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Foreword

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SYMPOSIUM

CRIMINAL BEHAVIOR AND THE BRAIN: WHEN LAW AND NEUROSCIENCE COLLIDE

FOREWORD

*Deborah W. Denno**

INTRODUCTION

This Foreword provides an overview of *Criminal Behavior and the Brain: When Law and Neuroscience Collide*, a symposium hosted by the *Fordham Law Review* and cosponsored by the Fordham Law School Neuroscience and Law Center. While the field of neuroscience is vast—generally constituting “the branch of the life sciences that studies the brain and nervous system”¹—this symposium focused on the cutting-edge ties between neuroscience evidence and the different facets of criminal law. Such an intersection invited commentary from an expert group on a wide span of topics, ranging from the historical underpinnings between law and neuroscience to the treatment of young adults to the different roles of neuroscience in the context of sentencing, expert testimony, defenses, prediction, punishment, and rehabilitation, as well as the civil and criminal divide. These diverse subjects have an overarching theme in common: each pertains in some way to the criminal justice system’s effort to punish or rehabilitate more fairly and effectively.

* Arthur A. McGivney Professor of Law, Founding Director, Neuroscience and Law Center, Fordham University School of Law. This Foreword reviews the *Fordham Law Review* symposium entitled *Criminal Behavior and the Brain: When Law and Neuroscience Collide* (cosponsored with the Fordham Law School Neuroscience and Law Center) held at Fordham Law School. I am most grateful to the symposium participants for their insightful interdisciplinary presentations as well as their articles published in this issue. I also thank the members of the *Fordham Law Review* for their incredible care and thought in organizing the symposium and the editorial process. Marianna Gebhardt and Erica Valencia-Graham provided excellent comments and assistance for this Foreword. I am indebted to Fordham Law School and the Gerald Edelman Fellowship for funding.

1. NEUROSCIENCE AND THE LAW: BRAIN, MIND, AND THE SCALES OF JUSTICE glossary at 206 (Brent Garland ed., 2004); see also OWEN D. JONES ET AL., LAW AND NEUROSCIENCE 762 (2014) (defining neuroscience as “[t]he scientific study of the structure and function of the nervous system; includes experimental and clinical studies of animals and humans”).

I. NEUROSCIENCE AND LAW:
HISTORY AND FRAMEWORK

Any informed discussion of criminal behavior and the brain must start with a historical overview of the use of neuroscience in the courtroom. Francis Shen's article focuses on developments in this area that have occurred over the nineteenth and twentieth centuries.² Shen contends that current studies of neuroscience and law should incorporate greater awareness of this history given the ways in which the past may illuminate the present.³ While brain science can improve the law, there always have been limits to how much science can resolve legal problems.⁴

Shen examines four sequential and overlooked "moments"⁵ in history: (1) the communications between medicine and law in the nineteenth century and the early twentieth century, (2) the start of the legal system's use of electroencephalography evidence in the mid-twentieth century, (3) the application of psychosurgery as a means of averting an individual's violent behavior during the 1960s and 1970s, and (4) the developing use of neuroscience in personal injury cases in the late 1980s and throughout the 1990s.⁶ Although the science during these moments has not always been successful in achieving its goals, much has been written on issues such as eugenics, phrenology, the frontal lobotomy, and what the past use of these techniques might predict for today.⁷

The law's engagement with the lobotomy in the 1940s and 1950s is perhaps the most concerning development in this area.⁸ Shen examines the most troubling aspects of this practice, both in modern times and decades ago,⁹ particularly in the context of racial unrest and urban riots.¹⁰ Yet, he acknowledges that "[p]sychosurgery made national headlines but never made much headway in the actual criminal justice system."¹¹

The surge of forensic neuropsychology in civil litigation in the 1990s had a different outcome, however. It provided a foundation for current advances in the intersection between neuroscience and law¹² as awareness grew of the increasing number of neuropsychologists testifying in court cases.¹³ Shen concludes by explaining that, while the history of neuroscience and law is generally problematic, underexplored, and incautious,¹⁴ "we are in the

2. Francis X. Shen, *The Overlooked History of Neurolaw*, 85 FORDHAM L. REV. 667 (2016).

3. *Id.* at 667–68.

4. *Id.* at 668.

5. *Id.*

6. *Id.*

7. *Id.* at 680–81.

8. *Id.* at 681.

9. *Id.* at 682–83.

10. *Id.* at 683–84.

11. *Id.* at 684.

12. *Id.* at 685.

13. *Id.* at 685–86.

14. *Id.* at 691–92.

middle of a revolution in neuroscience”¹⁵ that brings with it ever-increasing growth and interest in brain research.¹⁶ Shen’s article is a call to action, inviting readers to “learn from our past mistakes, build on our past successes, and forge a future of increasingly productive interdisciplinary conversation.”¹⁷

Elizabeth Bennett’s article also provides some historical perspective but centers on more recent developments, from the 1980s to the present, primarily within the retributivist versus consequentialist context.¹⁸ While Shen focuses on the evolution of neuroscience prior to and during the initial stages of its use in courtrooms, Bennett is concerned more with developing theories that underlie the link between law and neuroscience and how neuroscience is currently employed in courtrooms (to mitigate sentencing).¹⁹

Bennett begins by assuming that “[m]oral responsibility is the foundation of criminal law,”²⁰ and she raises the question of whether advances in neuroscience and brain imaging will weaken or even dissolve that foundation.²¹ To probe this issue, Bennett first describes the history and evolution of criminal law over time,²² noting that, although the criminal law varies in different societies and cultures, each system shares two key principles: (1) defendants must have some level of intent to be culpable for a criminal act and (2) the punishment the state provides will be proportional to that level of intent.²³ Bennett posits that neuroscience will help to ensure these two principles are enacted in a way that is more accurate and fair.²⁴ She claims that “[a] fair sentencing regime” requires both retributivist and consequentialist principles.²⁵

So far, prosecutors have not used neuroscience evidence to predict a defendant’s future violent behavior or recidivism nor to argue for longer sentences and preventive detention.²⁶ Yet it remains to be seen whether prosecutorial practices will change as neuroscience evidence becomes more accepted.²⁷ Likewise, many researchers in the fields of neuroscience and law anticipate that neuroscience will take a more significant role in identifying and explaining brain disorders that show a greater link to a defendant’s criminal conduct and mental state, including substance abuse addiction and defenses such as insanity.²⁸

15. *Id.* at 692 (quoting Henry T. Greely, *Law and the Revolution in Neuroscience: An Early Look at the Field*, 42 AKRON L. REV. 687, 688 (2009)).

16. *Id.* at 693.

17. *Id.* at 695.

18. Elizabeth Bennett, *Neuroscience and Criminal Law: Have We Been Getting It Wrong for Centuries and Where Do We Go from Here?*, 85 FORDHAM L. REV. 437 (2016).

19. *Id.*

20. *Id.* at 437.

21. *Id.*

22. *Id.* at 437–39.

23. *Id.* at 439–40.

24. *Id.* at 440.

25. *Id.* at 444.

26. *Id.* at 449.

27. *Id.* at 450.

28. *Id.*

Given these and numerous other potential uses for neuroscience in the criminal justice system, Bennett lists ways in which the criminal justice system could change.²⁹ For example, developments in neuroscience could expand or increase the number of excuses, including the ability to better identify those who should receive insanity verdicts.³⁰ In light of these and other possibilities, Bennett concludes by highlighting the enormous impact that neuroscience may have on the criminal justice system: if neuroscience “does eventually provide significant insights into the mind, it may well be necessary to revamp our thinking on the Anglo-American system of criminal justice and perhaps our approach to the law entirely.”³¹

II. NEUROSCIENCE AND SENTENCING POLICY

The potential role for neuroscience in law is perhaps most frequently discussed in the context of sentencing. Like Bennett, Nancy Gertner examines how neuroscience offers the possibility of yet another shift in American sentencing by aiding the development of a more informed sentencing approach.³² She begins with an overview of the history of sentencing and how changes throughout that history (such as the Sentencing Reform Act of 1984) have altered judges’ approaches.³³ Gertner writes from a highly personal perspective, given her seventeen-year federal judicial career; she explains that she is currently “reviewing the sentences [she] was obliged to give to hundreds of men—mostly African American men”—during the course of her years on the bench.³⁴ Her initial conclusion is striking: “I believe that 80 percent of the sentences that I imposed were unfair, unjust, and disproportionate.”³⁵ All the factors that she and neuroscientists have discovered to impact behavior were “irrelevant to the analysis [she] was supposed to conduct.”³⁶

With that bold start, Gertner views the topic of neuroscience and sentencing from three perspectives: (1) the “sentencer’s brain” and all that the sentencer experiences, (2) the “sentencing stage” and the kinds of rules that control it, and (3) the “substantive content” that neuroscience can contribute to sentencing.³⁷ She explains that, for the past thirty years, the sentencer’s brain has concentrated exclusively on retribution and sentencing disparity between judges, thereby buffering a “rigid, formulaic, and severe” sentencing scheme.³⁸ The past decade’s growing recognition of problems associated with mass incarceration, racial inequities, and high prison costs have prompted the concept of a “new rehabilitation” guided by

29. *Id.* at 450–51.

30. *Id.* at 451.

31. *Id.*

32. Nancy Gertner, *Neuroscience and Sentencing*, 85 FORDHAM L. REV. 533 (2016).

33. *Id.* at 534–41.

34. *Id.* at 533.

35. *Id.*

36. *Id.*

37. *Id.* at 533–34.

38. *Id.* at 534.

neuroscience.³⁹ Gertner emphasizes, however, that this “new rehabilitation” must avoid the problems of the past.

Gertner provides a detailed critique of the Sentencing Reform Act and the new agency it started, the U.S. Sentencing Commission.⁴⁰ Because the U.S. Sentencing Commission lacked sentencing experts and produced unsophisticated research, the Federal Sentencing Guidelines (“the Guidelines”) were ill informed and devoid of purpose.⁴¹ Indeed recent neuroscience research has shown the negative effects the Guidelines have imposed on judicial decision making and the unfairness it creates in sentencing.⁴² According to Gertner, the goal is to devise a system that enables judicial discretion and judgment while also bypassing the hazards of the pre-Guidelines flaws.⁴³ “This would be a system informed by appellate review, and even peer review, with evidence-based guidance from neuroscience, social psychology, and psychiatry—not mandatory diktats.”⁴⁴ Such a system would also address the problems that accompany expert sentencing at trial and the need to strengthen procedural protections in noncapital cases.⁴⁵

The “new rehabilitation” therefore provides opportunities for the criminal justice system to shun retribution in lieu of a regime more neuroscientifically suitable to defendants’ individual needs.⁴⁶ In addition, neuroscience findings can shed light on a range of other troubling challenges that impact offenders, including inadequate prison conditions, solitary confinement, prison violence, and issues pertaining to juveniles.⁴⁷ While neuroscience research also can help assess which programs succeed or fail,⁴⁸ Gertner warns that there are drawbacks to relying on neuroscience evidence.⁴⁹

Gertner ends by emphasizing the special role that neuroscience plays in sentencing determinations.⁵⁰ Instead of using neuroscience evidence to assess defendants’ culpability or whether they should be executed, “ordinary sentencing” should be “forward looking, considering recidivism, deterrence, and rehabilitation.”⁵¹ In focusing on defendants’ futures, the criminal justice system “should use all of the new tools at [our] disposal, so long as [we] understand[] the history and risks.”⁵²

Bernice B. Donald and Erica Bakies consider more specifically how neuroscience has been incorporated during the sentencing process, as well as

39. *Id.* at 535.

40. *Id.* at 536–37.

41. *Id.*

42. *Id.* at 538.

43. *Id.* at 541.

44. *Id.*

45. *Id.*

46. *Id.* at 544.

47. *Id.* at 544–45.

48. *Id.*

49. *Id.* at 545.

50. *Id.* at 546.

51. *Id.*

52. *Id.*

the tools that courts evaluate, such as neuroimaging.⁵³ Their article also discusses how neuroscience can help judges overcome their implicit biases.⁵⁴ Like the Gertner article, Donald and Bakies's article provides a thorough background on the current and perhaps future role of neuroscience in judicial decision making.⁵⁵

The authors begin by asking how neuroscience evidence could be effectively applied in the context of sentencing.⁵⁶ Their answer provides the article's theme that neuroscience can be used to show how certain actions may result from developmental problems associated with the brain, like the effects of complex trauma on children.⁵⁷ The authors' approach is consistent with current trends and efforts in neuroscience, including President Barack Obama's launch of the Brain Research through Advancing Innovative Neurotechnologies Initiative.⁵⁸ As a consequence, fields of study concerning the brain (such as neuropsychology) have grown substantially⁵⁹ and have enhanced the perspective and evidence that neuroscience provides.⁶⁰ This expanded multidisciplinary view can include measures ranging from brain scans to social and family histories⁶¹ as well as neuroscience research demonstrating how childhood trauma can impact brain development and behavior.⁶²

In order to provide perspective on these issues, the authors examine the history of sentencing in the United States from the seventeenth century through the 1980s, when sentencing centered on deterrence and incapacitation in light of the War on Drugs.⁶³ While judges initially possessed nearly unlimited sentencing discretion,⁶⁴ this lack of oversight changed in 1984 when Congress passed the Sentencing Reform Act, which established the U.S. Sentencing Commission and the Federal Sentencing Guidelines.⁶⁵ Donald and Bakies note that, although the Guidelines are no longer mandatory, they continue to have a negative effect on those who are mentally ill.⁶⁶

The authors also examine how neuroscience is currently incorporated within the criminal justice system, noting that it has been introduced in all three phases of a criminal trial: competency determinations, the guilt phase,

53. Bernice B. Donald & Erica Bakies, *A Glimpse Inside the Brain's Black Box: Understanding the Role of Neuroscience in Criminal Sentencing*, 85 FORDHAM L. REV. 481 (2016).

54. *See id.*

55. *See id.*

56. *Id.* at 481.

57. *Id.* at 481–82.

58. *Id.* at 482–83.

59. *Id.* at 483.

60. *Id.* at 483–87.

61. *Id.* at 484.

62. *Id.* at 485–87.

63. *Id.* at 488–92.

64. *Id.* at 489.

65. *Id.*

66. *Id.* at 490.

and the sentencing phase.⁶⁷ In civil cases, claims using neuroscience have covered a wide range of areas including personal injury, medical malpractice, and toxic exposure⁶⁸—associations that can also be relevant in the criminal context. While most jurisdictions accept a neuropsychologist’s testimony concerning the link between an existing brain injury and causation, a minority of states exclude it on the basis that only medical experts are qualified to testify on the relevant diagnostic and causal issues.⁶⁹ Still, neuroscience evidence is readily admitted into courtrooms and it plays a substantial role in mitigating factors applicable to the death penalty.⁷⁰ Indeed, cognitive scientists are now assisting defendants’ mitigation arguments “‘by invoking cutting-edge brain imaging research on the neurobiological roots of criminal violence’ within offenders’ brains.”⁷¹ This approach is consistent with the U.S. Supreme Court’s standard in death penalty cases that the sentence reflect the “uniqueness of the individual” and “a reasoned *moral* response to the defendant’s background, character, and crime.”⁷²

There are also a number of ways neuroscience evidence can reduce judges’ implicit bias.⁷³ Examples include neurological testing of a defendant’s thought processes so a judge can better understand what may have led to that defendant’s behavior.⁷⁴ In addition, “individuation” requires judges of behavior to obtain sufficient information about the person they are assessing so that they can know that individual’s personal attributes.⁷⁵

Donald and Bakies conclude by emphasizing that the individuals who gain the most advantages from neuroscience developments in the criminal justice system are those who have traumatic childhoods before they get involved in crime.⁷⁶ Individualized assessments can explain, in part, these defendants’ behaviors, especially if they experienced repeated traumatic situations, residence in a dangerous inner-city neighborhood, or a life growing up in foster care or the welfare system.⁷⁷ As the authors explain, “neuroscience offer[s] judges insight into individuals such as these, [and] it can also facilitate judges’ attempts to counteract implicit biases.”⁷⁸

Donald and Bakies’s focus on empathy and implicit bias is a fitting segue to an article on cautionary tales on empathy by Sheri Lynn Johnson, Amelia Courtney Hritz, Caisa Elizabeth Royer, and John H. Blume.⁷⁹ The authors

67. *Id.* at 493.

68. *Id.*

69. *Id.* at 494.

70. *Id.*

71. *Id.* at 497 (quoting O. Carter Sneed, *Neuroimaging and the “Complexity” of Capital Punishment*, 82 N.Y.U.L. REV. 1265, 1269 (2007)).

72. *Id.* (quoting *California v. Brown*, 479 U.S. 538, 545 (1987) (O’Connor, J., concurring)).

73. *Id.* at 499.

74. *Id.* at 500.

75. *Id.*

76. *Id.* at 502.

77. *Id.*

78. *Id.*

79. Sheri Lynn Johnson et al., *When Empathy Bites Back: Cautionary Tales from Neuroscience for Capital Sentencing*, 85 FORDHAM L. REV. 573 (2016).

explain how biases and stereotypes, specifically about race, can affect a judge's or juror's decision making.⁸⁰ Likewise, the article introduces a new way that neuroscience can be used within the sentencing context by revealing how empathy helps explain how jurors' identity affects decision making.⁸¹

Capital sentencing trials, the authors note, present an inherent conflict: while prosecutors try to dehumanize defendants before a jury, defense attorneys try to humanize them.⁸² One of the primary vehicles for humanizing a defendant is mitigating evidence, which the Supreme Court has defined "broadly."⁸³ Nonetheless, "[s]uch evidence, and the empathy for the defendant it is intended to create, is perceived as central to persuading jurors to spare a capital defendant's life."⁸⁴

The concept of empathy, while heavily researched, is still somewhat of a mystery "and its implications for capital trials are largely unexplored."⁸⁵ This is due, in part, to the concept's differing definitions across studies.⁸⁶ That said, recent developments in neuroscience have enabled researchers to investigate various "components" of empathy,⁸⁷ which the authors define "as the act of understanding and adopting another's perspective, either through affective or cognitive processes."⁸⁸

Individuals differ in their ability to empathize. In general, females are more empathic than males.⁸⁹ Older individuals (adults aged sixty to eighty) show higher empathy measures than all other age groups on some tests, but such results can differ depending on the kind of test being used.⁹⁰ Individual differences in the ability to empathize also may predict behavior, thus showing that an underlying cognitive component of empathy is influenced by an individual's attention and motivation.⁹¹ Individuals are more empathic toward those who bear a greater resemblance to them in terms of race, age, gender, et cetera (their "in-group"), than toward those of differing characteristics (their "out-group").⁹² They also are more apt to dehumanize and stereotype those they perceive to be in an out-group.⁹³ According to the authors, courtroom strategies may attempt to fuel the use of stereotypes, especially racial stereotypes, in an effort to dehumanize the defendant.⁹⁴

Researchers induce empathy to convey an emotional state in a range of ways—through facial expressions, bodily movements, mental processes,⁹⁵ or

80. *See id.*

81. *See id.*

82. *Id.* at 574.

83. *Id.*

84. *Id.* at 574–75.

85. *Id.* at 575.

86. *Id.*

87. *See id.* at 576.

88. *Id.* at 577–78.

89. *Id.* at 580.

90. *Id.* at 582.

91. *Id.*

92. *Id.* at 583.

93. *Id.*

94. *Id.* at 588.

95. *Id.* at 590.

simply asking a subject to “imagine him- or herself in the other’s place.”⁹⁶ Yet, the application of this research in the context of capital trials has had mixed results. As the authors note, in terms of jury selection, “the neuroscience of empathy is very helpful in explaining *how* the identity of the jurors affects decision making, but it is not so helpful in figuring out how to eliminate the effects of individual differences.”⁹⁷ Therefore, neuroscience research “reinforces the importance of vigilant judicial enforcement of prohibitions against discrimination in jury selection.”⁹⁸

These findings accentuate a number of problematic practices in death penalty litigation. First, a detailed voir dire may reveal which jurors are most empathic; yet courts that have prohibited attorneys from questioning jurors about their views on particular types of mitigation “thwart the purpose of individualized sentencing” as well as attorneys’ efforts to select the most appropriately empathic jurors.⁹⁹ Research has shown that specificity is important in this context because “it is more likely to evoke the automatic affective response.”¹⁰⁰ Second, the prosecutor’s presentation of aggravating evidence that is not relevant specifically to the defendant’s crime may enhance the probability that the jury will engage in arbitrary decision making.¹⁰¹ Likewise, the kind of victim-impact statements approved of in *Payne v. Tennessee*¹⁰² are inappropriate because they potentially encourage “empathy-induced aggression, for which there is no constitutional justification.”¹⁰³ Thus, both mitigating and aggravating evidence should be specific to the defendant’s case.¹⁰⁴

Overall, the authors conclude that the “neuroscience of empathy” reveals the extent to which decisions to sentence individuals to death are inevitably arbitrary and influenced by either “race or caprice.”¹⁰⁵ Efforts can be made to diminish the extent of this arbitrariness; yet “we cannot alter basic neural responses to the pain of others and therefore cannot rationalize (in either sense of the word) empathic responses.”¹⁰⁶

The article by Ruben Gur, along with his coauthors Oren Gur, Alon Gur, and Arona Gur, shifts the focus from a judicial and juror perspective on neuroscience to a medical and clinical perspective concerning the presentation of neuroscience evidence during the sentencing phase.¹⁰⁷ The article emphasizes in particular Ruben Gur’s experience as an expert witness and the lessons he learned from offering expert testimony on neuroscience in

96. *Id.* at 591.

97. *Id.* at 592.

98. *Id.* at 593.

99. *Id.* at 594.

100. *Id.* at 597.

101. *Id.* at 596.

102. 501 U.S. 808 (1991) (holding that the Eighth Amendment does not prohibit the admissibility of victim impact evidence at a capital sentencing hearing).

103. Johnson et al., *supra* note 79, at 596.

104. *Id.* at 595–97.

105. *Id.* at 598.

106. *Id.*

107. Ruben C. Gur et al., *A Perspective on the Potential Role of Neuroscience in the Court*, 85 *FORDHAM L. REV.* 547 (2016).

legal cases.¹⁰⁸ Gur describes the process he employs to create medical and scientific reports intended to be used on defendants' behalf during trials.¹⁰⁹ He also discusses how the evidence is treated in the courtroom—specifically, when and how it is presented, by whom, and for what purpose,¹¹⁰ and what happens if this evidence is *not* presented.

Gur and his coauthors begin with a brief history of the association between the human brain and behavior, the development of phrenology, and a discussion of early groundbreaking research that contributed to the discovery that brain lesions can influence different kinds of behaviors according to the type and location of the damage.¹¹¹ At the start of the twenty-first century, neuroscience testimony in courts began to emerge full force in important Supreme Court decisions, including *Atkins v. Virginia*¹¹² and *Roper v. Simmons*.¹¹³ In sync with these decisions, Gur has offered testimony concerning how certain types of brain damage have the potential to affect human behavior.¹¹⁴ As the authors explain, while the legal system has long considered the effects of brain damage on behavior, only recently has a “rigorously tested brain behavior science” become “increasingly available.”¹¹⁵ Predictably, some scientists oppose the use of such neuroscience evidence in court because they feel it is flawed or more influential than probative;¹¹⁶ yet perhaps the greater impediment for neuroscientist expert witnesses is that “while more precise and reliable, data will become increasingly more difficult to understand and, therefore, explain.”¹¹⁷

Gur's initial involvement in medical-legal consultation started with his research in the 1970s using neuroimaging technology to understand behavior and then his development of the largest normative positron emission tomography (PET) database at that time.¹¹⁸ This database became the foundation for Gur's testimony during a death penalty trial,¹¹⁹ after which he began receiving referrals primarily from defense attorneys in capital cases but also from prosecutors in criminal and civil cases involving questions about the effects of brain damage.¹²⁰

The authors describe, in detail, the standards that Gur and his team use to examine the link between behavior and brain function, as well as the

108. *See id.*

109. *Id.* at 559–65.

110. *Id.* at 565–69.

111. *Id.* at 549–52.

112. 536 U.S. 304 (2002) (holding that the Eighth Amendment prohibits the imposition of the death penalty on individuals with intellectual disabilities).

113. 543 U.S. 551 (2005); *see id.* at 578 (holding that the Eighth Amendment prohibits the “imposition of the death penalty on offenders who were under the age of 18 when their crimes were committed”).

114. Gur et al., *supra* note 107, at 557.

115. *Id.* at 548.

116. *Id.*

117. *Id.*

118. *Id.* at 557.

119. *Id.* at 558.

120. *Id.*

procedures he and interested lawyers follow to determine if Gur will get involved in a case.¹²¹ Gur and his coauthors conclude with a summary of the lessons that he and his team have learned over the years about testifying about neuroscience results.¹²² For example, while “courts and experts may vary in their knowledge and understanding of neuroscience methodology,”¹²³ it also bears emphasizing that “inappropriate dismissal of or failure to introduce neuroscience evidence pretrial [can produce a domino effect and have] long-term adverse effects on subsequent litigation.”¹²⁴

Finally, the authors address a number of objections commentators have offered regarding neuroscience evidence in the courtroom.¹²⁵ For example, in response to criticism that such testimony provides “an excuse for violence by deflecting responsibility from the person to a brain structure,” the authors emphasize that neuroscience evidence is only one of numerous possible mitigating factors in a case.¹²⁶ Regardless of these and other objections, the authors predict that the role of neuroscience in the legal system will continue to expand.¹²⁷

Gur and his coauthors’ forecast concerning the expanding role of neuroscience is aptly illustrated by Joel Zivot’s examination of the quandaries that arise when a defendant with a preexisting medical condition is sentenced to death by lethal injection. This situation thereby creates an Eighth Amendment issue that reveals a deficiency in our sentencing procedures.¹²⁸ In this context, neuroscience research can help to develop a more informed sentencing system, an approach also advocated by Gertner, Donald, and Bakies.

Zivot introduces his article with the case of Ernest Johnson, a Missouri inmate sentenced to death by lethal injection for killing three employees during a convenience store robbery.¹²⁹ Johnson, a victim of sexual abuse, also suffered from a number of other disorders, including an intellectual disability, fetal alcohol syndrome, traumatic head injury, and a brain tumor which was only partially removed.¹³⁰ Zivot’s article concerns the legal and ethical implications of using lethal injection drugs on Johnson given that the drugs could cause Johnson to suffer a painful seizure due to his vulnerable medical condition.¹³¹

In the context of this case, Zivot discusses capital punishment generally and the concept of cruel and unusual punishment under the Eighth

121. *Id.* at 559–65.

122. *Id.* at 565–69.

123. *Id.* at 565.

124. *Id.* at 568.

125. *Id.* at 569–71.

126. *Id.* at 569.

127. *Id.* at 571.

128. See Joel Zivot, *Too Sick to Be Executed: Shocking Punishment and the Brain*, 85 *FORDHAM L. REV.* 697 (2016).

129. *Id.* at 697.

130. *Id.*

131. See *id.* at 701.

Amendment with respect to execution methods.¹³² Lethal injection, now the most pervasive method of execution in the United States, is “never a medical act” according to Zivot; yet it “co-opts the tools of the medical trade” and therefore stirs controversy.¹³³

*Estelle v. Gamble*¹³⁴ held that indifference to prisoner health constitutes cruel and unusual punishment and therefore violates the Eighth Amendment.¹³⁵ *Estelle* has been interpreted as upholding a prisoner’s right to health care, which a warden has a legal duty to provide.¹³⁶ This obligation leads to Zivot’s core question: If an inmate dies as a result of a state-sanctioned execution, when, if ever, is it appropriate during the execution for the legal system to set aside the inmate’s healthcare? As Zivot contends, “[c]apital punishment cannot be brought about as a consequence of withholding necessary healthcare. Nor can it occur by the infliction of sublethal injuries that, in the course of time, are expected to worsen and cause death.”¹³⁷ Likewise, the state would be obligated to resuscitate any inmate who survives an execution attempt.¹³⁸

Missouri death-row inmate Russell Bucklew has serious health issues that could impede the state’s efforts to execute him by lethal injection.¹³⁹ Bucklew’s attorneys asked Zivot to examine Bucklew and give his opinion on Bucklew’s Eighth Amendment stay application concerning the effects of the lethal injection procedure on Bucklew’s condition.¹⁴⁰ According to Zivot, Bucklew “had a substantial risk of ‘suffering grave adverse events during the execution, including hemorrhaging, suffocating, and experiencing excruciating pain.’”¹⁴¹ Justice Alito granted Bucklew’s stay of execution and Bucklew remains on death row.¹⁴²

Where do these dilemmas leave Ernest Johnson, another physically impaired death row inmate? Johnson experiences seizures that seemingly stem from prior brain trauma and his parafalcine meningioma resection.¹⁴³ The drugs used during the lethal injection process are barbiturates, which have the potential to trigger seizures in someone with Johnson’s condition.¹⁴⁴ According to Zivot, Johnson’s “medical condition would lead to a seizure at the time of his execution, resulting in cruel punishment in violation of the Eighth Amendment.”¹⁴⁵ In part as a result of Zivot’s testimony, the Supreme Court eventually issued Johnson a temporary stay of execution.¹⁴⁶

132. *Id.* at 698.

133. *Id.*

134. 429 U.S. 97 (1976).

135. *Id.* at 104.

136. Zivot, *supra* note 128, at 698.

137. *Id.* at 699 (footnote omitted).

138. *Id.*

139. *Id.* at 700.

140. *Id.*

141. *Id.* (quoting *Bucklew v. Lombardi*, 783 F.3d 1120, 1126 (8th Cir. 2015)).

142. *Id.*

143. *Id.* at 701.

144. *Id.*

145. *Id.* at 702.

146. *Id.*

Johnson's medical condition presents a dilemma for both the courts and the medical system. "Lethal injection is not a medical act but approximates it to a sufficient degree that it compels the involvement of doctors. If a doctor comments or advises on aspects of execution, he or she risks being sanctioned or reprimanded by professional medical societies."¹⁴⁷ At the same time, if states continue to use lethal injection, they will remain plagued by uncomfortable medical questions. On this matter, Zivot's stance is clear: "Between the interests of the state and the interests of the medical profession, lethal injection does not offer an ethical, halfway compromise."¹⁴⁸

The articles by Zivot and Gur and his coauthors focus on the substance of their own expert testimony as well as the parameters of mitigating evidence and the context in which it is used. Deborah Denno's article continues the discussion further and concludes the section on sentencing by providing a detailed description of how and when prosecutors and defense attorneys present neuroscience evidence and for what purpose.¹⁴⁹ Denno's article takes an evidence-based and multidisciplinary approach to examining how courts respond to neuroscience evidence in capital cases when the defense presents it to argue that the defendant's mental state at the time of the crime was below the given legal requisite due to some neurologic or cognitive deficiency.¹⁵⁰ The article relies on data from Denno's Neuroscience Study ("the Study") to explore capital cases where the defendant argued for a lower level of mens rea.¹⁵¹ The Study consists of all criminal law cases (totaling 800) that addressed neuroscience evidence from January 1, 1992, to December 31, 2012.¹⁵² Attorneys can introduce neuroscience evidence either during the guilt-or-innocence phase, the penalty phase, or both.

In a capital case, "prevailing professional norms" mandate that attorneys conduct a "thorough investigation" of "all reasonably available mitigating evidence" pertaining to a defendant's relevant background and cognitive or intellectual deficiencies.¹⁵³ Courts not only expect attorneys to investigate and use available neuroscience evidence when appropriate but also penalize them for neglecting to do so. The Study shows that "courts regularly accept neuroscience evidence to mitigate punishments"¹⁵⁴ and that such evidence is introduced into court nearly exclusively by defense attorneys as a vehicle to eliminate or mitigate their clients' punishments, especially in death penalty cases.¹⁵⁵

147. *Id.* at 703.

148. *Id.*

149. Deborah W. Denno, *How Prosecutors and Defense Attorneys Differ in Their Use of Neuroscience Evidence*, 85 *FORDHAM L. REV.* 453 (2016).

150. *See id.*

151. *See id.*

152. *Id.* at 456.

153. *Id.* at 458 (first quoting *Strickland v. Washington*, 466 U.S. 668, 688 (1984); then quoting *Porter v. McCollum*, 558 U.S. 30, 39 (2009); and then quoting *Wiggins v. Smith*, 539 U.S. 510, 524 (2003)).

154. *Id.* at 459.

155. *Id.*

Neuroscience evidence, however, is rarely employed by prosecutors in rebuttal to argue future dangerousness.¹⁵⁶ Of the Study's 553 cases, only 10 cases (all capital murder) involved successful uses by prosecutors of such evidence.¹⁵⁷ Yet, Denno has shown that prosecutors do introduce such evidence on their own (not in rebuttal).¹⁵⁸ When they do, such evidence nearly always involves the victim rather than the defendant, and it is nearly exclusively brain scan evidence.¹⁵⁹ In addition, one-half of these cases relied on shaken baby syndrome evidence where the neuroscience diagnosis often "successfully serves as the sole foundation for a prosecutor's case; there is commonly no proof of the defendant's act or intent, except for the victim's brain scan and the accompanying medical expert testimony, because so little circumstantial evidence is available."¹⁶⁰ This finding not only shows a prosecutorial use of neuroscience evidence, but a troubling *misuse* of such evidence.¹⁶¹

Denno examines further the differences between prosecutors and defense attorneys in her analysis of thirty-nine capital cases in which neuroscience evidence was introduced to argue that defendants did not have the requisite *mens rea* to commit the crimes for which they were convicted.¹⁶² While most of these cases involved claims of ineffective assistance of counsel, defense counsel successfully used neuroscience evidence in nearly one quarter of them.¹⁶³

However, Denno contends that while courts seem to rely on a wide range of neuroscience evidence for their determinations in these cases, they lack sufficient guidance even under the framework of *Strickland v. Washington*.¹⁶⁴ Instead, the primary guidepost for many of these cases depends, either explicitly or implicitly, on "double-edged sword" arguments, which support the view that neuroscience evidence can either be helpful or hurtful to a defendant depending on how it is being argued.¹⁶⁵ According to Denno, the courts' emphasis on a double-edged-sword analysis is inadequate and speculative because courts commonly accept defense counsel's justifications for omitting neuroscience evidence when in fact it could well have helped the defendant in terms of mitigation.¹⁶⁶ Courts' responses also do not consider the additional kinds of evidentiary complexities involved in

156. *Id.* at 459–60.

157. *Id.* at 460.

158. *Id.* at 460–61.

159. *Id.*

160. *Id.*

161. *Id.* at 461.

162. *Id.* at 461–62.

163. *Id.* at 462.

164. 466 U.S. 668 (1984) (setting forth a two-part test to assess the validity of ineffective assistance of counsel challenges, noting first that a counsel's performance must actually be "deficient" and second that this deficient performance must have "prejudiced" the defendant). See Denno, *supra* note 149, at 463.

165. Denno, *supra* note 149, at 463.

166. *Id.* at 466–67.

lesser mens rea decisions assessing neuroscience, most particularly the role of context in distinguishing between aggravating and mitigating evidence.¹⁶⁷

Courts' differing perspectives on what constitutes mitigating or aggravating evidence therefore suggest that the "double-edged sword" framework is simplistic and, at times, misleading.¹⁶⁸ Denno sides with the court in *Smith v. Dretke*,¹⁶⁹ which proposes a "reasonable jurist[]" standard as well as reliance on professional norms to assess an ineffective assistance of counsel claim based on neuroscience.¹⁷⁰

The article concludes that courts could more effectively apply neuroscience evidence in intent determinations if they go beyond the double-edged sword approach and establish a more realistic framework in terms of the "reasonable jurist[]." ¹⁷¹ Neuroscience evidence and better guideposts, then, can help address questions about a defendant's level of intent, which lie at the heart of the criminal law and its system of punishment.¹⁷²

III. EXPANDING THE USES OF NEUROSCIENCE IN THE CRIMINAL JUSTICE SYSTEM

Many scholars see a potential for neuroscience to create positive future changes within the realm of the criminal law. For instance, neuroscience may help predict antisocial or violent behavior, advance reform in our correctional system, provide greater understanding of criminal mens rea and moral blameworthiness, and prove beneficial to areas of criminal law beyond mitigation during sentencing. The articles in this part each discuss one or more ways in which neuroscience can further aid the justice system.

The article by Jane Campbell Moriarty argues that advances in neuroscience can assist in a greater understanding of criminal mens rea and moral blameworthiness, which also would bolster the determination of lesser mens rea arguments along the lines discussed by Denno.¹⁷³ In addition, Moriarty believes that neuroscience can improve the approach and use of other defenses, particularly insanity.¹⁷⁴

Moriarty begins her article with the story of an extremely difficult and taxing patient in a psychiatric hospital.¹⁷⁵ After one of the hospital's doctors ordered a CT scan, which revealed damage to the patient's prefrontal cortex, the nurses tended to blame the patient less for her outbursts.¹⁷⁶ As Moriarty explains, "This state of mind and emotion, where we shift from blaming a person for behavior to potentially excusing her, is where the historical origins

167. *Id.* at 466.

168. *Id.* at 467.

169. 422 F.3d 269 (5th Cir. 2005).

170. Denno, *supra* 149, at 467.

171. *Id.* at 467–69.

172. *Id.* at 472.

173. Jane Campbell Moriarty, *Seeing Voices: Potential Neuroscience Contributions to a Reconstruction of Legal Insanity*, 85 *FORDHAM L. REV.* 599 (2016).

174. *Id.* at 603–04.

175. *Id.* at 599–600.

176. *Id.* at 600.

of the insanity defense reside within us.”¹⁷⁷ Neuroimaging test results that are both accurate and relevant to legal insanity may encourage “more rationally premised decision making.”¹⁷⁸ Yet, they also reveal complex and controversial questions¹⁷⁹ and considerations of whether, for example, human behavior should “be reduced to brain states.”¹⁸⁰

In general, Moriarty suggests that such images might provide a more realistic understanding of both mental illness and the effects of traumatic brain injury in the future, as well as better clarify the relationship between cognition and behaviors.¹⁸¹ Moriarty’s article, however, “focuses only on the conception of legal insanity in light of developing neuroscience” rather than courtroom evidence.¹⁸² She suggests that neuroscience might advance the conception of legal insanity in three ways: (1) by establishing current medical perspectives of legal insanity according to a “brain science that complements and possibly refines” observationally based diagnoses, (2) by better informing and integrating the association “between disordered thinking and aberrant behavior,” and (3) by illuminating “our moral sense of blameworthiness.”¹⁸³

The insanity defense has been heavily criticized for a range of reasons: it is rarely used or successful and it exists in a “state of chaos” in part because of restrictive legislation, public disfavor, and a political proclivity to incarcerate the mentally ill.¹⁸⁴ At the same time, research conducted in neuroscience and other scientific disciplines appears superior in the “understanding, prediction, diagnosis, and treatment of mental illnesses, such as schizophrenia.”¹⁸⁵ As Moriarty explains, “It is thus an appropriate time, perhaps, to consider developing neuroscience research and whether it could inform a reconstruction of legal insanity going forward.”¹⁸⁶ Such a recommendation is particularly timely given Moriarty’s discussion of the history and current state of the insanity defense and her conclusion that “whether the insanity defense—in any form—is a constitutionally protected right is unclear and far from certain.”¹⁸⁷ Regardless, a general consensus remains that the insanity defense serves a vital “jurisprudential role” for particular individuals.¹⁸⁸

In an effort to hone her points, Moriarty provides an overview of various imaging techniques (x-ray, CT, MRI, fMRI, PET) and selects schizophrenia as a point of focus.¹⁸⁹ She also discusses the frequency of traumatic brain

177. *Id.*

178. *Id.* at 601.

179. *Id.*

180. *Id.*

181. *Id.* at 601–02.

182. *Id.* at 602.

183. *Id.* 603–04.

184. *Id.* at 604–05 (quoting Christopher Slobogin, *An End to Insanity: Recasting the Role of Mental Disability in Criminal Cases*, 86 VA. L. REV. 1199, 1199 (2000)).

185. *Id.* at 607.

186. *Id.*

187. *Id.* at 610.

188. *Id.* at 611.

189. *Id.* at 611–12.

injury in the United States¹⁹⁰ and what current research and commentary reveal about the relationship between brain trauma and behavioral control.¹⁹¹ Such an overview fuels her agreement with those who believe there should be a volitional prong to the insanity defense and that neuroscience may “more accurately explain the relationship among brain lesions (or illness), cognition, impulsivity, and behavioral control.”¹⁹²

Neuroscience can enhance the role of blameworthiness in the criminal law by offering a stronger and more scientific foundation for diagnoses. “[N]euroscience may also encourage the judicial system to reject the stereotypes and myths that have shaped our current insanity defense doctrines and embrace a more humane way of dealing with the mentally ill and brain-injured criminal defendants.”¹⁹³ Indeed, research evaluating the impact of neuroscience explanations on defenses pertaining to mens rea and insanity should highlight the potential for neuroscience to help guide real decision making regarding insanity determinations. As Moriarty concludes, “The research on the effects of neuroscientific explanations for the mens rea defense and the insanity defense demonstrate the positive potential of neuroscience to improve decision making in response to such defenses.”¹⁹⁴

Similar to Moriarty’s article, the article by Elizabeth S. Scott, Richard J. Bonnie, and Laurence Steinberg discusses important changes in policy that have been prompted by neuroscience evidence, specifically juvenile culpability and developmental brain research.¹⁹⁵ The article examines what these neuroscience studies suggest in relation to the culpability of young adults, contending that there should be a transitional category for young adults that is distinct from juveniles and adults.¹⁹⁶ This transitional category would allow for more effective sentencing and rehabilitation opportunities for this group.¹⁹⁷

The past decade’s focus on the link between developmental brain research and crime regulation, especially as it relates to juvenile culpability, has been associated with a growing rejection by legislatures and courts of a punitive approach to young offenders.¹⁹⁸ As the authors note, four Supreme Court opinions have dismissed severe adult sentences for juveniles in light of two empirically based principles: First, because of their cognitive immaturity, juvenile offenders are generally less culpable and therefore merit less punishment than adults. Second, because their immaturity is the source of

190. *Id.* at 614–15.

191. *Id.* at 615.

192. *Id.* at 617.

193. *Id.* at 618.

194. *Id.*

195. Elizabeth S. Scott, Richard J. Bonnie & Laurence Steinberg, *Young Adulthood as a Transitional Legal Category: Science, Social Change, and Justice Policy*, 85 *FORDHAM L. REV.* 641 (2016).

196. *Id.* at 644.

197. *Id.*

198. *Id.* at 641, 657.

their criminality, more juveniles are capable of reforming their behavior relative to adults.¹⁹⁹

Indeed, the past decade's research also has shown that individuals continue to mature and develop up to their early twenties, therefore prompting the question of whether young adult offenders should benefit from the presumptions of lesser culpability and greater reform potential that are applied to juveniles.²⁰⁰ Such an approach "would represent a substantial departure from what has become a commonly recognized boundary in the justice system between juveniles and adults"—age eighteen.²⁰¹

Scientific research does not show, however, that youths between eighteen and twenty-one appear "indistinguishable from younger adolescents in attributes relevant to criminal offending and punishment."²⁰² Therefore, the authors question, "on both scientific and pragmatic grounds," proposals suggesting that the juvenile court's jurisdiction raise its cap to age twenty-one.²⁰³ That said, there are firm reasons to support some correctional reform, as young adult offenders can still lead societally productive lives if they are given the opportunity while they are still developing.²⁰⁴

The authors' suggestions for reform presume that young adults constitute a separate category of offenders and therefore merit special sentencing and parole policies as well as correctional programs geared toward taking on adult roles.²⁰⁵ In addition, they believe that juvenile correctional and rehabilitative programs can be tailored for young adults so that they can receive educational and vocational skill training and other policies directed toward reducing recidivism.²⁰⁶

The authors reject other proposals for handling young adults. For example, attempting "a unitary rehabilitative justice system with general jurisdiction over juveniles and young adults" is too bold a move.²⁰⁷ According to the authors, young adults will benefit more from institutional reforms in the adult system than from being relegated to a juvenile status, although juvenile court jurisdiction could perhaps be somewhat extended in certain circumstances.²⁰⁸ Regardless, adjusting sentencing policies for young adults and contributing to programs that provide them criminality-free life skills "will serve social welfare, as well as the interests of the most vulnerable young adults."²⁰⁹

In addition to aiding in the understanding of moral culpability and differences in brain development between groups, neuroscience can also be used to help decipher and predict violence. The article by Lyn M. Gaudet, Jason P. Kerkmans, Nathaniel E. Anderson, and Kent A. Kiehl focuses on

199. *Id.* at 642.

200. *Id.*

201. *Id.*

202. *Id.* at 643.

203. *Id.*

204. *Id.* at 644.

205. *Id.* at 656–62.

206. *Id.* at 663.

207. *Id.* at 664.

208. *Id.* at 664–65.

209. *Id.* at 666.

the prediction of antisocial behavior, contending that such efforts may help to reduce recidivism rates by providing a remedy for high-risk behavior through appropriate treatment.²¹⁰

In the article's introduction, the authors ask the following question, which frames the core of their argument: "If we can get information from neuroscience techniques, does that information add predictive utility to understanding and assessing antisocial behavior?"²¹¹ They conclude that current research would "suggest that it does."²¹²

In an effort to investigate this question, the article begins with a review of the four categories of factors currently available to predict antisocial behavior or violence: "dispositional, historical, clinical, and contextual."²¹³ After specifying the caveats and varying types of models that could weigh these factors, the article in turn discusses the different prediction models for determining future violence and how these models could accommodate incoming scientific advances.²¹⁴ These models have a range: (1) "clinical predictions," the oldest type of prediction in forensic settings, which typically use psychiatrists and psychologists;²¹⁵ (2) "actuarial predictions," which are based on longitudinal data and statistics to assess risk and the likelihood that an individual belongs to a predicted group;²¹⁶ and (3) "psychological and personality measures," which rely on neuropsychological testing and assessment of psychopathic personality disorder,²¹⁷ arguably "the single best predictor of criminal behavior and recidivism."²¹⁸

The authors then examine legal precedent concerning the application of different prediction methods and the challenges to them, primarily through the use of recidivism rates.²¹⁹ While some of the methods have been seriously challenged in court, the article notes that, in a series of three cases, the Supreme Court has upheld the use of psychiatric testimony for providing an expert opinion on a defendant's future dangerousness.²²⁰ In light of the dubious nature of this testimony, the authors emphasize that the "addition of actuarial tools also could be what distinguishes an assessment of future dangerousness as sufficiently reliable to pass *Daubert* [*v. Merrell Dow Pharmaceuticals, Inc.*²²¹] in comparison to a pure clinical assessment alone."²²² One powerful tool is an individual's brain age, as opposed to their chronological age.

210. Lyn M. Gaudet et al., *Can Neuroscience Help Predict Future Antisocial Behavior?*, 85 *FORDHAM L. REV.* 503 (2016).

211. *Id.* at 504.

212. *Id.*

213. *Id.*

214. *Id.* at 505.

215. *Id.* at 506.

216. *Id.* at 506–08.

217. *Id.* at 508–11.

218. *Id.* at 510.

219. *Id.* at 511–12.

220. *Id.* at 512–17.

221. 509 U.S. 579 (1993).

222. Gaudet et al., *supra* note 210, at 517.

The article introduces recent neuroscience research and reviews two studies that were able to accurately incorporate neuroimaging techniques to predict recidivism.²²³ While criticisms are commonly levied against the various prediction methods, there are also disparities between the attitudes of the scientific versus legal communities toward risk assessment generally and neuroscience specifically.²²⁴ In addition, the actuarial methods are viable and ethical only if certain conditions are met: researchers apply the appropriate techniques and tools,²²⁵ have sufficient training,²²⁶ and take into account potential equal protection implications so that offenders are not wrongly excluded from certain treatment programs that may be particularly beneficial to them.²²⁷

Finally, the authors explain why neuroscience methods are likely to continue to help inform and, ideally, improve the tools embraced by the criminal justice system by way of assessing, understanding, and predicting human behavior.²²⁸ The two forensic neuroprediction studies that the article examines, for example, “provide a strong demonstration of how neuroscience measures can change the way we think about variables that we already recognize for their influence on behavior,” including recidivism rates.²²⁹ To remedy recidivism, the United States needs to implement workable measures that incorporate an understanding of brain structure and function, particularly in individuals who have been violent or are at high risk for future violence.²³⁰

The authors’ belief that neuroscience can serve to improve the justice system’s approach to treatment is one that is also held by Arielle R. Baskin-Sommers and Karelle Fonteneau.²³¹ However, Baskin-Sommers and Fonteneau contend that the courtroom is not the correct setting within the justice system for the use of neuroscience.²³² Instead, neuroscience should be implemented to reform current policies related to the use of segregation, the physical surroundings and makeup of the correctional environment, and inmate treatments.²³³ Neuroscience can better help criminal defendants in this way than in the trial or sentencing phases.²³⁴

The application of neuroscience in the criminal justice system has recently taken center stage to help diagnose conditions that may mitigate an inmate’s responsibility as well as pinpoint those factors that may influence decision makers in sentencing.²³⁵ While some studies have revealed possible neural correlates of criminal conduct, “there is no discipline-wide consensus on

223. *Id.* at 517–18.

224. *Id.* at 525–26.

225. *Id.* at 526.

226. *Id.* at 527.

227. *Id.* at 529.

228. *Id.* at 530.

229. *Id.*

230. *Id.* at 530–31.

231. Arielle R. Baskin-Sommers & Karelle Fonteneau, *Correctional Change Through Neuroscience*, 85 FORDHAM L. REV. 423 (2016).

232. *See id.*

233. *See id.*

234. *See id.*

235. *Id.* at 423.

those correlates” or their associations to certain types of criminality.²³⁶ Rather, neuroscience tests are based on probability assessments: techniques such as EEGs and brain scans “cannot show beyond a reasonable doubt that distinct brain structures or abnormalities” impact an individual’s mental state at the time of the crime or whether that individual will commit future crimes.²³⁷ In addition, neuroscience tests are extremely expensive and financially inaccessible to many criminal defendants, thereby infusing the criminal justice system with even more economic disparities among defendants.²³⁸

The authors contend that findings from neuroscience can instead be applied to enhance correctional settings so that “[s]uch applications bypass the constraints and requirements of both science and the law without worsening the disparities that currently exist in the criminal justice process.”²³⁹ For example, solitary confinement, or segregation, pertains to an individual’s isolation in a prison cell for twenty-two to twenty-four hours a day.²⁴⁰ Such conditions are severely detrimental to an inmate’s mental and physical health, and they can cause “persistent emotional trauma and distress,” as well as hypersensitivity to the environment, hallucinations, anxiety, depression, and more.²⁴¹ There have been only a limited number of human studies on the “underlying mechanisms that produce such psychopathology.”²⁴² Yet a substantial amount of research on nonhuman animals has discovered evidence of chemical imbalances in the brain and cognitive impairment resulting from segregation.²⁴³ Some human studies on individuals raised in institutional settings have demonstrated similar patterns.²⁴⁴ Thus, neuroscience research points to the abolition of segregation because of its harmful effects.²⁴⁵

The overall physical surroundings and makeup of general population settings also negatively influence human behavior and brain functioning. As the authors note, “Neuroscience can be particularly useful in understanding the mechanisms that produce such adverse consequences as well as suggest policies and practices that avoid or counteract these effects.”²⁴⁶ Indeed, neuroscience research has revealed three factors that are especially damaging to the brains and behaviors of incarcerated individuals: overcrowding, noise, and toxins.²⁴⁷ These findings are particularly relevant for correctional facilities, which suffer from overcrowding, noise pollution, and toxin exposure resulting from inadequate sewage and waste disposal, poor water

236. *Id.* at 424.

237. *Id.*

238. *Id.*

239. *Id.*

240. *Id.* at 425.

241. *Id.* at 426.

242. *Id.*

243. *Id.* at 426–27.

244. *Id.* at 427–28.

245. *Id.* at 429.

246. *Id.*

247. *Id.*

quality, and other problems.²⁴⁸ But such factors also “have the potential to negatively impact neural regions responsible for emotion, cognition, and behavioral control,” as well as the capacity to “worsen already problematic neural and behavioral tendencies.”²⁴⁹

The authors conclude by calling for a reconceptualization of how neuroscience is used within the criminal justice system.²⁵⁰ If implemented appropriately, the kinds of neuroscience findings that the authors discuss “all have the tremendous potential to affect meaningful—and much needed—correctional change in the United States today.”²⁵¹

Erin Murphy’s article bridges the gap between the argument that neuroscience can be used to improve the sentencing process and Baskin-Sommers and Fonteneau’s argument that neuroscience instead can be used to improve correctional facilities and treatment.²⁵² Murphy claims that neuroscience has the ability to be employed in new settings, such as bail hearings, competency determinations, and noncapital sentencing.²⁵³ If applied successfully in these ways, neuroscience also may prove more relevant in civil adjudications as well. Given that neuroscience is constantly growing and evolving, Murphy’s approach is practical in its belief that the neuroscience applications will continue to expand to more settings within the judicial system.

Murphy’s article explores the future admissibility of “novel neuroscience evidence” in both civil and criminal cases.²⁵⁴ Murphy’s use of the phrase “novel neuroscience” is meant to “exclude relatively noncontroversial uses of neuroscience” or the “fairly noncontroversial consequence” as well as “assessments that have only remote connection to the physical condition of the brain.”²⁵⁵

As a foundation for her article, Murphy introduces some background to the *Daubert* rulings and highlights issues regarding the decision’s applicability to civil versus criminal cases.²⁵⁶ In essence, there appears to be “a *Daubert* double-standard.”²⁵⁷ Murphy points out that in civil cases, courts discuss “both science and statistics with plenty of acumen,” but in criminal cases, “courts are unable to muster the most minimal grasp of why a standardless form of comparison might lack evidentiary reliability or trustworthiness.”²⁵⁸

Such a distinction between the civil and criminal contexts is difficult to decipher because the two fields often rely on different disciplines for their

248. *Id.* at 429–32.

249. *Id.* at 432.

250. *Id.* at 436.

251. *Id.*

252. See Erin Murphy, *Neuroscience and the Civil/Criminal Daubert Divide*, 85 FORDHAM L. REV. 619 (2016).

253. See *id.*

254. *Id.* at 620.

255. *Id.*

256. *Id.* at 621.

257. *Id.* at 624.

258. *Id.* (quoting Jane Campbell Moriarty, *Will History Be Servitude?: The NAS Report on Forensic Science and the Role of the Judiciary*, 2010 UTAH L. REV. 299, 315).

evidence.²⁵⁹ But even when civil and criminal cases both share the same kind of evidence, courts are more willing to admit evidence for the prosecution than for plaintiffs in civil cases.²⁶⁰ This outcome supports Murphy's "underlying premise: it depends as much on the offering party as it does on the type of case."²⁶¹

Murphy contends that novel neuroscience presents a different kind of framework because it can provide relevant evidence to all parties involved in a case.²⁶² In civil cases, novel neuroscientific evidence is generally offered by plaintiffs to demonstrate a brain injury, support a finding of toxic encephalopathy, or engage in lie detection.²⁶³ In criminal cases, however, novel neuroscientific evidence is most commonly introduced by the defendant in death penalty cases for the purpose of mitigation.²⁶⁴ Yet, so far, courts have been inconsistent in their attitude toward novel neuroscience even for these purposes.²⁶⁵

While the future of neuroscientific admissibility is unknown, Murphy tells us to presume two possibilities: (1) claimants, seemingly undaunted, will persist in proffering such evidence, and courts will keep facing challenges concerning scientific validity and (2) the science will become ever more valid and reliable.²⁶⁶ Yet Murphy emphasizes "one significant exception" to the tendency of courts to resist novel neuroscience evidence: when defendants in sentencing proceedings offer it.²⁶⁷ She predicts that such an exception may encourage prosecutors to use novel neuroscience evidence more frequently and that it may lead to the use of such evidence in the guilt and pretrial phases as well.²⁶⁸

There is a third possibility that Murphy considers: "[T]he current trend holds even as prosecutors seek to marshal neuroscientific evidence in support of their claims. Courts would extend the general skepticism shown to plaintiffs who offer novel techniques to prosecutors, even while continuing to carve out a role for the criminal defendant."²⁶⁹

Novel neuroscience, therefore, presents a point of conflict. Nonetheless, Murphy believes that it is capable of gaining traction in civil cases as well.²⁷⁰ The evidence will start to become more familiar to judges and the "novelty . . . may start to wear off."²⁷¹ Judges may also develop a greater sense of the disparities involved with its use—"the notion that neuroscience is somehow reliable enough for a death sentence determination but not for

259. *Id.* at 625.

260. *Id.* at 625–26.

261. *Id.* at 626.

262. *Id.* at 627–28.

263. *Id.* at 629.

264. *Id.*

265. *Id.*

266. *Id.* at 630.

267. *Id.* at 633.

268. *Id.* at 634.

269. *Id.*

270. *Id.* at 639.

271. *Id.*

less serious offenses or monetary claims.”²⁷² In addition, judges may start to consider “such evidence reliable when it confirms other proof, or even their own intrinsic beliefs about a particular condition, and incline toward a more generous *Daubert* or *Frye* [*v. United States*]²⁷³ standard in noncapital or civil cases.”²⁷⁴

CONCLUSION

This Foreword’s discussion of articles on neuroscience and the law represents a range of experts who participated in the *Fordham Law Review*’s symposium, *Criminal Behavior and the Brain: When Law and Neuroscience Collide* (cosponsored by the Fordham Law School Neuroscience and Law Center). The symposium provided a comprehensive forum on the legal, scientific, and ethical issues that concern the human brain and behavior. May this forum inspire other scholarly gatherings on this rapidly evolving topic.

272. *Id.*

273. 293 F. 1013 (D.C. Cir. 1923).

274. Murphy, *supra* note 252, at 639.