process by providing several factors for him to consider in the evidentiary rule application process.¹³⁹

This process should result in the admissibility of expert witness testimony about the adolescent brain. It is relevant, first and foremost, because the testimony assists the trier of fact¹⁴⁰ by providing scientific data on matters vital to exculpating the

¹³⁶ *Id.*

¹³⁷ *Id.* at 588 (emphasis added) (citations omitted).

¹³⁸ *Id.* at 589.

¹³⁹ *Id.* at 592. The trial judge must assess (1) whether the expert is proposing to testify to scientific knowledge and (2) whether that scientific knowledge will assist the trier of fact to understand or determine a fact in issue. *Id.* Also, scientific knowledge assists the trier of fact when it is based on (1) methods and principles that can and have been tested, (2) theories or techniques that have been subject to peer review with due consideration to be given to, and (3) the technique’s known or potential rate of error. *Id.* The Court notes that publication of the theory or technique is only one element of review. *Id.* at 593. The main point here is that the knowledge to which the expert testifies has been appropriately scrutinized by the scientific community. *Id.* This article asserts that brain imaging technology affords us certain knowledge about the regions of the brain and their function that scientists generally agree. The expert witness testimony of what the technology reveals about the adolescent brain development passes the *Daubert* test. In light of the current technological limitations, however, this article advocates for use of the testimony only to the extent of its tested and proven parameters.

¹⁴⁰ *Id.* at 591.

juvenile offender under the Infancy Defense. If the defense requires a determination that an adolescent understands the difference between right and wrong behavior,¹⁴¹ scientific data that inform the jury about the adolescent brain decision-making process helps the judge or jury determine whether the law should impose the same level of responsibility on a juvenile as it does on his adult counterpart.¹⁴² If the trier of fact considers the scientific data on the immature prefrontal lobe development,¹⁴³ he can meaningfully assess an appropriate legal sanction or exculpation.

The scientific data speaks directly to one of perhaps several facts at issue in determining whether a juvenile defendant understood the wrongdoing. The trial court judge can fairly determine that it meets the relevancy standard under *Daubert* and then assess whether the prosecution or the defense has refuted or sufficiently established exculpation.¹⁴⁴ The scientific data showing adolescent brain deficiency may seemingly result in validation of an Infancy Defense assertion every time it is offered. Nevertheless, the adversarial process presents an opportunity for the opposing side or prosecution to refute the trier of fact's understanding of the adolescent brain capacity. In fact, the *Daubert* Court states, "[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence."¹⁴⁵

In other words, the Court contemplates situations where the trial judge preliminarily determines that the questioned evidence is admissible. If the scientific evidence is relevant, the trial court

¹⁴¹ Bazelon, *supra* note 8, at 169.

¹⁴² *Id.* at 187.

¹⁴³ Schwartz, *supra* note 101, at 87–88.

¹⁴⁴ Conversely, it may appear that the scientific data showing adolescent brain deficiency would practically result in validation of an Infancy Defense assertion every time they are offered. This argument is shortsighted, however, in light of the opportunity under a modified Infancy Defense model for the opposing side or prosecution to refute the trier of fact's understanding of the adolescent brain capacity.

¹⁴⁵ *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 596 (1993).

judge need not be constrained by concern over the foundationally sound scientific evidence because the “process” will ferret out and address those concerns. Consequently, the trial court judge’s decisions as the final arbiter in determining admissible issues where neuroscience and the law converge operate within the safeguard of the adversarial system. He must consider the soundness of scientific evidence and its reliability,¹⁴⁶ allowing for this evolving area of science.¹⁴⁷ We must view the trial court judge’s application of relevancy standards from the liberal perspective articulated by *Daubert*¹⁴⁸ and supported by the differing treatment of children as embraced by prior U.S. Supreme Court jurisprudence in *Roper*.

We charge the highest Court in the land with stewardship over proper application of the Constitution as a living document that is relevant to the times in which it governs. Science is life and evolves just like society’s views. The Court’s decisions determine just how tolerant the legal process will be in its application of progressive scientific evidence. Therefore, states must follow a tolerant path toward application of evidentiary standards that assist the triers of fact as to the evolving developmental brain of

¹⁴⁶ *Id.* at 589.

¹⁴⁷ See generally Shepherd, *supra* note 92, at 51 (where the author discusses the evolution of scientific brain research since the 1990s and its implications in the criminal justice system).

¹⁴⁸ The U.S. Supreme Court’s liberal review of the admissibility standards bears importance because, just as in its review of the Eighth Amendment in *Roper*, the review of the *Frye* standard occurs after the passage of several years. Even though the Court considers congressional statutory enactment of the Federal Rules of Evidence in *Daubert* rather than application of Eighth Amendment constitutional protections as in *Roper*, we observe the *Daubert* court making decisions in a timely context. In *Roper*, the Court interprets society’s views of “evolving standards of decency[.]” See generally *Roper v. Simmons*, 543 U.S. 551 (2005). In *Daubert*, the court is interpreting factors for admitting “novel” scientific evidence. See generally *Daubert*, 509 U.S. 579. Not so surprisingly, the final outcome in both landmark cases represents expansion of the Supreme Court’s prior positions. We must view the *Daubert* charge to the trial court judge as one made in the evolving spirit of U.S. Supreme Court jurisprudence reflecting treatment of children differently under the law.

juveniles. The Court's decision in *Daubert* and case law decided thereafter provides a sufficient foundation for the trial court judge to act as gatekeeper and apply evidentiary standards for determining the admissibility of expert witness testimony based on adolescent brain imaging science.

B. A Causal Connection Between Expert Testimony and the Juvenile's Cognitive Capacity

Following the *Daubert* decision, the federal courts continued to sculpt the legal framework of evidentiary rule analysis. In "*Daubert II*,"¹⁴⁹ the Ninth Circuit further opined on the "post-*Daubert*" world. The court described the trial court judge's task of determining the "soundness" of scientific "methodology" of an expert as "daunting," but guided by illustrative factors as part of a two-prong analysis.¹⁵⁰ Under the facts in *Daubert II*, the court decided that the experts had to testify to the pertinent inquiry of causation between the drug, Bendectin, and the minor children's limb reduction defects.¹⁵¹ This subsequent interpretation of the

¹⁴⁹ *Daubert v. Merrell Dow Pharms., Inc.*, 43 F.3d 1311, 1318 (1995) (holding, on remand, that the expert testimony was not admissible because the three groups of experts were testifying to conclusions that do not reflect consensus within the scientific community).

¹⁵⁰ *Id.* at 1315–16, 1318. First, the trial judge must determine "whether the experts' testimony reflects 'scientific knowledge,'" is "derived by the scientific method," and results from work that is "good science." *Id.* at 1315. Second, the trial judge must perform a "'fit' requirement" showing that the expert testimony logically advances a material aspect of the proposing party's case. *Id.* at 1315. "One very significant fact to be considered is whether the experts are proposing to testify about matters" that result from research "conducted independent of the litigation. . . ." *Id.* at 1317. The trial judge should regard this fact as objective proof that the expert will testify to research based on good science. *Id.* at 1320. Even further, the Ninth Circuit describes the second requirement as determining whether the testimony "fit" an issue in the case, or otherwise met the "helpfulness" standard in Rule 702. *Id.* at 1320. This means that there must be "a valid scientific connection to a pertinent inquiry" before the testimony can be admitted. *Id.* (quoting 509 U.S. 579, 591).

¹⁵¹ *Id.* Two minors sued Merrell Dow for products liability when they suffered limb reduction birth defects. The minors alleged that their mothers' ingested morning sickness pills manufactured by the defendant causing the birth defects in utero.

Supreme Court's analysis in *Daubert* raised the more specific issue of sufficient connection between the expert's testimony and the facts presented in the case. The substantive tort law in California provided the basis for the *Daubert II* court's causation determination.¹⁵²

While the court acknowledged that modern tort law does not always require direct causation, ultimately, it placed a burden on the plaintiff to show more likely than not that their injuries were caused by the defendant's drug.¹⁵³ Based on the "post-*Daubert* world" directive, the trial court judge must still find a causal connection between the expert's testimony, based on adolescent brain imaging showing diminished cognitive capacity of adolescents, and the specific cognitive capacity of the individual juvenile defendant.¹⁵⁴ Nevertheless, this article suggests that the

¹⁵² *Id.* at 1320. Plaintiffs offered circumstantial rather than direct proof of causation and were unsuccessful in satisfying the burden imposed by the court.

¹⁵³ *Id.*

¹⁵⁴ See U.S. v. Williams, No. CR 06-00079 DAE-KSC, 2009 WL 424583, at *11 (D. Haw. Feb. 20, 2009). When assessing the second prong for determining whether the testimony on the condition of "borderline intellectual functioning" ("BIF") and the issue in the case, the court stated the following:

Dr. Young's testimony that BIF and brain damage *could* have the *potential* to impact Defendant's ability to form mens rea is a tenuous causal connection. Had Dr. Young stated that BIF "often" or "likely" had an impact on Defendant's cognitive abilities, the connection would be more obvious. In reality, any number of things can have the potential to impact the abilities of a person of even average intelligence.

However, in light of the fact that Dr. Young's testimony can inform the jury of situations in which people with BIF and brain damage are particularly vulnerable to cognitive disability, this Court finds Defendant has shown a minimal causal connection to the inquiry of capacity to form specific intent. This Court understands Dr. Young's testimony to mean that Defendant has particular strengths and weaknesses which may be exacerbated in certain situations. As such, her diagnosis is not implying that it was equally likely that Defendant had the capacity on the day of T.E.W.'s death as any other day. Rather, the jury will be able to take Dr. Young's description of Defendant's weaknesses and disabilities and consider those in light of the factual

application of the evidentiary rules must allow the trial court judge to assess the proffered neuroscience in light of its ability to inform the trier of fact of relevant considerations as to inherent characteristics of that adolescent offender.¹⁵⁵

The adolescent brain's cognitive process speaks directly to the issue of "knowing" the wrongfulness of one's actions.¹⁵⁶ The juvenile defendant is asserting that these scientific data are material to this determination under the states' Infancy Defense law.¹⁵⁷ It is difficult not to accept scientifically proven data explaining a juvenile defendant's brain development if the inquiry is whether the law should allow exculpation based on "infancy" or differences between adolescence and adulthood. When the testimony is offered in the context of an Infancy Defense, the trial judge as "gatekeeper" can consider the scientific data as probative¹⁵⁸ in establishing the helpfulness of this exculpatory tool without requiring a direct causal connection.¹⁵⁹

Some states' case law follows a liberal approach for establishing the relevancy of expert testimony,¹⁶⁰ while others apply the general acceptance standard.¹⁶¹ In *Marsh v. Valyou*, The

evidence put forth about the particular circumstances surrounding the alleged abuse.

Id. at *11–12.

¹⁵⁵ *Id.* at *12.

¹⁵⁶ Buss, *supra* note 47 at 495.

¹⁵⁷ See Shepherd, *supra* note 92, at 52 (concluding that it is helpful for lawyers to understand neurology and to communicate it when defending juveniles).

¹⁵⁸ See Williams, 2009 WL 424583 at *3.

¹⁵⁹ See Smith v City of Gulfport, 949 So. 2d 844, 850 (Miss. Ct. App. 2007) (determining that the trial court did not err in assessing the "degree of scientific certainty" from which the expert testified and that such expert testimony was required to prove causation); see also Daubert v. Merrell Dow Pharms., Inc., 43 F.3d 1311, 1320 (1995).

¹⁶⁰ See Williams, 2009 WL 424583 at *1.

¹⁶¹ See Zink v. State, 278 S.W.3d 170, 180 (Mo. 2009) (holding that the results of a PET scan were inadmissible to show defendant's personality disorder. The witness' testimony was not generally accepted scientific evidence

Supreme Court of Florida applied the causal link issue more liberally by admitting expert testimony as to whether several car accident traumas could cause fibromyalgia.¹⁶² In *Marsh*, the court held that the expert testimony making causation arguments about fibromyalgia as a pain syndrome “is not ‘new or novel.’”¹⁶³ And, the “differential diagnosis technique” used to counter the expert’s testimony meets the general acceptance standard.¹⁶⁴ The evidence was ultimately admitted despite an absence of epidemiological studies or the need for more research showing a causal link between the two.¹⁶⁵ What’s notable about the *Marsh* decision is the important distinction between brain imaging technology used to draw conclusions about the adolescent brain and well known scientific debates over correlation to conditions like fibromyalgia. This distinction forms the basis for the court’s analysis that expert opinion testimony (and its conclusions) based on generally accepted methods and principles must be given proper weight by the trier of fact, but not expressly excluded.¹⁶⁶ *Marsh* follows its own precedent from five years earlier stating, “once the *Frye* test is satisfied through proof of general acceptance of the basis of the opinion, the expert’s opinions are to be evaluated by the finder of

because it did not show how the PET scan can be linked to diagnosed personality disorders; therefore, it has limited mitigating value).

¹⁶² *Marsh v. Valvyou*, 977 So. 2d 543, 550 (Fla. 2007). The defendant in the negligence action filed by the plaintiff argued that the expert testimony should not be admissible since the connection between trauma and fibromyalgia was not a generally accepted assertion in the scientific community. *Id.* at 545. The court admitted the testimony even without any studies demonstrating the causal link. *Id.* at 550.

¹⁶³ *Id.* at 548.

¹⁶⁴ *Id.* at 549. The Florida Supreme Court ultimately concludes that the trier of fact can properly resolve causation issues resulting from contrary scientific theories. *Id.*

¹⁶⁵ *Id.* The court cites to Florida’s 1st District Court of Appeals, decided after *Daubert*, that stated, “[w]hile . . . there continues to be scientific debate . . . we find the epidemiological science and methodology underlying [the expert’s] testimony to be established, reliable and well-founded.” *Id.* (citing *Berry v. CSX Transp., Inc.*, 709 So. 2d 552, 568 (Fla. Dist. Ct. App. 1998)).

¹⁶⁶ *Id.* at 564.

fact and are properly assessed *as a matter of weight, not admissibility*.”¹⁶⁷

In the end, Judge Ezra in the *Williams* case embraces such adversarial mechanisms by stating, “[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence.”¹⁶⁸ This has to be the proper approach when facing the evolving nature of expert witness testimony based on scientific methods. Once the adolescent brain imaging technology is established as “generally accepted” (in those states following *Frye*) or reliable (in those states applying *Daubert*), the expert’s statements regarding the deficiencies in brain function as it pertains to the issue of wrongfulness can be properly weighed by the judge or jury, but *not* unfairly excluded as inadmissible. The legal structure imposes evidentiary boundaries like those in *Daubert* to protect against the higher risk of confusion and misunderstanding of scientific evidence. This article suggests, however, that the evidentiary boundaries can be sustained and still accommodate developing, probative information about the adolescent brain when imposing normative legal standards based on one’s knowledge of wrongfulness.

C. The “Gatekeeper” Reigns

The Supreme Court’s decision in *Daubert* set the foundation for the trial court judge’s role as gatekeeper.¹⁶⁹ It is in this capacity that he can apply the evidentiary rules so as to admit brain imaging technology. In subsequent cases, the U.S. Supreme Court articulated the states’ latitude in promulgating constitutionally permissible rules that exclude evidence as “long as they are not ‘arbitrary’ or ‘disproportionate to the purposes they are designed to

¹⁶⁷ *Id.* at 549 (emphasis added).

¹⁶⁸ *United States v. Williams*, No. CR 06-00079 DAE-KSC, 2009 WL 424583, at *15 (D. Haw. Feb. 20, 2009) (citing to *Daubert I*, 509 U.S. at 596).

¹⁶⁹ *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 598 (1993). After positioning the trial judge as gatekeeper over the application of evidentiary standards, the U.S. Supreme Court vacated and remanded the lower court’s judgment for further proceedings. *Id.*

serve.”¹⁷⁰ The evidentiary rules must still reflect fundamental Sixth Amendment rights allowing criminal defendants to present a meaningful defense.¹⁷¹ This is consistent with the Court’s reasoning in *Daubert* that points to fundamental fairness principles in the adversarial process.¹⁷²

While *Daubert II* continued the reign of a more liberal approach to the use of expert witness testimony,¹⁷³ the Supreme Court Justices later granted considerable discretion to the trial court judge’s gatekeeping capacity regarding admissibility of, not only, scientific evidence, but also technical or other specialized knowledge.¹⁷⁴ The Court reiterated the intent of the gatekeeping requirement as insuring the relevance and reliability of expert testimony.¹⁷⁵ With this discretion, subsequent courts directly turned to the Federal Rules of Evidence for guidance in determining the admissibility of scientific evidence.¹⁷⁶

Under the states’ evidentiary rules, trial court judges practically apply the mandates of their own jurisdictional equivalent of

¹⁷⁰ *United States v. Scheffer*, 523 U.S. 303, 308 (1998) (quoting *Rock v. Arkansas*, 483 U.S. 44, 56 (1987)).

¹⁷¹ *See generally* *Chambers v. Miss.*, 410 U.S. 284 (1973) (holding that the exclusion of evidence and inability to cross-examine impeded the defendant’s fundamental right to due process).

¹⁷² *Id.*

¹⁷³ *Pettit*, *supra* note 53, at 326.

¹⁷⁴ *Scheffer*, 523 U.S. at 311 (per se rule excluding polygraph evidence is constitutional; however, the trial court’s exercise of discretion provides tension between the prior *Daubert* opinion and *Scheffer*); *See* *General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997) (mandating that evidentiary rulings made at trial be reviewed under an abuse of discretion standard that examines the trial court’s acceptance, or rejection, of both the methodology *and* conclusions of the expert). The court notes that, “conclusions and methodology are not entirely distinct from one another.” *Id.*; *see also* *Kumho Tire Ltd. v. Carmichael*, 526 U.S. 137, 152 (1999) (ruling that the trial judge’s decision should be reviewed based on an abuse of discretion standard that gives him “considerable leeway in deciding in a particular case how to go about determining whether particular expert testimony is reliable”). *Id.* at 155.

¹⁷⁵ *See Scheffer*, 523 U.S. at 311.

¹⁷⁶ *See* *United States v. Williams*, No. CR 06-00079 DAE-KSC, 2009 WL 424583, at *2–4 (D. Haw. Feb. 20, 2009); *See also Kumho*, 526 U.S. at 152.

Federal Rule of Evidence (“FRE”) 702¹⁷⁷ and FRE 403.¹⁷⁸ *Daubert* summarily provides that scientific testimony must assist the trier of fact¹⁷⁹ without prejudicing or confusing the jury.¹⁸⁰ Therefore, we see a compounded analysis in that while the scientific evidence may be based on “reliable” principles and methods, it has become essential to *also* determine that the expert witness testimony offers a probative value that is not substantially outweighed by potential prejudice and confusion.¹⁸¹

¹⁷⁷ FRE 702 states:

If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training or education may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods and (3) the witness has applied the principles and methods reliably to the facts of the case.

FED. R. EVID. 702. The general standard for admissibility of scientific evidence reflected in FRE 702 requires relevancy and reliability; however, the expert who testifies as to the scientific data must also satisfy the additional points (1) through (3) stated above. These points make clear the prevailing role of the trial court judge in ultimately assessing the proffered evidence and its impact on any case.

¹⁷⁸ FRE 403 states: “Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence.” FED. R. EVID. 403.

¹⁷⁹ *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 592 (1993).

¹⁸⁰ *Id.* at 595.

¹⁸¹ The *Daubert* Court specifically provides guidance to the trial court judge in determining the admissibility of evidence, stating:

Additionally, in the event the trial court concludes that the scintilla of evidence presented supporting a position is insufficient to allow a reasonable juror to conclude that the position more likely than not is true, the court remains free to direct a judgment, . . . and likewise to grant summary judgment These conventional devices, rather than wholesale exclusion under an uncompromising ‘general acceptance’ test, are the appropriate safeguards where the basis of scientific testimony meets the standards of Rule 702.

Id. at 596. Here, the Court points to other mechanisms within the adversarial process that the trial court judge can utilize so as to ensure a proper result. The

With the power granted under *Daubert*, the trial court judge assumes the role of gatekeeper by not only determining relevancy issues, but also wielding a sword in the form of an exclusionary rule—FRE 403. The expert testimony based on adolescent brain imaging overcomes relevancy obstacles because it presents valuable testimony as part of a meaningful Infancy Defense. The trial court judge fulfills his role as gatekeeper by appreciating the probative value of the testimony lest it be stricken by the “exclusionary sword.”¹⁸²

D. Relevancy, Reliability, and The Exclusionary Sword

Cases addressing expert witness testimony specifically based on brain imaging technology rather than opinion testimony of psychological defect are scarce. Courts admit evidence based on other brain abnormalities under the states’ evidentiary rules.¹⁸³ In these instances, however, the courts are applying FRE 702 and 403 to non-scientific evidence based on expert’s opinion testimony.¹⁸⁴

The *Sandoval-Mendoza* case most importantly portrays the nature of scientific evidence and witness testimony in a light that embraces difficult decisions generated by the technology used in adolescent brain imaging. The Ninth Circuit states the following:

The district court concluded that the proposed medical expert opinion testimony was unreliable because it did not conclusively prove

mechanisms are preferable to a broad scale exclusion of otherwise valuable evidence. Since the Court places confidence in the ability of the trial court judge to assess and weigh evidentiary concerns even more than in cases involving lay witnesses, the state courts should follow its direction and sentiment when interpreting and applying its evidentiary rules regarding the admissibility of adolescent brain science.

¹⁸² *Id.* at 595.

¹⁸³ See generally *United States v. Williams*, No. CR 06-00079 DAE-KSC, 2009 WL 424583, at *2–4 (D. Haw. Feb. 20, 2009).

¹⁸⁴ See *United States v. Sandoval-Mendoza*, 472 F.3d 645 (9th Cir. 2006) (reinforcing the “gatekeepers” role by holding that medical expert testimony based on MRI scans and other performance IQ testing was admissible. The Ninth Circuit admitted the expert witness testimony reasoning that *Daubert* instructs the district court judge as a “gatekeepers, not a fact finder.” *Id.* at 654. Juries, instead of judges, can weigh differing, credible, and qualified expert testimony. *Id.*

Sandoval-Mendoza's brain tumor caused susceptibility to inducement or a lack of predisposition. But medical knowledge is often uncertain. The human body is complex, etiology is often uncertain This does not preclude the introduction of medical expert opinion testimony when medical knowledge "permits the assertion of a reasonable opinion."¹⁸⁵

Adolescent brain imaging technology, like the MRI in *Sandoval-Mendoza*, presents medical knowledge on which experts will have differing opinions. Regardless, the testimony is relevant and does not confuse the issue of juvenile offenders' cognition under the Infancy Defense. The technology that images the adolescent brain cannot currently show direct correlation between an individual's brain function and the specific brain images presented in court.¹⁸⁶ However, experts can properly testify as to the conclusions that can be drawn from the images pertaining to most adolescent brain structures. After determining their credibility, the jury (trier of fact) can then appropriately weigh the testimony offered in support of the juvenile offender's meaningful defense.¹⁸⁷

Three years after the *Sandoval-Mendoza* case, the United States District Court of Hawaii¹⁸⁸ provided an even more in-depth and timely illustration of what should be the proper analysis to be performed by the trial court judge when confronted with novel scientific methodology in the adjudication and prosecution of today's juvenile offenders.¹⁸⁹ Though the *U.S. v. Williams* case does not involve a juvenile defendant, its analytical approach is instructive to the arguments in favor of utilizing adolescent brain neuroscience in the courtroom.¹⁹⁰ First, the district court fully

¹⁸⁵ *Id.* at 655.

¹⁸⁶ Brown, *supra* note 87, at 1131–1132 (arguing that "the probative value of functional brain imaging for mens rea" is limited).

¹⁸⁷ United States v. Sandoval-Mendoza, 472 F. 3d at 656.

¹⁸⁸ United States v. Williams, No. CR 06-00079 DAE-KSC, 2009 WL 424583 (D. Haw. Feb. 20, 2009).

¹⁸⁹ In *Williams*, the court denied the Government's motion to exclude expert testimony based on "borderline intellectual functioning" offered by the defendant at the guilt phase of trial. *Id.* at *19.

¹⁹⁰ Defendant Williams was charged with the felony murder of his five-year-old daughter while in the perpetration of child abuse. *Id.* at *1. The opinion written by District Court Judge Ezra exemplifies the relatively rigid, yet necessarily flexible application of the federal rules in the context of mental

embraces the flexibility of the trial judge contemplated by *Daubert* when it methodically examines each expert and his proffered testimony under the two-prong analysis expressed by *Daubert II*.¹⁹¹ Judge Ezra references *Daubert* and other Ninth Circuit opinions as support for his use of discretion when he states, “[we must] ...strike the appropriate balance between admitting reliable, helpful expert testimony and excluding misleading or confusing testimony to achieve the flexible approach.”¹⁹²

Judge Ezra’s response to the Government’s Federal Rules of Evidence 702 and 403 challenges foreshadows the “gatekeepers” undoubtedly ponderous task while appropriately characterizing it as a “balance” that, in this author’s view, must be achieved, especially where evolving scientific evidence is at issue.¹⁹³ Significant comparisons between the *Williams* analysis of proffered testimony and that of a juvenile offender establish how the trial court judge can permissibly admit expert witness testimony based on adolescent brain imaging technology.¹⁹⁴ While the expert witness testimony offered in *Williams* does not involve

health expert witness testimony offered to show that the Defendant suffers from “borderline intellectual functioning” and brain damage. *Id.* In this case, the expert witness testimony is offered to establish that the Defendant did not have the capacity to form the requisite intents of two charges:

- (1) intentionally or knowingly causing death or serious bodily injury to the daughter and (2) a willful attempt to inflict injury upon the person of another or a threat to inflict injury upon the person of another which, when coupled with an apparent present ability, causing a reasonable apprehension of immediate bodily harm.

Id.

¹⁹¹ *Id.* First, the proffered testimony must reflect scientific knowledge that is derived by scientific methods and whose work product amounts to “good science.” *Id.* at *3. Next, the proffered testimony is reliable if it “logically advances a material aspect of the proposing party’s case.” *Id.* As Judge Ezra sets forth the basis of his application, he devotes substantial time to quotations that seemingly represent his philosophy on the “gatekeepers” charge that he accepts as a trial court judge. *Id.*

¹⁹² *Id.* at *3 (citing *United States v. Rincon*, 28 F. 3d 921, 926 (9th Cir. 1994)).

¹⁹³ *Id.* at *4.

¹⁹⁴ *See id.*

brain imaging technology, Judge Ezra demonstrates the willingness to “balance” the potential value of medical evidence presented by the technology.¹⁹⁵

The court in *Williams* ultimately concludes that the neuropsychologist’s methods and testing procedures are reliable and that the failure to administer a functional MRI does not prevent the expert’s testimony, but only pertains to its weight.¹⁹⁶ Similarly, the trial judge can evaluate the expert testimony on the extent of adolescent brain development, including opinions based on functional MRI technology, without completely excluding such testimony. Keep in mind that the functional MRI is not novel in its use, but the use of images showing the adolescent brain functions is.¹⁹⁷ The District Court in *Williams* also broadens what “helpfulness” means to the fact finder when assessing the admissibility of evidence. The court analyzes expert witness testimony in the context of mens rea elements, and not pertaining to establishment of a defense (infancy).

Nevertheless, the court’s reasoning on the subject matter of the expert testimony closely parallels the arguments made in favor of admitting evidence on adolescent brain deficiency.¹⁹⁸ Even though Judge Ezra acknowledges the Government’s concern over expert witness testimony that is not helpful to the jury, he views the

¹⁹⁵ The court states, “Dr. Hall’s testimony as to its [the functional MRI] usefulness weighs heavily, as does Dr. Young’s own admission that such tests would be something she would find helpful in considering her [expert’s] diagnosis.” *Id.* at 5. The Government requested that the Defendant undergo the scan, and the court held that it would only order the procedure if both parties agreed to it. *Id.* The Government also contended the neuropsychologist’s failed to conduct a QEEG (qualitative EEG) on defendant’s brain. *Id.*

¹⁹⁶ *Id.* at 6.

¹⁹⁷ Tancredi & Brodie, *supra* note 89, at 282–85. fMRIs are used for visual encoding to determine the reproducibility of fMRI measurements during high cognitive functioning, reproducibility of pre-surgical lateralization directed at mapping brain areas involved with language processing and studying neural correlates of psychological processes, how such processes develop over time in learning and neuro-psychiatric disorders and used to predict the impact on memory of temporal lobectomies. *Id.*

¹⁹⁸ *Williams*, 2009 WL 424583 at *7.

explanation of Defendant's capabilities as more important than a specifically coded diagnosis.¹⁹⁹ The court states:

[W]hether [borderline intellectual functioning] is a symptom or a formal diagnosis, its existence may help explain Defendant's capabilities or lack thereof. If Defendant indeed suffers from sub-par intellectual functioning, such a finding could seriously impact how he comprehends situations and reacts to them.²⁰⁰

Specifically coded diagnoses are generally regarded as "helpful" to the jury, and therefore, testimony is easier for the trier of fact to integrate into their fact finding task. Nevertheless, Judge Ezra appropriately considers the importance of the fact finder's basic understanding of the defendant's capabilities in the absence of specifically coded diagnoses.²⁰¹

In the case of juvenile offenders, expert witness testimony based on adolescent brain imaging, likewise, provides the jury with helpful information about the adolescents' range of cognition and functioning as shown through brain imaging despite the fact that this information is not readily tied to a specific disorder or DSM-IV classification, which refers to the Diagnostic and Statistical Manual of Mental Disorder published by the American Psychiatric Association.²⁰² When considering the evidence in light of bolstering an Infancy Defense asserted by the population of

¹⁹⁹ *Id.* The court considers the testimony despite the Government's challenge that Defendant's asserted "condition" is not a recognizable "diagnosis" for which the expert testimony would prove helpful to the jury in better understanding the issue of mens rea capacity. *Id.*

²⁰⁰ *Id.* The court further explains that BIF constitutes a mental health condition that may indicate general tendencies, but not necessarily a formal diagnosis. However, this does not diminish the reliability of expert testimony as to the specific nature of the condition. *Id.*

²⁰¹ Even though the explanation of capabilities associated with the "diagnosis" was more important than a specific identified disorder, the court required that the defendant, at a minimum, produce a credible definition of "borderline intellectual functioning." After responding to the court's request, the defendant was still unable to successfully provide a reference that clearly set forth the characteristics of borderline intellectual function in a manner that would not be misleading. Reliability may not be tied to a specific diagnosis, but there must be clarity in the expert's definition of "conditions" to which he testifies. *Id.* at 8.

²⁰² *Id.* at 7.

fourteen to eighteen-year-olds who are more likely to face adult criminal sanctions, the testimony provides relevant information that will help the jury assess potential exculpation.

Additionally, the district court develops an alternative to exclusion of evidence that might otherwise appear to confuse the jury. The potential for misunderstanding or confusion over a psychological “condition” that cannot be clearly defined speaks to the essential purpose of the evidentiary rules. Yet, Judge Ezra approaches this quandary by employing an alternative to exclusion that limits the allowable statements made by the expert about a condition (BIF) so as *not* to suggest a formal or recognized disorder, but only a description of certain abilities and disabilities.²⁰³

With brain imaging technology, it will be important that a trial court judge also focus more on the diagnostic tools used as the basis of the expert’s testimony about the adolescents’ brain development.²⁰⁴ The current imaging technology shows blood flow activity in relevant portions of the brain as well as decreased or minimal blood flow.²⁰⁵ The expert witness can testify to what researchers and studies have shown about the images and brain

²⁰³ *Id.* at 9–10. The court cites to the Seventh and Ninth Circuit precedent in *United States v. Lamarre*, 248 F.3d 642 (7th Cir. 2001) (allowing defendant’s expert to testify to his “borderline intellectual functioning” condition as “scientifically valid social science” that can be showed to the jury) and *United States v. Finley*, 301 F.3d 1000 (9th Cir. 2002) (allowing the defendant’s expert to testify that he lacked the requisite intent to defraud because he had an “atypical belief system”). The District Court of Hawaii ultimately concludes that the proffered testimony regarding the intellectual deficiencies associated with BIF and the scientific testing that serves as the basis of the deficiencies has attained sufficient acceptance within the community to satisfy the intent of *Daubert*. *Williams*, 2009 WL 424583 at *9–10.

²⁰⁴ *Williams*, 2009 WL 424583, at *11. The *Williams* court espouses its interpretation of *Daubert* principles indicating that the determination is less about credibility and conclusions and more about *reliability of the tools* used as the basis of the testimony. *Id.*

²⁰⁵ Tancredi & Brodie, *supra* note 89, at 273–74.

functioning.²⁰⁶ The tools are scientifically proven to reliably show the regions of the brain. The trier of fact can assess application of the normative standard and determine if the decreased functioning in certain regions of the brain resulted in a deficient cognition process sufficient to establish exculpation under the Infancy Defense.

Finally, the District Court in *Williams* provides support for admitting evidence that provides less than a concrete causal connection for relevancy purposes.²⁰⁷ The *Williams* court aptly applies the relevance standard of expert witness testimony for a mens rea defense that, likewise, applies for assessing the relevance of testimony offered to show an exculpatory Infancy Defense. Current brain imaging technology is not able to show a *specific individual's brain image* nor can the technology render the type of conclusions that must be drawn about an individual adolescent's state of mind under legal standards.²⁰⁸ In asserting an Infancy

²⁰⁶ Rogers & DuBois, *supra* note 33, at 22–23 (explaining the present potential uses of fMRI's such as using the images to explain neuroscience evidence to laypersons).

²⁰⁷ When determining whether the expert testimony is relevant to the issue at hand, Judge Ezra (citing to the Ninth Circuit precedent) notes that the causal connection between the expert testimony and the mens rea issue is necessary, especially in mental health disorder defenses. *Williams*, 2009 WL 424583 at *11. Again, an important distinction exists between the mens rea defense and exculpatory defenses in that the trier of fact may still find that the requisite state of mind exists, but decide to allow for legal excuse of the defendant under the facts. See generally Rogers & DuBois, *supra* note 33. Bearing that analytical context in mind, one must appreciate this key difference between the legal standard for establishing intent as opposed to proving cognitive abilities.

²⁰⁸ Brown & Murphy, *supra* note 87, at 1139. The authors argue that functional magnetic resonance imaging (“fMRI”) and other types of functional brain imaging technologies are improperly introduced in criminal trials as evidence of a defendant's past mental state, partly because the fMRI methodology only measures neuronal activity indirectly. *Id.* The technology shows individual brain anatomy that varies significantly, thereby making it difficult to determine a correlation between parts of the brain in one person and the standardized anatomical regions on the average structural brain image that is used when the individual brain data is “warped” or normalized to map on to a 3-D template brain structure. *Id.* Computer programs take the spatial data and reconstruct it into an image using multiple regression statistical techniques and

Defense, the juvenile defendant is offering the expert testimony to show the function and deficiency of an adolescent brain for cognitive assessment of right and wrong. Under *Williams*, adolescent brain imaging technology can be admissible as an established diagnostic tool that is relevant to the juvenile offender's physiological brain capabilities and inform the trier of fact as to its results despite sufficient causal connection.²⁰⁹

Comparably, this article asserts that the expert witness testimony is relevant to the issue of wrongfulness in an Infancy Defense and informs the trier of fact on a level of understanding that science and technology has not previously afforded. The knowledge is imperative to the adjudication and prosecution of today's juvenile offender who is between fourteen and eighteen since most jurisdictions have effectively turned the normative standard for imposing legal responsibility on them away from any acknowledgement of their "juvenile" status.²¹⁰ The expert's

mathematical modeling. *Id.* This process is often invisible even to the researcher, as it is done by software installed on the fMRI machine. *Id.*

²⁰⁹ In *Williams*, the expert was required to testify as to whether the Defendant's mental or psychological condition impaired his ability to form intent or inflict severe pain (elements of the charges). *Williams*, 2009 WL 424583 at *11. Under the *Williams* facts, the expert testified that BIF and brain damage have only the "potential" to impact the Defendant's state of mind, thereby making a tenuous causal connection. *Id.* But, Judge Ezra points out that the testimony can still "inform[]" the jury. *Id.* at 12. Although the connection is not apparent, Judge Ezra valued his testimony because it aided the trier of fact in understanding characteristics of the Defendant. He states the following:

This court understands Dr. Young's testimony to mean that Defendant has particular strengths and weaknesses which may be exacerbated in certain situations. . . . [Accordingly] . . . the jury will be able to take Dr. Young's description of Defendant's weaknesses and disabilities and consider those in light of the factual evidence put forth about the particular circumstances surrounding the alleged abuse.

Id. at *11–12. Informing the jury can be more valuable than a tenuous causal connection even if that causal connection serves as a guiding beacon for the trial judge in determining whether the expert's testimony is pertinent to the case. *Id.*

²¹⁰ FLA. STAT. ANN. § 985.556 (West 2008) (requiring the court to exercise an involuntary mandatory waiver if the child was fourteen years of age or older and the adjudication was for the commission of, attempt to commit, or conspiracy to commit crimes such as murder, carjacking, or aggravated assault); OHIO REV.

testimony pertains to the issue of cognition by describing specific deficiencies that may operate under the facts presented where the law²¹¹ seeks to punish the juvenile offender as if he were an adult.

Jurors and judges operating as triers of fact most often make experiential assumptions about adolescents and their behaviors.²¹² However, adolescent brain imaging is reliable and relevant information that further sculpts the basis for assessing exculpation of the juvenile offender even when there is less than a direct causal link between the expert's testimony and the brain images presented at trial. With the evolving neuroscience that shows the capabilities and function of the adolescent brain,²¹³ the juvenile offender must be allowed to meaningfully and fairly offer expert witness testimony that will inform jurors beyond their previously held assumptions.

Certainly the prosecutor in the adjudication and prosecution of a juvenile offender will offer contrary expert testimony to refute the juvenile offenders' claim of "infancy." The adversarial process lends itself to this counterattack on the content of expert testimony

CODE ANN. § 2152.10 (LexisNexis 2002) (requires a transfer if the child was 14 or 15 at the time of the act, was previously adjudicated delinquent, and remained in the custody of the department of youth services); TENN. CODE ANN. § 37-1-134 (LexisNexis 2006) (allows the transfer of children 16 years of age and younger if the child was charged with crimes such as first degree murder, rape, aggravated robbery, and kidnapping); TEX. FAM. CODE ANN. § 54.02 (LexisNexis 1999) (gives the court discretion to transfer a child 14 years of age or older if the alleged crime committed was a felony, but requires a transfer if the child has been transferred previously and the alleged crime was a felony). (Statutes are updated.)

²¹¹ *Williams*, 2009 WL 424583, at *12.

²¹² In *Williams*, the court reasoned that the expert testimony was relevant because without it, the "average layperson juror" tends to operate under assumptions of typical intellectual capability rather than being fully informed by the expert's specialized knowledge. *Id.* at *12. Likewise, our current normative standards allow assumptions to operate for only seven or eight year olds in most jurisdictions. *Id.* Otherwise, a rebuttable presumption for those less than twelve or fourteen must be proven. *Id.* This means we prosecute those less than eighteen years old under certain assumptions about their cognitive and experiential functioning abilities and then proceed to treat them as adults. *Id.*

²¹³ Blakemore & Choudhury, *supra* note 115, at 296.

particularly as it relates to scientific technology that may not have previously disposed itself to this type of legal scrutiny. The *Daubert* Court and subsequent lower courts like the district court in *Williams* take a broad view of the conflicting, qualified testimony by not assessing the credibility of opinions, but the reliability of them based on the methods employed.²¹⁴

E. *The Exclusionary Sword and Establishing Adolescents' Acts of Wrongfulness*

Reliable and relevant evidence is still subject to exclusion if the trial court judge determines that its probative value does not outweigh its tendency to mislead the jury or confuse the issues through application of the exclusionary rule standards of Federal Rules of Evidence (FRE) 403.²¹⁵ Notwithstanding the sensitivities and concerns surrounding scientific methods and testing, the District Court in *Williams* does not shy away from the nature of scientific evidence, but instead rests on the court's discretion granted by U.S. Supreme Court in *Daubert*.²¹⁶ The states should, likewise, embrace the parameters of evidentiary analysis that embodies the practice and policy of the *Daubert* evidentiary standards for admitting expert witness testimony based on scientific evidence.

This article advocates for the same flexible approach used by the *Williams* court when admitting expert witness testimony based on adolescent brain imaging offered to exculpate juvenile offenders under an Infancy Defense. Such expert witness testimony is probative to a modified Infancy Defense since it

²¹⁴ *Williams*, 2009 WL 424583, at *14.

²¹⁵ FED. R. EVID. 403.

²¹⁶ After consulting U.S. Supreme Court precedent on challenges to a state statute prohibiting admissibility of mental health testimony, the *Williams* court found the probative value of expert witness testimony regarding BIF and its impact on Defendant's ability to reason and learn from experience to significantly outweigh any potential jury confusion. *Williams*, 2009 WL 424583 at *13. Emphasizing the reliability of the expert's testimony that has bearing on the mens rea element and acknowledging the imprecision of mental health diagnosis, the *Williams* court ultimately depended heavily on the "broad latitude" granted to trial court judges by *Daubert*. *Id.* at *13, *19.

addresses the grounds for exculpation when factors such as the juvenile defendant's cognitive ability and corresponding behavioral response is at issue. Experts can testify to the known boundaries of adolescent brain development and the associated behavioral characteristics.²¹⁷ Because the states' transfer laws allow for prosecution of the youngest members of the adolescent population, expert testimony pertaining to the cognition and behavior processes of these potential juvenile offenders is highly relevant.

Additionally, the expert testimony can inform the jury about the brain functioning and deficiencies of fourteen to eighteen year olds in jurisdictions where the common law presumption of infancy is interpreted by the courts so as to legislatively abrogate the defense.²¹⁸ Moreover, we have seen that even the U.S. Supreme Court entertained adolescent brain imaging technology as relevant to the issue of Eighth Amendment protection from capital punishment.²¹⁹ Certainly the states' courts can, at common law, permit juvenile offenders to have a constitutionally mandated meaningful defense where the expert witness testimony is offered to establish "infancy."

The solution must occur at common law under the constitutional guarantee of a juvenile defendant's right to a meaningful defense. The states' legislature may proscribe *where* the juvenile offender is held legally responsible for his actions (juvenile court adjudication or criminal court prosecution), but the courts must ensure a meaningful defense when placement of youths' legal responsibility is at issue. If we continue to legislate

²¹⁷ See generally Maroney, *supra* note 33 (analyzing cases where experts used developmental neuroscience to argue diminished cognitive capacity).

²¹⁸ *W.D.B. v. Commonwealth*, 246 S.W.3d 448, 452 (Ky. 2007) (determining that the legislative purpose enunciated in the juvenile code along with subsequently enacted comprehensive legislation indicates the jurisdiction's intent not to codify the presumption and the courts, therefore, have no authority to judicially create the defense).

²¹⁹ See generally *Roper v. Simmons*, 543 U.S. 551 (2005) (holding that it was unconstitutional to sentence a juvenile to death based on their lessened blameworthiness).

away adolescence through transfer laws, then we must not ignore the juvenile defendant's assertion of a meaningful defense that includes offering information to the trier of fact on the exculpatory issue of infancy. Juveniles can offer adolescent brain technology in the context of the states' existing Infancy Defense models.

**V. THE IMPORTANCE OF ADOLESCENT BRAIN IMAGING
OFFERED UNDER A COMMON LAW INFANCY DEFENSE: AN
EXAMINATION OF WASHINGTON, KENTUCKY, AND CALIFORNIA**

A. Sex Crimes Committed by Juveniles

A juvenile defendant must be allowed to offer evidence of adolescent brain function in cases where a defense of youthful incapacity involves the adolescent's ability to differentiate between wrong and right sexual conduct. The common law defense of infancy that is bolstered by adolescent brain imaging must prevail even when the states' legislature seeks to abrogate its operation. Sexual conduct with others presents one of the most compelling cases for considering not only major developmental differences between adolescents and adults, but also a defense under which these key differences are the focal point for imposing the appropriate legal standard of criminal culpability. In the ordinary course, sexual conduct is not "misconduct" or criminal if it occurs between the appropriate people and under the appropriate circumstances.²²⁰ Washington and Kentucky provide illustration of these points in the context of juveniles charged with sex crimes.

1. Washington

In *State v. Ramer*,²²¹ the Washington Supreme Court recognized the complexities entailed when assessing the child's

²²⁰ See Gary Chartier, *Natural Law, Same-Sex Marriage, and the Politics of Virtue*, 48 UCLA L. REV. 1593, 1630–31 (2001) (discussing ethical ramifications of departure from the norms governing sexual conduct and the moral appropriateness of same-sex marriages).

²²¹ *State v. Ramer*, 86 P.3d 132 (Wa. 2004) (holding that the State failed to overcome the presumption that the child lacked capacity to commit first degree rape). In addition to codifying its Infancy Defense, Washington utilizes a

capacity to commit a crime.²²² This case involved an 11-year-old juvenile defendant who was charged with first degree rape of a child. The juvenile defendant, Ramer, was accused of sexual misconduct with a younger child in the home of his mother's friend. At a hearing to determine Ramer's capacity to commit first degree rape,²²³ the defense counsel offered two expert witnesses.²²⁴ Each testified that Ramer did not understand the act of having sexual contact with the younger child nor did he understand why

common law interpretation of how the defense should be applied through consideration of the following seven factors for determining capacity:

(1) the nature of the crime, (2) the child's age and maturity, (3) whether the child evidenced a desire for secrecy, (4) whether the child told the victim (if any) not to tell, (5) prior conduct similar to that charged, (6) any consequences that attached to that prior conduct, and (7) whether the child had made an acknowledgment that the behavior is wrong and could lead to detention. Expert witness testimony that explains adolescent brain imaging can be used to augment the understanding and application of each of these factors.

Id. at 136–37.

²²² Washington statute provides in part that: “[c]hildren of eight and under twelve years of age are presumed to be incapable of committing the crime.” WASH. REV. CODE ANN. § 9A.04.050 (West 2009). This presumption may be removed by proof that they have “sufficient capacity to understand the act or neglect, and to know that it was wrong.” The state overcomes this presumption through clear and convincing evidence that the child had sufficient capacity to understand the act and to know that it was wrong. *Ramer*, 86 P.3d at 138.

²²³ After a hearing held on the capacity of the child to commit the crime, the Superior Court Judge Pomeroy found that Ramer was “a highly sexualized young person, who clearly was confused about appropriate sexual behaviors and could not understand the prohibitions on sexual behavior with other children.” *Id.* at 135. The Court of Appeals reversed, and the Washington Supreme Court granted discretionary review. *Id.* After detailed examination of the trial record, the Washington Supreme Court found that the Court of Appeals improperly determined that the State did *not* fail to overcome the statutory presumption by clear and convincing evidence. *Id.* at 138.

²²⁴ The two experts, Dr. Brett Trowbridge, Ph.D., J.D., a forensic psychologist, licensed attorney, and former prosecutor, and Peg Cain, M.A., a mental health specialist, both testified after evaluating Ramer and preparing written reports. Dr. Trowbridge opined that Ramer did not understand the act charged, nor did he understand how conduct enjoyed by someone else could be wrong (much less illegal). *Id.* at 137–38.

his contact amounted to criminal activity called “rape.”²²⁵ At this point, expert witness testimony based on adolescent brain imaging would be used by the juvenile defendant to show the brain capacity of a defendant like Ramer and his limitations in making judgments about *appropriate* sexual conduct when, as Ramer stated, “[i]t wasn't wrong because he was into it too.”²²⁶

With regard to sex crimes, the courts have held that, “when a juvenile is charged with a sex crime, the State carries a greater burden of proof in showing that the child understood the illegality of the act.”²²⁷ Consequently, it becomes more difficult to prove that the child understood the wrongfulness of his acts. In *Ramer*, the court noted that the nature of the crime is an important factor, but with sex crimes it is very difficult to tell if a child understands the prohibitions on sexual behavior with other children.²²⁸

²²⁵ Additionally, Dr. Cain’s testimony, based on her observations of Ramer’s attitude and demeanor during the evaluation, indicated that he did not appreciate the inappropriateness or wrongfulness of sexual contact under these circumstances because when the younger child’s mother first questioned Ramer about the incident, he “freely admitted” his behavior. *Id.* at 134. Likewise, when the detective initially asked him if he believed that what he had done with the younger child was wrong, Ramer equivocated, responding, “kind of sort of wrong.” *Id.* Then later, he qualified his answer by stating, “[i]t wasn't wrong because he was into it too.” *Id.* The specialists’ conclusions consistently confirmed that Ramer believed that it was not wrong to have sexual conduct with a younger child if the other child enjoyed and voluntarily participated in the act. *Id.* Moreover, if the other child voluntarily participates, Ramer failed to comprehend why it was considered “rape”.

²²⁶ *Id.* at 134.

²²⁷ *Id.* at 137.

²²⁸ The prosecution presented its expert witness, Thomas Nore, M.S.W., a juvenile probation counselor who had twenty-six years of experience in his position, but had not conducted an evaluation of Ramer. *Id.* at 135. Nore testified that he believed Ramer understood the wrongfulness of his conduct based on instruction from Ramer’s parents. *Id.* He also indicated that “Ramer had been told by his parents that ‘sexual contact with each other in the home or anyone else’ was wrong.” *Id.* at 135. Nore further opined that Ramer “had knowledge and experience far beyond any 11 year old I’d ever met. In fact far beyond some 16-, 17-year-olds.” *Id.* Therefore, Ramer knew the serious consequences of sexual contact and had the capacity to commit the crime. *Id.* At this point, expert witness testimony based on adolescent brain imaging would

Adolescent brain imaging research provides relevant information about a preadolescent's capacity to make judgments and weigh the consequences of sexual behavior. The information assists the trier of fact regarding their deficiencies in understanding and distinguishing the inappropriateness of criminal conduct.

Ramer provides a classic example of how children's perception and conduct in situations requiring assessment of moral issues (especially complex ones like sexual conduct) can be improperly impacted by collateral influences. Adults are more often resolved in their convictions about what is right and wrong after considering all justifications and rationalizations that often impact their decisions. Adolescents, however, rarely possess the capacity to even consider, much less discern the rightfulness or wrongfulness, of justifications and rationalizations surrounding their conduct.²²⁹ Adolescent brain imaging research informs the trier of fact on the relevant issue of a juvenile's capacity and decision making processes at the neurological level.²³⁰

Information about adolescent brain maturity may be most useful in cases involving decisions and judgments about sexually appropriate conduct for a prepubescent or adolescent child. One's exercise of proper judgment, assessment of risks, and management of emotions truly define the boundaries between criminal and non-criminal conduct. While most judgments about sexual conduct among adolescents do not lead to criminally culpable conduct, it is an area where an adolescent's decisions are largely driven by his emotions and inability to properly perceive the corresponding

be used by the juvenile defendant to show the brain capacity of a defendant like *Ramer* and his limitations in making judgments about *appropriate* sexual conduct when, as *Ramer* stated, "[i]t wasn't wrong because he was into it too." *Id.* at 134.

²²⁹ *Id.* at 137. The Washington Supreme Court concluded that there was sufficient evidence for the superior court to find that the State failed to establish that *Ramer* knew the wrongfulness of his actions based on the testimony offered by the case detective and the psychiatrist, one who waived in their determination of the defendant's capacity and the other who opined that *Ramer* did not have the capacity to understand the illegality of his sexual misconduct.

²³⁰ See Aronson, *Brain Imaging, Culpability and the Juvenile Death Penalty*, *supra* note 34, at 120.

risks.²³¹ In cases like *Ramer*, where the sexual contact between two underage children amounts to potentially criminal culpability, the modified Infancy Defense put forth in this article would allow the juvenile defendant to meaningfully defend himself by offering adolescent brain imaging to inform the fact finder as to the extent of his ability to govern himself appropriately.

2. *Kentucky*

Kentucky has abolished the use of the Infancy Defense at common law under the guise of juvenile court rehabilitative theory.²³² Such jurisdictions must reconsider how the proposed Infancy Defense model can amplify our understanding of juvenile criminal culpability. Mental capability defines the parameters of prosecutors and defense counsels' arguments in criminal cases.²³³ The Supreme Court of Kentucky in *W.D.B. v. Commonwealth*²³⁴ abrogated the common law Infancy Defense in juvenile court²³⁵ in a case where a twelve-year-old was adjudicated delinquent on the offense of first-degree sexual abuse of a three-year-old victim.²³⁶

²³¹ See Johndro, *supra* note 17, at 347 (explaining how the adolescents' decision making capacity and their behavior-control ability is deficient because their choices are emotionally charged based on the dynamics of group pressures that may encourage participation in criminal activity). See also Elizabeth S. Scott and Laurence Steinberg, *Blaming Youth*, 81 TEX. L. REV. 799 814–815 (2003) (explaining that research evidence supports the difference in perception of and attitudes toward risk when comparing adolescents to adults concluding that adolescents and young adults generally take more health and safety risks than do older adults by engaging more frequently in behaviors such as unprotected sex).

²³² *W.D.B. v. Commonwealth*, 246 S.W.3d 448, 450 (Ky. 2007).

²³³ Rogers & DuBois, *supra* note 33, at 18.

²³⁴ 246 S.W.3d 448.

²³⁵ The following cases have also ruled similarly: Connecticut in *In re Tyvonne*, 558 A.2d 661 (Conn. 1989); Pennsylvania in *In re G.T.*, 597 A.2d 638 (Pa. Super. Ct. 1991); Rhode Island in *In re Michael*, 423 A.2d 1180, 1183 (R.I. 1981) (holding that in proceedings in which juveniles are found delinquent or wayward, "there is no necessity for finding that the juvenile had such maturity that he or she knew what he or she was doing was wrong").

²³⁶ *W.D.B.*, 246 S.W.3d at 450. The Kentucky Supreme Court affirmed the District Court decision prohibiting application of a common law presumption where an eight year old boy fondled a three year old behind a shed. The district

The court expressly denounced judicial decision making on policy grounds where the legislature has stated its purposes in the absence of codifying the Infancy Defense presumption.²³⁷ Its approach presents a compelling scenario in favor of applying an Infancy Defense model using adolescent brain science that operates in the absence of a presumption but bolsters expert opinion testimony that is pertinent to the court's determination of "capacity." Because the history of juvenile court reform is founded in legislative movement by the states, the courts abdicate the task of common law presumption.²³⁸

In this case, W.D.B.'s adjudication in juvenile court depended on whether he had the capacity to know between right and wrong; however, when he argued that the common law presumption of infancy applied, the court determined that Kentucky juvenile code provisions governed instead.²³⁹ Therefore, when the juvenile does not operate under the presumption that he lacks criminal capacity, then the court assumes his capacity is the same as an adult's.²⁴⁰ The ruling from this case exemplifies why the courts should extend the evidentiary rules to accommodate the modified Infancy Defense model proposed here. In a policy argument asserting that a presumption of incapacity protects children from the prosecution establishing criminal mental state, W.D.B. asserted the Infancy Defense during the adjudication hearing which is the functional equivalent in juvenile court to the guilt/innocence phase of a

court had sentenced the defendant as a juvenile sex offender under KY. REV. STAT. ANN. § 635.510 (LexisNexis 2008).

²³⁷ *W.D.B.*, 246 S.W.3d at 451–452.

²³⁸ *Id.*

²³⁹ *Id.* at 452. The Supreme Court of Kentucky was unwilling to rule on what they deemed to be a policy argument once the Kentucky legislature enacted a comprehensive Juvenile Code that did not specifically provide for the infancy defense. The Court viewed application of the common law presumption as countering the clinical and rehabilitative purposes of the Juvenile Code. *Id.* at 450.

²⁴⁰ *Id.* at 449–51 (explaining the creation of a common law youthful incapacity presumption in Kentucky and subsequent enactment of extensive Juvenile Code provisions that explicitly omit the presumption).

criminal trial.²⁴¹ He argued that allowing assertion of the Infancy Defense (i.e., lack of criminal capacity) at this stage would then require proof by the prosecution of his mental state.²⁴²

Even though the court determined that W.D.B. knew the difference between right and wrong, the state still had to establish its burden on the legal elements of mens rea.²⁴³ Under a modified Infancy Defense, the juvenile defendant offers the defense of incapacity separate from establishing the mens rea elements, circumstantially, and sans out-of-court confessions. There would be no presumption in favor of the juvenile defendant which means that the prosecution can refute the capacity determination with its own evidence. If the juvenile defendant is successful in establishing incapacity, then the case ends. However, if unsuccessful, the prosecution would carry the burden on the separate determination of criminal intent.

Consider the value added to a juvenile defendant's meaningful defense based on a procedural variation under the W.D.B. facts where, in addition to the expert testimony from the neuropsychologist, there would be expert testimony based on adolescent brain imaging technology offered on the issue of "capacity" between right and wrong. Before reaching the issue of criminal mental state, the expert would provide additional relevant information on what science tells us about adolescent brain deficiencies for the trier of fact to consider in light of the facts and the juvenile offender's out of court confession. In the proposed model, however, the juvenile defendant must establish the Infancy Defense in the absence of a presumption.

²⁴¹ *Id.* at 452.

²⁴² *Id.* at 452.

²⁴³ *Id.* The prosecution ultimately established its burden circumstantially through the combined out of court confession of W.D.B. that was corroborated by the circumstances of the crime. The Kentucky Supreme Court held that there was no error committed by the trial court because W.D.B.'s confession, the father's testimony, and the facts surrounding the incident were sufficient. The court also reasoned that the nature of the offense did not yield physical evidence; therefore, making it acceptable to corroborate the circumstances of the crime. *Id.* at 456.

The expert testimony based on adolescent brain imaging would aid the trier of fact just like the testimony offered by the neuropsychologist in W.D.B. who testified to his mental health diagnoses. Just as the expert opinion testimony is relevant in such cases, the scientific evidence of adolescent brain imaging qualifies our understanding of how adolescents like W.D.B. process their “knowledge” of right and wrong.

B. *A Juvenile’s “Admission of Knowledge”*

1. *California*

Admitting testimony on the cognitive function of the adolescent brain assists the trier of fact in determining an adolescent’s admitted “knowledge” under the facts. In some cases, juvenile offenders will be unable to support an Infancy Defense based on expert witness testimony when other compelling evidence like their admissions of wrongful conduct is offered to suggest a heightened cognitive function.²⁴⁴ A fair and meaningful defense, however, must include not only what experiential evidence provides, but also what relevant scientific evidence reveals about the adolescent’s cognitive immaturity and lack of appreciation for wrongful activity.²⁴⁵

The Court of Appeals in California recently applied their infancy and insanity defense statute²⁴⁶ in *In re Shawn J.*,²⁴⁷ where it

²⁴⁴ See *State v. Bell*, 80 P.3d 367, 376 (2003). The Supreme Court of Kansas cautiously considered a juvenile’s confession by stating that: “[w]here the accused is a juvenile . . . this court exercises the greatest care in assessing the validity of the confession. In determining whether a confession is voluntary, consideration is given to the totality of the circumstances and great reliance is placed upon the finder of fact.” *Id.* Relevant scientific evidence of the adolescent brain comprises the totality of circumstances when the trier of fact determines the juvenile’s admitted “knowledge.” *Id.*

²⁴⁵ See Lucy C. Ferguson, *The Implications of Developmental Cognitive Research on “Evolving Standards of Decency” and the Imposition of the Death Penalty on Juveniles*, 54 AM. U. L. REV. 441, 458 (2004) (discussing how scientific findings of diminished capacity, when coupled with other exacerbating factors such as abuse and neglect, explain juvenile cognitive immaturity).

²⁴⁶ CAL. PEN. CODE § 26 (West 2010). Under the California Code, infancy and insanity defenses are provided in section 26 which, in pertinent part, states:

examined the Infancy Defense as it applies to cases brought under section 602 of the California Welfare and Institutions Code.²⁴⁸ Under the statute, even though children under the age of eighteen are generally within the juvenile court's jurisdiction, if a child over the age of fourteen is charged with certain more severe crimes, he is prosecuted in adult court. *Shawn J.* originated from an order of wardship involving a juvenile offender who was eleven years old when he shot another minor with a BB gun.²⁴⁹ The case involved

"Persons capable of committing crime; exceptions. All persons are capable of committing crimes except those belonging to the following classes: (1) Children under the age of 14, in the absence of clear proof that at the time of committing the act charged against them, they knew its wrongfulness. (2) Persons who are mentally incapacitated."

²⁴⁷ *In Re Shawn J.*, No. B207843, 2009 WL 1758930 at *1–*4, *2 (Cal. Ct. App. June 23, 2009) (holding that the juvenile's admission waived his right to appeal the prosecution's evidence). In his appeal, Shawn J. asserted that the prosecution had failed to meet its statutorily imposed burden to overcome the presumption of infancy. *Id.* At first glance, the presumption and the "clear proof" as a heightened burden appear to work to the advantage of the juvenile offender. *Id.* The juvenile offender asserts the insufficiency of evidence challenge in the context of what is determined to be a "permissible" waiver of his rights and a legal "admission" to the alleged crime. *Id.* In the admission statements, the juvenile offender makes affirmations pertaining to the issue of knowledge between right and wrong under the Infancy Defense. *Id.* Additionally, the admission is equal to a guilty plea that cannot be challenged under precedent based on the insufficiency of evidence. *Id.* at *3.

²⁴⁸ CAL. WELF. & INST. CODE § 602 (West 2010). The California statute outlines jurisdictional limits of the juvenile court as well as the adult criminal court based on the alleged offenses. Section 602 provides, in pertinent part, "(a) Except as provided in subdivision (b), any person who is under the age of 18 years when he or she violates any law of this state or of the United States or any ordinance of any city or county of this state defining crime other than an ordinance establishing a curfew based solely on age, is within the jurisdiction of the juvenile court, which may adjudge such person to be a ward of the court. (b) Any person who is alleged, when he or she was 14 years of age or older, to have committed one of the following offenses shall be prosecuted under the general law in a court of criminal jurisdiction [murder and various sex offenses]." *Id.*

²⁴⁹ *In re Shawn J.*, 2009 WL 1758930 at *1. The Prosecution rebutted the presumption of infancy by offering the statements made by Shawn J. where he admitted the charge. *Id.* He stated that his parents had taught him the difference between "doing what's right and wrong," and that he knew it was wrong to shoot someone with a BB gun. *Id.* With this admission, California applied its rules of

not only application of the Infancy Defense, but also the juvenile offender's admission about his knowledge of wrongful conduct. The case exemplifies in many respects the reasons why juvenile offenders must be able to assert a modified common law Infancy Defense that considers adolescent brain development.

Here, the prosecution was "deemed" to have sufficient evidence based on the juvenile's admission statements to overcome the presumption and prove guilt beyond a reasonable doubt.²⁵⁰ Shawn J. was, therefore, unable to challenge on appeal the sufficiency of evidence that was "deemed" rather than actually offered.²⁵¹ His "admission" that he knew the wrongfulness of his actions formulated the basis of the prosecution's argument on rebuttal. The problem here is the entanglement of legal process that essentially obviated the juvenile offender's right to meaningfully offer "adolescence" as a defense. As a matter of policy, we must ask whether we want to modify our normative standards for imposing criminal responsibility on adolescents under these circumstances, if at all.

Consider whether an expert's testimony as to adolescent vulnerability and susceptibility to coercion confirms or diminishes his own admission regarding his improper or illegal conduct.²⁵²

criminal procedure that treat the plea as, "a *judicial admission of every element of the offense charged . . . serves as a stipulation that the People need introduce no proof whatever to support the accusation . . .*" *Id.* at *2.

²⁵⁰ *Id.* at *2. The court explained that the juvenile's confession was "itself a conviction." *Id.*

²⁵¹ *Id.* The trial court relied upon the adolescent's admissions as "substantial proof . . . of requisite knowledge."

²⁵² See Shepherd, *supra* note 91, at 51. The author observes how adolescents tend to be easily influenced in police interrogations. He states:

[adolescents are] . . . inherently more vulnerable than adults to the processes of police investigations, and to the procedures of trial and sentencing . . . [and that] the techniques widely used in police encounters with teenagers, combined with the adolescent's psychological and neurological vulnerability, make them more likely to consent to police intrusions into their liberty and to break down during police interrogations, and even lead to false confessions that result in the conviction of the innocent.

Id.

Probably any parent can attest to some level of their adolescent's admission of wrongfulness and knowledge of it at the time of an offense. The question becomes whether the parent or society still holds them responsible on any level for their bad decision. When viewed more broadly, we can see that California's interpretation and disposition of the Infancy Defense was based on the juvenile's statements of admission and the value of these statements as "sufficient" evidence to counter the presumption of infancy. In effect, the operable rule of criminal procedure robbed the California juvenile defendant of an opportunity to meaningfully assert relevant testimony on the issue of his "knowledge." Even if we assume ideal compliance with Fifth Amendment protections and confession laws, the legal process of *In re Shawn J.* buttresses the argument made here for a modified Infancy Defense law that allows for full consideration of relevant evidence on the issue of the juvenile offender's cognition and level of function.

While the evidence is subject to prosecutorial rebuttal, the proposed Infancy Defense model advocated in this article avoids circumventing the inquiry into levels of cognitive function through statements made by the juvenile offender "admitting" to his knowledge. A juvenile's admission may still operate to conclusively support the elements of the charge, but it would not be applied as evidence of his cognitive function.²⁵³ As long as our legal system currently punishes all individuals based on some knowledge of their acts and satisfaction of other relevant criminal elements, we must allow, at common law, for a juvenile offender to qualify what it means for an adolescent to "know" about wrongfulness and still engage in illegal behavior. Under the current legislative and common law scheme explained in *In re Shawn J.*, California may provide for the Infancy Defense, but operation of other criminal procedures effectively squelches its consideration.²⁵⁴

²⁵³ See *In Re Shawn J.*, 2009 WL 1758930 at *3 (referring to California precedent where a plea is judicial admission to the elements of a crime).

²⁵⁴ *Id.* The appellate court held that the juvenile's admission waived his right to appellate challenges to the People's evidence. *Id.*

One might question under *In re Shawn J.* why it is necessary for a juvenile court judge to consider the Infancy Defense when disposition involved his continual wardship of the court for some unknown rehabilitative plan or possible detention.²⁵⁵ Some may find that successful assertion of the proposed Infancy Defense amounts to a perceived injustice and, at a minimum, shocks the conscience. While exculpation of the juvenile offender in *In re Shawn J.* might garner such a response, there are cases where perhaps proof of the juvenile defendant's offense is less evident. And, if the Infancy Defense had successfully been asserted with admission of expert witness testimony, then Shawn J. would have escaped sanction for firing the BB gun.

This article does not advocate for a categorical excuse of adolescent criminal responsibility.²⁵⁶ However, in cases where juveniles are subject to harsher sentencing schemes that can be imposed in state juvenile courts as well as adult criminal courts, we must afford the adolescent some legally permissible vehicle by which he can offer an exculpatory defense that considers pertinent information of deficient brain functioning. Perhaps the "Shawn J.'s" of this world should endure the consequence of "bad decision-making" notwithstanding adolescent brain deficiencies. However, where adolescents who commit more serious offenses face sentencing schemes like those imposed on adults, the law must afford them opportunity to assert their status as an adolescent. The Infancy Defense model proposed here allows for reliable scientific information that is relevant to the juvenile's "knowledge" and acts of wrongfulness. Adults who commit the most egregious crimes can afford themselves of all types of relevant defenses that, if successful, exculpate or mitigate their crimes. There is no greater offense to our sensibilities than to ignore consideration of

²⁵⁵ CAL. WELF. & INST. CODE § 602 (West 2010). Under California's jurisdictional statute, absent murder and various sex offenses, the juvenile court judge would ideally impose sanctions that are in accordance with the crime. *Id.*

²⁵⁶ See Bazelon, *supra* note 8, at 169. The author recognizes that the common law Infancy Defense can operate to prevent legal consequence for the child's wrongdoing.

those scientific facts, which explain and substantiate different treatment of children under the law.

VI. CONCLUSION

The U.S. Supreme Court encourages us to re-evaluate our normative standards for imposing criminal liability on adolescents whose diminished culpability markedly distinguished them from adults.²⁵⁷ Under a modified Infancy Defense, courts should consider how their diminished culpability is evidenced by studies of the adolescent brain which show regions that, more likely than not, govern their decision-making capacity.²⁵⁸ Admitting adolescent brain studies is especially necessary to the meaningful defense of the juvenile when fourteen to eighteen year olds are most likely to be treated as adults under current transfer and certification laws.²⁵⁹ Even further, the cognitive maturity level of the average juvenile offender between the ages of eleven and fourteen is oftentimes well below their chronological age.²⁶⁰ Consequently, perhaps exculpation from criminal liability is warranted even where a level of cognition exists. A meaningful defense formulates the groundwork for a fair trial where the juvenile defendant is allowed to offer evidence for purposes of

²⁵⁷ *Roper v. Simmons*, 543 U.S. 551, 570–71 (2005).

²⁵⁸ *Kaban*, *supra* note 9 at 47.

²⁵⁹ K.Y. REV. STAT. ANN. 635.020(4) (requiring juveniles fourteen years of age and older charged with using firearms in the commission of felonies to be tried as adults). Nonetheless, in California, for example, the Infancy Defense model is limited to those under the age of fourteen who are not subjected to adult criminal court prosecution based on certain delineated offenses. CAL. WELF. & INST. CODE § 602 (West 2010).

²⁶⁰ See Vance L. Cowden & Geoffrey R. McKee, *Competency to Stand Trial in Juvenile Delinquency Proceedings—Cognitive Maturity and the Attorney-Client Relationship*, 33 U. OF LOUISVILLE J. FAM. L. 629, 647 (1995) (“[the cognitive maturity level below the juvenile’s chronological age] is important to the child’s ability to understand the proceedings and the nature of the charges against him or her. But it is even more critical to the child’s inability to consult with counsel and to assist in his or her defense. A juvenile functioning at this level of cognitive maturity may be ill-equipped to understand the various choices that are available to him or her, let alone the potential consequences of the different decisions.”).

assessing his capacity to fully appreciate the wrongfulness of his action.

The defense would be asserted without the presumption of “incapacity” or “knowledge” of right and wrong currently present in most states. Instead, the prosecution and defense would be on equal footing as to the burden of establishing and refuting sufficient evidence. Operation of the Infancy Defense means that the jury will consider whether to proceed with imposing criminal responsibility under the facts and the alleged charge. Prosecutors must then refute the affirmative defense. Ultimately, the mechanisms of adversarial process would fully operate to determine whether criminal responsibility should be imposed. The primary difference is that the juvenile’s affirmative defense is more meaningful when asserted based on expert testimony regarding their cognitive brain function.²⁶¹

Many jurisdictions have abrogated the statutory Infancy Defense, thereby exposing juveniles to prosecution and/or sentencing as if they were adults.²⁶² As a result, fewer assertions of exculpation from legal responsibility have been made by juvenile offenders.²⁶³ In the absence of statutory Infancy Defense models, it is incumbent upon judges at common law to expand their evidentiary rule interpretation of the “gatekeeper” and allow the expert testimony to be admitted as probative on the pertinent issue of criminal responsibility. This author advances the argument that

²⁶¹ Duke T. Oishi, *A Piece of Mind for Peace of Mind: Federal Discoverability of Opinion Work Product Provided to Expert Witnesses and Its Implications in Hawai’i*, 24 U. HAW. L. REV. 859, 878 (2002) (explaining the importance of expert witness when the fact finder must assess subjects outside their common knowledge). In order to appreciate a juvenile’s cognitive brain function through the scientific data that provides measure, an expert must provide testimony as part of the juvenile’s affirmative defense. *Id.*

²⁶² *W.D.B. v. Commonwealth*, 246 S.W.3d 448, 450 (Ky. 2007) (discussing a Kentucky Supreme Court case as illustration of abrogation of the common law Infancy Defense). *See also* Beale, *supra* note 20, at 520–21.

²⁶³ Many Infancy Defense cases were decided before 1990, during a time when less punitive measures predominated our juvenile justice and criminal systems. Kaban, *supra* note 9, at 55–56.

notions for fundamental fairness minimally require that the juvenile offender be allowed to offer this information²⁶⁴ even though several commentators dispute the injection of scientific evidence in the courtroom that attempts to connect adolescent brain development to legal excuse or culpability.²⁶⁵

We can speculate as to whether the law should formulate categorical rules or evaluate case-by-case exceptions, but at some point we must involve reliable and relevant scientific technology in the adversarial process to evaluate imposition of criminal responsibility. The courts at common law are designed to fairly ferret out disagreement over imposition or excuse from liability without waiting for the legislature to make categorical determinations. Trial court judges must fairly consider scientific factors that influence adolescents' cognitive capacity so that the adjudication and prosecution of juvenile offenders reflects our knowledge of childhood development.

²⁶⁴ See generally Scott & Steinberg, *supra* note 231 (supporting consideration of scientific evidence to mitigate criminal liability).

²⁶⁵ See Tancredi, *supra* note 89, at 293–294 (detailing some of the technical inherent limitations of the fMRI and difficulties of using fMRI images to draw legal conclusions. Specifically, the image does not explain an individual's violent behavior which is critical for imputing responsibility. The inability to infer causal relationships based on the images presents a major limitation on its use in the courtroom). See also Brown, *supra* note 87, at 1183–84 (questioning the use of fMRI images in the courtroom to determine the individual's degree of culpability in mens rea claims when the technology is based on averaged data that compares the individual to a group). Nevertheless, the article does not completely deny use of the technology in the courtroom, but instead, favors use of Rule 403 that excludes prejudicial evidence or evidence lacking probative value, rather than *Daubert* (or similar) rules governing scientific evidence. See also Stephen J. Morse, *Immaturity and Irresponsibility*, 88 J. CRIM. L. & CRIMINOLOGY 15, 40, 41–42 (1997) (positing that children clearly act intentionally, therefore, morality and the law seeks to excuse their behavior as intentional and purposeful. While juveniles make choices, oftentimes, they reflect their lack of experience and knowledge of the full range of potential choices in any given circumstance. Regardless, their actions are intentional and are not excused because they are unintentional. And, lack of mental capacity to make a choice does not justify excuse).

If juvenile offenders are to be truly considered less blameworthy than adults, preservation of the Infancy Defense is crucial.²⁶⁶ This is true even when they should be held accountable for their actions. Adolescent brain imaging technology informs us on essential differences between how adults make decisions regarding their conduct as distinct from adolescents.²⁶⁷ Incorporating the technology into a modified Infancy Defense model provides the fact finder with the data necessary to determine adolescent criminal capacity. A more in-depth determination of the differences between adolescents and adults can direct the standard by which we impose criminal sanctions.²⁶⁸ While adolescents often know the wrongfulness of their actions, our normative legal standards should appropriately absolve them from criminal responsibility when adolescent brain imaging can guard lawmakers and society against overestimation of their criminal culpability.

²⁶⁶ *Roper v. Simmons*, 543 U.S. 551, 591 (2005).

²⁶⁷ While adults use their prefrontal cortex to process information, teenagers use their amygdala because their prefrontal cortex is not mature. In fact, it is the last area of the brain to mature and is the one responsible with “risk assessment, impulse control, behavior regulation, and moral reasoning.” Kaban, *supra* note 9, at 48.

²⁶⁸ One author suggests that we assess an adolescent’s decision making ability on the following three categories established by a developmental psychologist: (1) responsibility, which includes autonomy and independence of thought; (2) temperance, which contemplates the ability to limit impulsiveness; and (3) perspective, which focuses on an individual’s ability to frame a particular decision in a larger context. Kim Taylor-Thompson, *States of Mind/States Of Development*, 14 STAN. L. & POL’Y REV 143, 156 (2003). The author advocates for a more in-depth dialogue about the fundamental developmental differences between children and adults in their treatment under the criminal justice system. She also describes the views of our criminal justice system regarding adolescent offenders as based largely on an “overestimation of [the adolescents’] decision-making capacities. . . .” *Id.* at 172.