USING COGNITIVE NEUROSCIENCE TO PREDICT FUTURE DANGEROUSNESS

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I. INTRODUCTION

> *It is, of course, not easy to predict future behavior. The fact that such a determination is difficult, however, does not mean that it cannot be made. Indeed, prediction of future criminal conduct is an essential element in many of the decisions rendered throughout our criminal justice system. . . . And any sentencing authority must predict a convicted person's probable future conduct when it engages in the process of determining what punishment to impose. . . . The task that a [capital sentencing] jury must perform in answering the statutory question in issue is thus basically no different from the task performed countless times each day throughout the American system of criminal justice.*[1]

Cognitive Neuroscience, which involves an analysis of the structure and function of the brain, is beginning to explain why individuals engage in violent, aggressive, and impulsive behavior. Researchers have discovered that certain brain injuries, such as frontal lobe disorder and damage to the limbic system (which contains the neural circuit connecting the amygdala to the pre-frontal cortex), can cause individuals to lose control over their behavior. As a result, those afflicted with these injuries, either in the form of lesions or tumors, are predisposed to engage in aggressive behavior, rage

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1. Jurek v. Texas, 428 U.S. 262, 274–76 (1976) (holding that "[w]hat is essential is that the jury must have before it all possible relevant information about the individual whose fate it must determine").

attacks, and sudden bursts of anger—precisely the type of behavior we classify as criminal. What neuroscience has uncovered, however, is that individuals with these disorders are not like the typical violent criminal; instead, they suffer from serious—and cognizable—defects in reasoning, judgment, and self-control, which have implications upon both their culpability and the nature of sentences that they should receive.

This Article discusses current difficulties in determining "future dangerousness," addresses recent findings by neuroscientists, and proposes a means by which those suffering from frontal lobe disorder and/or amygdalar injury should be treated differently in the criminal system. As a threshold matter, what this article does *not* do is argue that brain-damaged individuals should avail themselves of the insanity defense, or otherwise be considered to lack the mens rea necessary for commission of a particular crime. Research has demonstrated that individuals with frontal lobe disorder and/or limbic system damage still know "right" from "wrong" and still retain the ability to form the requisite intent prior to committing a particular criminal offense. However, their judgment and reasoning are so impaired such that their knowledge that a certain act is wrongful does not prevent them from doing it. This inability to control their actions often leads to violent or aggressive behavior, including "rage" attacks, creating a biological blueprint for criminal behavior.

Based upon neuroscientific data showing that brain-disordered individuals suffer from impulse control problems and violent tendencies, this Article proposes that the criminal justice system can now more accurately predict "future dangerousness," namely, which criminal offenders are more likely to commit criminal attacks upon the termination of their sentence. We can now demonstrate that most offenders with damaged or impaired frontal lobes (1) suffer from a cognizable mental illness; and (2) remain a danger to themselves or others upon release. Since the state can now prove these two factors, it has a legitimate basis to confine "high risk" offenders involuntarily either during or after completion of their sentence. The purpose of involuntary confinement is both utilitarian and rehabilitative: to protect the public by reducing recidivism rates, and to treat—to the best extent possible—the offender's mental illness.

Part II of this Article discusses the difficulty of predicting "future dangerousness" in the courts. Part III discusses cognitive

neuroscience and its implications for the criminal justice system. Part IV proposes that the state may properly petition the court for the involuntary commitment of brain-injured criminal offenders, provided that certain procedural safeguards are provided.

II. PROBLEMS DETERMINING "FUTURE DANGEROUSNESS" AND LESSONS FROM COGNITIVE SCIENCE

A. "Future Dangerousness"

"[F]rom a legal point of view, there is nothing inherently unattainable about a prediction of future criminal conduct."[2] It is axiomatic that courts have "repeatedly treated predictive evidence relating to future dangerousness as highly relevant to the sentencing concerns."[3] Indeed, in *Simmons v. South Carolina*,[4] the U.S. Supreme Court held that "a defendant's future dangerousness bears on *all* sentencing determinations made in our criminal justice system."[5] Put another way, the Court has endorsed the view that "[c]onsideration of a defendant's past conduct as indicative of his probable future behavior is an inevitable and not undesirable element of criminal sentencing."[6]

For example, in the death penalty context, courts have stated that "[i]t has long been held that a sentencing court may evaluate and consider a defendant's propensity to commit acts of violence in the future as an aggravating factor weighing in favor of the death

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2. Schall v. Martin, 467 U.S. 253, 278 (1984).

3. Patterson v. South Carolina, 471 U.S. 1036, 1041 (1985); *see also* Johnson v. Texas, 509 U.S. 350, 369–70 (1993) (quoting Skipper v. South Carolina, 476 U.S. 1, 5 (1986)) ("Consideration of a defendant's past conduct as indicative of his probable future behavior is an inevitable and not undesirable element of criminal sentencing."); Kelly v. South Carolina, 534 U.S. 246, 254 (2002) (noting that "evidence of dangerous 'character' may show 'characteristic' future dangerousness").

4. Simmons v. South Carolina, 512 U.S. 154, 162 (1994).

5. *Id.* (emphasis added). The Court further stated in dicta that

> prosecutors in South Carolina, like those in other States that impose the death penalty, frequently emphasize a defendant's future dangerousness in their evidence and argument at the sentencing phase; they urge the jury to sentence the defendant to death so that he will not be a danger to the public if released from prison.

Id. at 163.

6. Skipper v. South Carolina, 476 U.S. 1, 5 (1986).

penalty."[7] Specifically, in *Simmons*, the Court held that it was appropriate to consider "the defendant's potential for reform and whether his probable future behavior counsels against the desirability of his release into society."[8] Indeed, "[e]vidence of future dangerousness has generally been upheld as admissible at the federal level under the FDPA [Federal Death Penalty Act] . . . [and] lower courts have uniformly upheld future dangerousness as a non-statutory aggravating factor in capital cases under the FDPA."[9] To be sure, the Court has admitted into evidence "expert psychiatric predictions of future dangerousness even where the expert witness was testifying based on hypotheticals without ever having examined the defendant."[10] In the Court's view, the consideration of future dangerousness in the death penalty—and other contexts—is justified because "the jury must have before it all possible relevant information about the individual defendant whose fate it must determine."[11]

Additionally, predictions of future dangerousness have been used in determining whether mentally ill individuals (or criminal defendants) should be involuntarily committed to a facility for rehabilitative treatment (in some cases *post-sentence*[12]) based upon the fact that they are a danger to themselves or others.[13] For example, in the civil commitment context, the inquiry focuses upon

7. United States v. Umana, 707 F. Supp. 2d 621, 633, 634, 636 (W.D.N.C. 2007) ("In addition to lay testimony, the government may also offer expert opinion testimony concerning the future dangerousness. . . . [A]lthough future dangerousness is the jury's overall inquiry, the defendant's potential for rehabilitation is directly relevant to his future dangerousness.").

8. *Simmons*, 512 U.S. at 162 (quoting California v. Ramos, 463 U.S. 992, 1003, n.17 (1983)).

9. United States v. Diaz, No. CR 05-00167, 2007 WL 656831, at *23 (N.D. Cal. Feb. 28, 2007) (quoting United States v. Bin Laden, 126 F. Supp. 2d 290, 303 (S.D.N.Y 2001)). The court also held, however, that "evidence of defendants' future dangerousness should be limited to that which shows their potential for dangerousness *while incarcerated*. . . . If . . . the government's incarceration protocols would nullify defendants' dangerousness, presentation of this evidence to the jury would not be relevant to the sentencing determination." *Id.* at *23 (emphasis in original).

10. *Patterson*, 471 U.S. at 1042.

11. *Jurek*, 428 U.S. at 276.

12. *See, e.g.*, Jones v. United States, 463 U.S. 354, 368–69 (1983) ("There simply is no necessary correlation between the severity of the offense and length of time necessary for recovery. The length of the acquitee's hypothetical criminal sentence therefore is irrelevant to the purposes of commitment.").

13. *Id.* at 370 (allowing indefinite detention of defendants who successfully assert an insanity defense).

whether "the individual is mentally ill and *dangerous* to himself or others and is in need of confined therapy."[14] Furthermore, in *Heller v. Doe*,[15] the Court held that, both with respect to the mentally retarded and mentally ill, "diagnosis and [future] dangerousness" were the primary factors in determining whether civil commitment was warranted.[16] As the *Heller* Court stated, "the state has a legitimate interest . . . in providing care to its citizens . . . 'as well as authority under its police power to protect the community from' . . . any dangerous . . . persons."[17] In fact, in certain cases, a person who poses a "danger to others or the community" may be confined without a showing of mental illness.[18] Ultimately, therefore, if the State can demonstrate that an individual "is mentally ill and dangerous," it may order the involuntary commitment of an individual to a mental institution despite the "significant deprivation of liberty,"[19] coupled with the "adverse social consequences"[20] and "stigma" that such commitment often engenders.[21]

Finally, reliance upon future dangerousness is perhaps the most important factor when determining whether a repeat sexual

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14. Addington v. Texas, 441 U.S. 418, 429 (1979) (emphasis added); *see also* O'Connor v. Donaldson, 422 U.S. 563, 564–66 (1975) (discussing the civil commitment procedure).

15. Heller v. Doe, 509 U.S. 312, 317–18 (1993).

16. *Id.* at 324. To involuntary commit the mentally retarded, the state was required to prove, by clear and convincing evidence, that

> (1) [t]he person is a mentally retarded person; (2) [t]he person presents a danger or a threat of danger to self, family, or others; (3) [t]he least restrictive alternative mode of treatment presently available requires placement in [a residential treatment center]; and (4) [t]reatment that can reasonably benefit the person is available in [a residential treatment center].

Id. (quoting Ky. Involuntary Commitment Procedures § 202B.040).

17. *Heller*, 509 U.S. at 332 (quoting *Addington*, 441 U.S. at 426).

18. Foucha v. Louisiana, 504 U.S. 71, 80 (1992). The Court continued,

> [T]he State must establish the grounds of insanity and dangerousness permitting confinement by clear and convincing evidence. Similarly, the State must establish insanity and dangerousness by clear and convincing evidence in order to confine an insane convict beyond his criminal sentence, when the basis for his original confinement no longer exists.

Id. at 86 (internal citations omitted).

19. *Addington*, 441 U.S. at 425. The state must prove that the subject is dangerous by clear and convincing evidence. *Id.* at 433.

20. *Id*.

21. *Id*.

offender or pedophile should be confined to a mental institution following his sentence.[22] In this context, the courts rely upon "volition" or "control" as a factor separate from future dangerousness, and thereby focus upon "the forcible civil detainment of people who [can or cannot] control their [sexual] behavior and who thereby pose a danger to the public health and safety."[23] In this way, the courts require that legislation ensures "to limit involuntary confinement [of sexual offenders] to those who suffer from a volitional impairment rendering them dangerous beyond their control."[24] In *Kansas v. Crane*,[25] the Court held that "our cases suggest that civil commitment of dangerous sexual offenders will normally involve individuals who find it particularly difficult to control their behavior . . . [such that] they are 'unable to control their dangerousness.'"[26] In the Court's view, therefore, the "volitional" or "control" aspect "underscored the constitutional importance of distinguishing a dangerous sexual offender subject to commitment 'from other dangerous persons' . . . . And a critical distinguishing feature of that

22. *See, e.g.*, R.W. v. Goodwin, Civil No. 08-4841, 2009 WL 1405514, at *7 (D.N.J. May 19, 2009) (stating "a state may constitutionally deprive a person of freedom from detention so long as it establishes dangerousness and a mental abnormality that makes it difficult for the person to control his dangerous behavior . . . regardless of whether the State is providing treatment").

23. Kansas v. Hendricks, 521 U.S. 346, 357 (1997) (holding that individuals with, *inter alia*, mental abnormalities, may be involuntarily committed after their sentence has been served).

24. *Id*. at 358. *But see* Huftile v. Hunter, No. CIV S-05-0174, 2009 WL 111721, at *1 (E.D. Cal. 2009) (holding that the evidence was insufficient to support a finding that the defendant was a sexual predator).

25. Kansas v. Crane, 534 U.S. 407, 415 (2002).

26. *Id.* at 413. The *Crane* Court further held,

> [W]e did not give to the phrase "lack of control" a particularly narrow or technical meaning. And we recognize that in cases where lack of control is at issue, "inability to control behavior" will not be demonstrable with mathematical precision. It is enough to say that there must be proof of serious difficulty in controlling behavior. And this, when viewed in light of such features of the case as the nature of psychiatric diagnosis, and the severity of the mental abnormality itself, must be sufficient to distinguish the dangerous sexual offender whose serious mental illness, abnormality, or disorder subjects him to civil confinement from the dangerous but typical recidivist convicted in an ordinary criminal case.

Id.

'serious . . . disorder' . . . consisted of a special and serious lack of ability to control behavior."[27]

In this area, therefore, "[a] finding of dangerousness, standing alone, is ordinarily not a sufficient ground upon which to justify . . . involuntary commitment. . . . [There must be] added statutory requirements . . . to limit involuntary . . . confinement to those who suffer from a volitional impairment rendering them dangerous beyond their control." [28] Consequently, the involuntary commitment of sexual offenders or pedophiles rests upon determination of future dangerous and volitional capacity, which "requires proof of more than a mere disposition to violence; rather it requires evidence of past sexually violent behavior and a present mental condition that creates a likelihood of such conduct in the future . . . ."[29] Simply stated, commitment will be warranted where it is "difficult, if not impossible, for the defendant to control his dangerous [sexual] behavior."[30]

Many courts have relied upon the predictive value of future dangerous and volitional capacity when determining whether to involuntarily commit violent sexual criminals. For example, in *United States v. Wilkinson*, [31] concerning a potentially dangerous sexual predator, the Court held that

> an inmate cannot be civilly committed merely because he may be dangerous if released . . . . [C]ommitment is constitutionally permissible only if the government proves by clear and convincing evidence that a person is dangerous because he has a serious mental condition which causes him to have serious difficulty in making reasoned choices and controlling his behavior."[32]

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27. *Crane*, 534 U.S. at 412–13 (quoting *Hendricks*, 521 U.S. at 360).
28. *Hendricks*, 521 U.S. at 358.
29. *Id*. at 357.
30. *Id.* at 358.
31. United States v. Wilkinson, 646 F. Supp. 2d 194, 196 (D. Mass. 2009). In *Wilkinson*, the State attempted to prove lack of control based upon the fact that the defendant had "Anti-Social Personality Disorder." While conceding that Wilkinson had the disorder, the court held that "[t]he government has not proven that Antisocial Personality Disorder alone ever causes a person to have serious difficulty in controlling his conduct. In essence, the evidence indicates that individuals with severe forms of that disorder may often make unlawful choices, but they are able to control their conduct." *Id*.
32. *Id.*

More specifically, the court held that "the government must demonstrate that 'as a result of' the 'serious mental illness, abnormality or disorder,' a person 'would have serious difficulty [controlling his behavior] if released.' . . . '[T]here must be proof of serious difficulty in controlling behavior.'"[33] Indeed, it is the lack of behavioral control that distinguishes the "dangerous sexual offender . . . from the dangerous but typical recidivist . . . ." [34] Therefore, as with decisions concerning capital punishment and involuntary commitment for non-sexual offenders, confinement rests upon predictions about *future behavior* based upon *past* conduct.[35]

Critically, however, and somewhat paradoxically, the courts—and commentators—have consistently recognized that predictive adjudications, whether it be for future dangerousness or lack of control, are often unreliable or, in some instances, simply inaccurate.[36] For example, in *Umana*, the Court explicitly recognized

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33. *Id.* at 201 (quoting 18 U.S.C. § 4247(a)(6); Kansas v. Crane, 534 U.S. 407, 413 (2002)); *see also* In re Commitment of W.Z., 173 N.J. 109, 129 (N.J. 2002). In *W.Z.*, the New Jersey Supreme Court analyzed the constitutionality of its own Sexually Violent Predator Act (SVPA), and held,

> The SVPA authorizes the involuntary commitment of an individual believed to be a "sexually violent predator" as defined by the Act. . . . The present mental condition and required threat of dangerousness are contained in other parts of the Act, including the expanded definitions of the terms in the phrase "suffers from a mental abnormality or personality disorder that makes the person likely to engage in acts of sexual violence if not confined in a secure facility for control, care and treatment." . . . What is important is that . . . the mental condition must affect an individual's ability to control his or her sexually harmful conduct.

Id. at 127 (quoting N.J. Stat. Ann. § 30:4-27.28 (West 2008)).

34. *Wilkinson*, 646 F. Supp. 2d at 200 (quoting *Crane*, 534 U.S. at 413); *see also* Richard S. v. Carpinello, 589 F.3d 75, 82 (2d Cir. 2009) (distinguishing dangerous sexual offender from typical recidivist based on lack of behavioral control); Sokolsky v. Rostron, No. CIV S-07-1002, 2008 WL 4279384, at *2 (E.D. Cal. Sept. 9, 2008) (determining sexually violent predators under California law are those who have been convicted of a sexually violent crimes, have a diagnosed mental disorder, and are likely to engage in future sexually violent crime based on that disorder); R.W. v. Goodwin, Civil No. 08-4841, 2009 WL 1405514, at *5 (D.N.J. May 19, 2009) (finding sexual criminals can remain in confinement even if they are not receiving treatment); Huftile v. Hunter, No. CIV S-05-0174, 2009 WL 111721 (E.D. Cal. Jan. 16, 2009) (rejecting habeas corpus petitioner's claim of decreasing recidivism based on test results and increase in age).

35. *See, e.g.*, *Goodwin*, 2009 WL 1405514, at *6 (relying on conviction and mental disorder to predict future behavior).

36. United States v. Umana, 707 F. Supp. 2d 621, 634 (W.D.N.C. 2010).

that "some studies indicated that predictions of future dangerousness are often wrong."[37] In fact, the courts have consistently acknowledged that expert testimony concerning "future dangerousness" is often unreliable, if not "more prejudicial than probative."[38] In *United States v. Taveras*,[39] the Court also recognized that "[p]rojections of future dangerousness are precarious" because "[t]hey require jurors to predict, beyond a reasonable doubt, future conduct based on an often uncertain pattern of past behavior."[40] Specifically, in *Barefoot v. Estelle*,[41] the Court noted that a "leading thinker on this issue" had "'concluded that the best clinical research currently in existence indicates that *psychiatrists and psychologists are accurate in no more than one out of three predictions of violent behavior*,'" even when assessing institutionalized violent criminals.[42]

The *Addington* Court echoed this view by stating that the process of psychiatric diagnosis "often makes it very difficult for the expert physician to offer definite conclusions about any particular patient."[43] Thus, "[g]iven the lack of certainty and the fallibility of psychiatric diagnosis, there is a serious question as to whether a state could *ever* prove beyond a reasonable doubt that an individual is both mentally ill and likely to be dangerous."[44] Perhaps the most damaging criticism of future dangerousness/lack of control

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37. *Id*. (citing Barefoot v. Estelle, 463 U.S. 880, 899 (1983)).

38. United States v. Diaz, No. CR 05-00167, 2007 WL 656831, at *23 (N.D. Cal. Feb. 28, 2007); *see also* Brian Sites, *The Danger of Future Dangerousness in Death Penalty Use*, 34 Fla. St. U. L. Rev. 959, 974–78 (2007).

39. United States v. Taveras, 424 F. Supp. 2d 446 (E.D. Tex. 2006).

40. *Id.* at 455.

41. *Barefoot,* 463 U.S. at 880.

42. *Id*. at 901 n.7 (citations and internal quotations omitted) (quoting John Monahan, The Clinical Prediction of Violent Behavior 47–49 (1981) (emphasis in original)).

43. Addington v. Texas, 441 U.S. 418, 430 (1979). As the *Addington* Court held,

> [t]here may be factual issues to resolve in a commitment proceeding, but the factual aspects represent only the beginning of the inquiry. Whether the individual . . . is in need of confined therapy turns on the *meaning* of the facts which must be interpreted by expert psychiatrists and psychologists. . . .
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> The subtleties and nuances of psychiatric diagnosis render certainties virtually beyond reach in most situations.

Id. at 429–30.

44. *Id*. at 429 (emphasis added).

predications is found in *United States v. Sampson*,[45] where the Court, quoting two recent studies, observed,

> For nearly twenty years we have known that psychiatrists cannot predict whether a person who has committed a violent act will be violent in the future . . . . Even the most scientific predictions based on thorough examination, diagnosis of mental symptoms, past patterns of behavior, and probabilistic assessment are wrong nearly as often as they are right. The most common courtroom predictions—frequently based solely on hypotheticals—are wrong twice as often as they are right.[46]
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> . . . [B]oth clinicians [psychiatrists and psychologists] tend to think that they have more information than they really do and that they are poor at making extreme judgments. . . . [S]tereotypes and prejudices are just as likely to taint the decisions of clinicians as they are of lay people. As a result, clinicians are no better than lay people in making these decisions.[47]

In fact, a recent study analyzing predictions of future dangerousness found that expert witnesses' predictions are

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45. United States v. Sampson, 335 F. Supp. 2d 166, 219 (D. Mass. 2004).

46. *Id*. (quoting Erica Beecher-Monas & Edgar Garcia-Rill, *Danger at the Edge of Chaos: Predicting Violent Behavior in a Post-Daubert World*, 24 Cardozo L. Rev. 1845, 1845–46 (2003).

47. Sampson, 335 F. Supp. 2d at 219 (quoting Erica Beecher-Monas, *The Epistemology of Prediction: Future Dangerousness Testimony and Intellectual Due Process*, 60 Wash. & Lee L. Rev. 353, 362–63 (2003)). The Court further discussed the fact that

> [j]urors . . . may give great deference to the testimony of a psychiatrist as a supposed expert for purposes of determining future dangerousness. As the American Psychiatric Association stated in *Barefoot [v. Estelle, discussed infra],* "A psychiatrist comes into the courtroom wearing a mantle of expertise that inevitably enhances the credibility, and therefore the impact, of the testimony." . . . Therefore, there is good reason to fear that that the testimony of a psychiatrist on the issue of future dangerousness will be given more weight than it deserves.

Sampson, 335 F. Supp. 2d at 220 (quoting Eugenia T. La Fontaine, *A Dangerous Preoccupation with Future Danger*, 44 B.C. L. Rev. 207, 228 (2002)).

inaccurate in an overwhelming majority of cases.[48] Stated simply, "[t]he scientific community virtually unanimously agrees that psychiatric testimony on future dangerousness is, to put it bluntly, unreliable and unscientific."[49] Despite these concerns, in particular respecting the admissibility of such evidence under the *Daubert* criteria,[50] the courts have consistently allowed future dangerousness to exist as a relevant factor in the sentencing process.[51] This is particularly troublesome given the fact that a defendant's sentence "constitutes a significant deprivation of liberty that requires due process protection."[52] Ultimately, therefore, "[b]ecause most

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48. *Sampson*, 335 F. Supp. 2d at 219–20. Additionally, the *Sampson* Court held that

> [d]evelopments in the law and more recent scientific research suggest that expert testimony on future dangerousness would be inadmissible under the Federal Rules of Evidence . . . . The same considerations suggest that it may be timely for the Supreme Court to reconsider whether jurors can ascertain future dangerousness in a particular case . . . .

Id. at 218.

49. Flores v. Johnson, 210 F.3d 456, 464 (2000) ("[n]either the Court nor the State of Texas has cited a single reputable scientific source contradicting the unanimous conclusion of professionals in this field that psychiatric predictions of long-term future violence are wrong more often than they are right."); *see also* Randy Otto, *On the Ability of Mental Health Professionals to Predict Dangerousness: A Commentary on Interpretations of the "Dangerousness" Literature*, 18 Law & Psychol. Rev. 43, 64 (1994) (arguing that even if mental health professionals have some ability to accurately predict dangerous behavior, there are still considerable rates of error).

50. *See* Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579, 589–90 (1993). In *Daubert*, the Court delineated five factors to guide a court's determination regarding the admissibility of scientific evidence. They are as follows:

1. Whether the theory has been tested;
2. Whether the theory has been subjected to peer review and publication;
3. The known rate of potential error;
4. The existence of standards controlling the operation of the technique; and
5. The degree to which the theory has been generally accepted by the scientific community.

Applying these criteria, the *Flores* Court concluded that "the use of psychiatric evidence to predict a murderer's 'future dangerousness' fails all five *Daubert* factors." *Flores*, 210 F.3d at 464.

51. *See, e.g.*, U.S. v. Umana, 707 F. Supp. 2d 621, 634 (W.D.N.C. April 19, 2007) ([T]he Fourth Circuit has "consistently upheld consideration of future dangerousness as an aggravating factor.").

52. *Addington*, 441 U.S. at 425.

psychiatrists do not believe that they possess the expertise to make long-term predictions of dangerousness,"[53] use of future dangerousness by courts and juries in sentencing a criminal defendant raises serious problems of fairness, substantive and procedural due process, and calls into question the legitimacy of the criminal sentencing process.[54]

B. Cognitive Neuroscience—Improving Future Dangerousness and Culpability Determinations for Adolescent and Adult Violent Criminal Offenders

Cognitive neuroscience "is an investigational field that seeks to understand how human sensory systems, motor systems, attention, memory, language, higher cognitive functions, emotions and even consciousness arise from the structure and function of the brain."[55] Indeed, "[t]he focus of cognitive neuroscience has expanded from an inquiry into basic sensorimotor and cognitive processes to the exploration of more highly complex human behaviors."[56] Put another way, neuroscientists believe that "'[a]s we understand more about the details of the regulatory systems in the brain and how decisions emerge in neural networks, it is increasingly evident that moral standards, practices, and policies reside in our neurobiology.'"[57] Stated simply, "[t]he foundational premise of cognitive neuroscience

53. *Flores*, 210 F.3d at 465; *see also* Heller v. Doe, 509 U.S. 312, 324 (1993) ("[M]any psychiatric predictions of future violent behavior are inaccurate.").

54. *See generally* Mitzi Dorland and Daniel Krauss, *The Danger of Dangerousness in Capital Sentencing: Exacerbating the Problem of Arbitrary and Capricious Decision-Making*, 29 L. & Psychol. Rev. 63 (2005) (arguing that the use of future dangerousness in capital sentence proceedings has resulted in arbitrary and capricious punishments); Meghan Shapiro, *An Overdose of Dangerousness: How "Future Dangerousness" catches the Least Culpable Capital Defendants and Undermines the Rationales for the Executions It Supports*, 35 Am. J. Crim. L. 145 (2008) (arguing that the use of future dangerousness is unconstitutional in light of punishment's goals of incapacitation and retribution); Brian Sites, *The Danger of Future Dangerousness in Death Penalty Use*, 34 Fla. St. U. L. Rev. 959 (2007) (detailing specific procedural requirements before future dangerousness evidence should be admitted).

55. O. Carter Snead, *Neuroimaging and the "Complexity" of Capital Punishment*, 82 N.Y.U. L. Rev. 1265, 1273 (2007) ("[c]ognitive neuroscience has been described as a 'bridging discipline'—between biology and neuroscience, on the one hand, and cognitive science and psychology, on the other.").

56. *Id*.

57. *Id*. at 1274 (quoting Patricia Smith Churchland, *Moral Decision-making and the Brain*, *in* Neuroethics: Defining the Issues in Theory, Practice and Policy 3, 3 (Judy Illes ed., 2006)).

is that all aspects of the mind [and moral decisions] are ultimately reducible to the structure and function of the brain."[58] In this way, neuroscientists posit that human thought and behavior are caused solely by physical processes taking place inside the brain—"[an explanation] of human behavior in purely material terms."[59] As a result, "neuroscience may have important implications for both how we understand the multiple influences on violent behaviour and how the legal system may better engage with violent criminals."[60]

Neuroscientists have focused their research on two specific areas of the brain: (1) a part of the brain's "frontal lobe" including the pre-frontal cortex,[61] and (2) the amygdala.[62] The pre-frontal cortex—which consists primarily of the orbital, ventromedial, ventrolateral, and dorsolateral cortexes—is responsible for executive decision-making, that is, reasoning, ethical choices, impulse and aggression control, as well as feelings of regret and empathy.[63] As a result, frontal lobe disorder—which includes damage to the pre-frontal cortex and is the most common form of brain damage—affects, among other things, self-control, social behavior, and the ability to plan behavior, conform to social norms/values, and exhibit sensitivity towards others.[64] Perhaps the most alarming aspect of frontal lobe

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58. Snead, *supra* note 55, at 1277. Snead explains further that

> cognitive neuroscience follows the dominant approach of modern science, which seeks to understand and explain all observable phenomena as functions of their component parts. Under this methodology, questions of biology are thought to be reducible to matters of chemistry, which are, by extension, reducible to problems of physics. In principle, this approach will ultimately lead to the analysis of all phenomena in terms of the relationships of motion and rest among their most elemental particles.

Id. at 1278.

59. *Id*. at 1277 (quoting in part Martha J. Farah, *Neuroethics: The Practical and the Philosophical*, 9 Trends Cognitive Sci. 34, 34 (2005)).

60. Dean Mobbs et al., *Law, Responsibility, and the Brain*, 5(4) PloS Biology e103 (2007), *available at* http://www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.0050103 (last visited Nov. 11, 2010).

61. In this Article, the use of "frontal lobe disorder" should be construed to include damage to the pre-frontal cortex.

62. Mobbs et al., *supra* note 60, at 0693–94.

63. *Id.*

64. Richard E. Redding, *The Brain-Disordered Defendant: Neuroscience and Legal Insanity in the Twenty-First Century,* 56 Am. U. L. Rev. 51, 58–60 (2006). As Redding explains, "[f]rontal lobe dysfunction (when due to damage in the ventromedial prefrontal cortex) is thought to impair the emotional or somatic marking of stimuli linked to reward and punishment, which guides people in

disorder is that it has "prevalence rates of ninety-four percent among homicide offenders, sixty-one percent among habitually aggressive adults, forty-nine to seventy-eight percent among sex offenders, and seventy-six percent among juvenile offenders."[65]

Neuroscientists have also studied the amygdala, which controls emotional responses, aggression, and responses to another's expression of fear.[66] Individuals with a damaged amygdala and a history of violent behavior demonstrate a "poorer recognition of facial expressions,"[67] which often serve as inhibitors of violent behavior towards others. Specifically, using specific neuroimaging techniques, volunteers were presented with "a paradigm in which the appearance of a face on a screen was followed by painful shock in one condition but not in a second condition."[68] The results demonstrated that "normal" volunteers had "increased activity in the amygdala in response to faces associated with shock, whereas psychopathic individuals showed no significant change in activity in this region."[69] Stated simply, an individual with amygdalar damage will have no emotional, empathetic, or sympathetic reaction to those victims who respond in terror to the violence, often deadly, that this individual inflicts upon them. Ultimately, therefore, what these studies show, is that "we are closer to realizing . . . the biological roots of criminality."[70] However, this does not—and has not—changed the

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using past experience to anticipate future consequences of their behavior." *Id*. at 72.

65. *Id.* at 57.
66. Mobbs et al., *supra* note 60, at 0694.
67. *Id*.
68. *Id.*
69. *Id.*
70. Redding, *supra* note 64, at 56. Redding explains,

> Though criminal behavior is seldom due to any single biological, psychological, or sociological cause, we are closer to realizing the early criminologist's dream of identifying the biological roots of criminality. Many neuroscientists and mental health professionals now refer to "crime as a disease," the "psychopathology of crime," and "the neurobiology of violence." A "'biological brain-proneness' toward violence is widely accepted by neuroscientists." And, as one psychiatrist predicted, "we're going to be able to diagnose many people who are biologically brain-prone to violence." New brain imaging technologies allow us to "literally look at, and into, the brains of [criminals] using functional and structural imaging techniques."

Id. at 56–57 (quoting Jeffrey L. Kirchmeier, *A Tear in the Eye of the Law: Mitigating Factors and the Progression Toward a Disease Theory of Criminal*

fact that there is a difference between cognitive capacity, which neuroscience does not address, and volition, which neuroscience does address. In other words, an individual with frontal lobe disorder and/or limbic system damage (such as an amygdalar injury) still knows the difference between "right" and "wrong," and is able to understand that particular behaviors are in violation of the criminal law. Instead, brain-injured individuals lack only the ability to control their behavior. Whether through impaired judgment or an inability to control behavior, these individuals cannot use their knowledge of wrongfulness to direct their behavior in appropriate ways. This Article—and its proposal—reflect this critical distinction.

Consequently, this Article does not argue that brain damage in criminal defendants affects their mens rea, intent, or sanity. Studies demonstrate that individuals with prefrontal cortex/frontal lobe disorder know that their particular actions violate a particular law, statute, or societal norm.[71] As a result, accepting the findings of cognitive science does not support, explicitly or implicitly, a claim that the insanity defense should be reformed, or that defendants with frontal lobe disorder are not competent to stand trial.

Rather, this Article relies upon neuroscientific evidence to propose a novel solution to the problem of predicting "future dangerousness" and a new manner in which criminal defendants should be treated during and after they are convicted of particular offenses. To begin with, cognitive neuroscience has established with sufficient certainty the particular areas of the brain that affect action

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Justice, 83 Or. L. Rev. 631, 631 (2004) (quoting Victor Hugo, The Last Days of a Condemned, *in* The Death Penalty: A Literary and Historical Approach 103, 105 (Edward G. McGehee & William H. Hildebrand eds., 1964))); *see also* Adrian Raine, The Psychopathology of Crime: Criminal Behavior as a Clinical Disorder 3 (1993); Jan Volavka, Neurobiology of Violence xv–xvi (1995) (asserting that despite the "long and disturbing history" of biological theories linking individual characteristics and racial groups to undesirable characteristics, that "relations between genes and environment" are important in explaining the development of violent behavior); Nathanial J. Pallone & James J. Hennessy, *Brain Dysfunction and Criminal Violence*, 35 Society 21, 21 (1998) (observing, after reviewing studies from the past thirty-five years, that violent offenders exhibit "a relative incidence of neuropathology . . . many hundreds of times in excess of that found in the general population"); Adrian Raine, *Psychopathy, Violence and Brain Imaging*, *in* Violence and Psychopathy 35, 35 (Adrian Raine and Jose Sanmartin eds., 2001) ("[N]ow we can literally look at, and into, the brains of murderers using functional and structural imaging techniques which are currently revolutionizing our understanding of the causes of clinical disorders.").

71. *See infra* Part IV.D.

relevant to aggression and impulse control. As a result, neuroscientific studies provide a far more accurate method by which to predict the future dangerousness of certain defendants, particularly violent criminals. Finally, and most importantly, this Article argues that, based upon predictions of "future dangerousness," defendants convicted of violent offenses can be committed to a mental institution after they serve their sentence, if there still exists evidence of, among other things, pre-frontal cortex/frontal lobe disorder, disorder of the amygdala, or other disorders that affect aggression, impulse control and judgment. This argument is predicated on the fact that a violent criminal defendant with a specific brain disorder can be successfully treated to a sufficient extent such that recidivism rates will substantially decrease. It is also based upon a utilitarian premise, that is, incapacitation of violent offenders—based upon more accurate assessments of future dangerousness—will enhance public safety and protect the community from potentially violent and untreated individuals.

III. COGNITIVE NEUROSCIENCE AND ITS IMPLICATIONS FOR THE CRIMINAL JUSTICE SYSTEM

The following cases discuss individuals that were afflicted with the brain disorders discussed above, and whose actions arguably reflected a connection between their behavior and those injuries. As stated above, however, this evidence is not used to support an insanity or lack of mens rea defense, but is instead designed to show that (1) their actions may warrant a finding of lesser culpability, and (2) the involuntary confinement proposal is both practical and warranted.

A. Background

1. Charles Whitman

Before he killed fourteen people and wounded thirty-one at the University of Texas, Charles Whitman was described as "handsome," "fun," "high spirited" and in many respects the "all American boy."[72] When he was twelve years old, he became one of the

72. Gary M. Lavergne, A Sniper in the Tower: The Charles Whitman Murders 4, 11, 234 (1997).

youngest Eagle Scouts on record and in high school, pitched for the baseball team and managed the football team.[73] After high school he joined the Marines, where he was described as "the kind of guy you would want around if you went into combat."[74] He married while in the Marines, and would make notes to himself, one regarding his wife, stating, "[r]eceived a call from Kathy . . . it was fabulous. . . . I will love her until the day I die. She is definitely the best thing I have in life . . . ."[75] Thereafter, he obtained a scholarship to the University of Texas, performed volunteer work while having a part-time job as a bank teller, and was described by his supervisor as "an outstanding person, very likeable, neat, and nice looking."[76]

Suddenly, however, Whitman began to suffer severe headaches and frequently grew angry or acted aggressively. He repeatedly wrote notes reminding himself to control his anger and to "smile."[77] As he continued to experience increased feelings of anger, Whitman sought professional help at the University of Texas, where he admitted to have attacked his wife on two occasions.[78] In addition, his doctor stated that "[h]is real concern is with himself at the present time. He readily admits having overwhelming periods of hostility with a very minimum of provocation. [He makes] vivid reference to thinking about going up on the tower [at the University of Texas] with a deer rifle and start shooting people [sic]."[79]

Whitman never again met with a doctor about his condition. Before climbing the tower, he composed another letter to himself. In that letter, he wrote,

> I don't quite understand what it is that compels me to type this letter. . . . I don't really understand myself these days. . . . However, lately (I can't recall when it started) I have been a victim of many unusual and irrational thoughts. These thoughts constantly recur, and it requires tremendous mental effort to concentrate . . . . I talked with a doctor once for about two hours and tried to convey to him my fears that I felt come [sic] overwhelming violent impulses. After one session I never saw the Doctor again, and since

73. *Nation: The Madman in the Tower*, Time, Aug. 12, 1966, at 14.
74. Lavergne, *supra* note 72, at 18.
75. *Id.* at 27.
76. *Id.* at 47.
77. *Id.* at 121.
78. *Id.* at 59.
79. *Id.* at 233.

> then I have been fighting my mental turmoil alone, and seemingly to no avail. *After my death I wish that an autopsy would be performed on me to see if there is any visible physical disorder.* I have had some tremendous headaches in the past and have consumed two large bottles of Excedrin in the past three months.[80]

One day before Whitman climbed the tower at the University of Texas, he visited his mother just after midnight and followed her into her bedroom where he strangled her, stabbed her in the chest with a hunting knife, and brutally smashed the bones in her left hand.[81] After murdering his mother, Whitman left a note saying, "I have just taken my mother's life. I am very upset over having done it . . . I am truly sorry . . . . Let there be no doubt in your mind that I loved this woman with all of my heart."[82]

After murdering his mother, Whitman then made the decision to kill his wife, stating, "[i]t was after much thought that I decided to kill my wife, Kathy, tonight . . . . I love her dearly . . . . I cannot rationaly [sic] pinpoint any specific reason for doing this."[83] Whitman stabbed his wife to death just several hours after he killed his mother.[84] He then wrote another note saying,

> I imagine it appears that I bruttaly [sic] kill [sic] both of my loved ones . . . . If my life insurance policy is valid . . . . [p]lease pay off all my debts . . . . Donate the rest anonymously to a mental health foundation. Maybe research can prevent further tragedies of this type."[85]

The next day, Whitman climbed the tower at the University of Texas and started shooting, killing fourteen people and injuring thirty-one.[86]

In the post-mortem autopsy, a "pecan-sized"[87] Glioblastoma multiforme tumor was removed from "the right temporo-occipital"

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80. *Id.* at 92–93 (emphasis added).
81. *Id.* at 102–03.
82. *Id.* at 103.
83. *Id.* at 93.
84. *Madman in the Tower*, *supra* note 73, at 16.
85. Lavergne, *supra* note 72, at 109.
86. *Id.* at xi, 303.
87. *Madman in the Tower*, *supra* note 73, at 19.

region of Whitman's brain.[88] While acknowledging at the time that they could not definitively link Whitman's behavior to his brain tumor, the team of doctors who had worked on the report observed that "the highly malignant brain tumor conceivably could have contributed to [Whitman's] inability to control his emotions and actions."[89]

2. The Schoolteacher

A forty-year-old school schoolteacher, by all accounts successful and happily married, suddenly began making sexual advances towards his stepdaughter.[90] The Court offered him two

88. Press Conference, Report to the Governor, Medical Aspects, Charles J. Whitman Catastrophe 7 (Sept. 8, 1966), *available at* http://alt.cimedia.com/statesman/specialreports/whitman/findings.pdf.

89. *Id.* at 8. Indeed, it is precisely the amygdala, an "almond-shaped cluster of neurons," that is involved in the processing of emotions. Kristen Gartman Rogers & Alan DuBois, *The Present and Future Impact of Neuroscience Evidence on Criminal Law*, The Champion, Apr. 2009, at 18, *available at* http://www.nacdl.org/public.nsf/$$searchChampion (enter article title in the "search for" field and click "search").

90. Redding, *supra* note 64, at 51–52. Redding also describes the famous story of Phineas Gage, "a railway foreman whose left frontal lobe was severely damaged when an explosion propelled a tamping iron through his head," as follows:

> The personality and behavior changes seen in Gage after the injury were dramatic. "So radical was the change in him that friends and acquaintances could hardly recognize the man." He became irritable and amoral, his social functioning declined significantly, and he frequently became involved in fights and drunken brawls . . . Few cases, to be sure, are as stark. But brain-damaged defendants are seen everyday in American courtrooms, and in many cases, their criminal behavior appears to be the product of extremely poor judgment and self-control. Individuals with frontal lobe disorder . . . 'become disinhibited . . . [t]heir capacity to say to themselves, 'Stop! Don't say or do that. It is not wise,' is damaged. As one court explained, 'due to the defendant's brain impairment and problems with his frontal lobe functioning, the defendant had no judgment, in that *he could appreciate the criminality of his conduct*, but could not conform his conduct to the requirements of the law.' Indeed, frontally-damaged individuals typically do not lack understanding, they lack behavioral control."

Id. at 52–53 (quoting Antonio R. Damasio, Descartes' Error: Emotion, Reason and the Human Brain 8 (1994); John Martyn Harlow, *Passage of an Iron Rod Through the Head*, 39 Boston Med. & Surgical J. 389, 389–93 (1848); Jonathan H. Pincus, Aggression, Criminality, and the Human Frontal Lobes, Functions and

options—either attend a Sexaholics program or face incarceration.[91] The schoolteacher chose the Sexaholics program, but failed because he could not stop making sexual advances to other program members.[92]

The schoolteacher then underwent neuroimaging examinations, which revealed a large brain tumor "displacing part of the frontal lobe (and hypothalamus) of his brain."[93] After the tumor was removed, the schoolteacher's illegal sexual behavior immediately ceased.[94]

3. Herbert Weinstein

Herbert Weinstein and his wife Barbara were married for many years and resided in Manhattan, New York.[95] One morning, Weinstein suddenly strangled his wife and threw her body outside of their twelfth-story apartment, in an attempt to make her death look like a suicide.[96]

Weinstein's defense sought to mitigate his responsibility by introducing neuroscientific evidence that directly impacted his culpability for this crime.[97] The evidence revealed several brain disorders that characteristically implicate the "executive functions," of the brain, that is, reasoning, intent and judgment.[98] To begin with, Weinstein underwent a skin conductance response test, which revealed that he had lesions on the frontal lobes of his brain.[99] The defense then adduced evidence that Weinstein's brain was abnormal due "to the presence of an arachnoid cyst, the attendant displacement of the left frontal lobe, and firm indications of metabolic imbalance

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Disorders 547, 549 (Bruce L. Miller & Jeffrey L. Cummings eds., 1999); Cooper v. State, 739 So. 2d 82, 88 (Fla. 1999)); *see also* Cathy Crimmins, Where is the Mango Princess (2000) (describing the long recovery the author's husband underwent after a traumatic brain injury).

91. Redding, *supra* note 64, at 52.

92. *Id*. at 52.

93. *Id*.

94. *Id*.

95. *See* People v. Weinstein, 591 N.Y.S.2d 715, 717 (N.Y. Sup. Ct. 1992); *see generally* Jeffrey Rosen, *The Brain on the Stand*, N.Y. Times, Mar. 11, 2007, § 6 (Magazine), at 48 (discussing Weinstein case's impact on criminal law).

96. *Weinstein,* 591 N.Y.S.2d at 717.

97. *Id*. at 717–18.

98. *Id*. at 722–23.

99. *Id*. at 718.

near the cyst and the regions of the brain opposite it."[100] When examining this evidence, the Court held as follows:

> The frontal lobes of the brain—the general region where Weinstein's abnormalities are most apparent—control the so-called executive functions. The ability to reason and to plan constitute the most important of these functions. The frontal lobes, in other words, are the seat of man's cognitive powers. According to evidence at the hearing, damage to the frontal lobes can adversely affect a person's reasoning capabilities. Putting it another way . . . "cognitive impairment is a sign of frontal lobe dysfunction." Thus . . . damage to the frontal lobes may be signaled by an erosion of a person's powers of judgment, insight and foresight. These are matters that are generally accepted as valid in the fields of psychiatry, psychology and neurology.[101]

As a result, Weinstein's defense relied upon this information "to call at trial a psychiatrist to testify that at the moment Weinstein allegedly killed his wife, he lacked the cognitive ability to understand the nature and consequences of his conduct or that his conduct was wrong."[102] The court held that this testimony was admissible.[103]

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100. *Id*. at 722. More specifically, this conclusion was supported by

> scans of Weinstein's brain obtained through positron emission tomography (PET) . . . [as well as skin conductance tests] . . . [and] Weinstein's PET scans confirmed that a cyst exists within the arachnoid membrane, one of the brain's protective coverings. . . .
>
> . . . .
>
> PET scans and SCR test results . . . are factors that a psychiatrist will rely upon at trial to explain his diagnosis that, due to mental disease or defect, Weinstein was not criminally responsible for the death of his wife.

Id. at 717–18.

101. *Id*. at 722–23 (internal citations omitted).

102. *Id*. at 723. Importantly, this Article will not argue what Weinstein's defense attorney was essentially arguing—that he was temporarily insane at the time of the offense. The inclusion of this information is simply to demonstrate the impact that frontal lobe disorder can have on behavioral control and, how, in turn, this can influence criminal behavior.

103. *Id*. at 724. The discussion of the admissibility of neuroscientific evidence, under both *Frye* and *Daubert* will be discussed in the "The Guilt/Innocence Phase" section, Part IV(B) *infra.*

B. Cognitive Neuroscience and Criminal Decision Making

1. Cognitive Neuroscience as a Theory of Human Behavior

Cognitive neuroscience is "an investigational field that seeks to understand how human sensory systems, motor systems, attention, memory, language, higher cognitive functions, emotions, and even consciousness arise from the structure and function of the brain."[104] As Professor Steven Erickson explains, "[i]mplicit in this model is the notion that, in time, all human experiences will be accessible by various physical apparatuses designed to explore the brain, that all mentation will be measurable by these devices, and that accurate predictions of future behavior by way of brain activity can be made solely by understanding the material properties of the brain."[105] To be sure, "cognitive neuroscience confidently suggests [that] our perception of personhood grounded in the sense that we choose how to act is false and untenable . . . instead, we are a passive audience to the electrical cadence of neuronal firings buried deep within our heads."[106] In this way, "[w]hat we perceive as the mind is nothing more than a cognitive adaptation established by our brains to allow higher-ordered behavior."[107]

Consequently, "[t]he very notion of human agency—that people evaluate their environments, make choices, and impose those choices in the world—is entirely incompatible with the cognitive neuroscience theory of personhood."[108] Rather, "cognitive

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104. Snead, *supra* note 55, at 1273.

105. Steven K. Erickson, *Blaming the Brain*, 11 Minn. J.L. Sci. & Tech. 27, 37 (2010).

106. *Id*. at 37–38.

107. *Id*. at 38.

108. *Id*. at 39. Erickson explains further,

> The foundational walls upon which it [cognitive neuroscience] rests hold unwaveringly to the tenets of classical physics, reductive materialism, and hard determinism. . . . [W]e are automatons, fooled by a belief in goal-directed behavior that we perceive is under our control but is entirely the product of forces set into motion long before our existence. That we may believe that we prefer and choose to indulge in chocolate ice cream over vanilla is an illusion . . . .
>
> . . . [T]here is no 'you' as commonly understood: The brain and mind are synonymous. . . . That our brains engage in behavior before we become consciously aware of it means behavior operates independently of our consciousness. At the

neuroscience asserts that all individual thoughts, emotions, and feelings can be traced to certain defined biological locations of the brain."[109] Critically, therefore, this view "has serious implications for theories of culpability and responsibility so fundamentally rooted in most legal systems."[110]

2. Studying the Structure and Function of the Brain

Cognitive neuroscientists use a variety of techniques to examine whether a particular individual has sustained damage to certain areas of the brain, such as the pre-frontal cortex.[111] To begin with, neuroscientists use computed tomography ("CT") scanning and magnetic resonance imaging ("MRI") to examine the structure and architecture of the brain.[112]

More important, however, are the "functional techniques," which measure the brain's neural activity and thus form the basis for many conclusions regarding brain-damaged defendants.[113] The first method used to examine the brain's electrical function was electroencephalography ("EEG"), which "uses electrodes placed on the scalp to directly measure 'event related potential,'—namely—the total response of a large number of neurons inside the brain."[114] An additional technique, magnetoencephalography ("MEG") "directly measures the magnetic fields produced by these same electrical charges from neural activity."[115] However, neither of these systems can "localize the source of the electrical signal measured,"[116] so they cannot be used to pinpoint the location of damage or impairment.

Significantly, though, the more modern techniques of positron emission tomography ("PET"), single-photon emission computed tomography ("SPECT"), and functional magnetic resonance imaging

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> least we are fools under the direction of our selfish genes; at the worst our identity is an utter illusion.

Id. at 37–39.

109. *Id*. at 42.

110. *Id*. at 39.

111. Snead, *supra* note 55, at 1281; *see also* Owen D. Jones et al., *Brain Imaging for Legal Thinkers: A Guide for the Perplexed*, 2009 Stan. Tech. L. Rev. 5 at ¶¶ 13–18 (2009) (describing different techniques for brain imaging).

112. Snead, *supra* note 55, at 1281 (citations omitted).

113. *Id*. at 1282, 1292–93 (describing ways in which defendants use neuroimaging evidence in criminal cases).

114. *Id*. at 1282.

115. *Id*.

116. *Id*.

("fMRI"), have solved this problem.[117] As Professor O. Carter Snead explains, "[i]t has long been thought that there is a relationship between neuronal activity and regional cerebral blood flow—that is, blood flow to the region of the brain that is active during a given task."[118] Each of the preceding techniques relies upon this principle; they are able to "measure highly localized brain activity by recording certain proxies associated with cerebral blood flow."[119]

Ultimately, fMRI has become the most widely used and accepted technique in neuroimaging.[120] Like its counterparts, fMRI "relies on the principle that regional brain activation is indicated by increased cerebral blood flow."[121] However, "[w]hereas PET and SPECT utilize the proxies of blood flow and metabolic activity (e.g., glucose metabolism) of brain cells, fMRI measures the surplus of oxygenated blood recruited to the active brain region under consideration."[122] More specifically, "when the brain activity in a particular region increases, so too does the concentration of oxygenated blood (the 'hemodynamic response'), while the concentration of deoxygenated blood simultaneously decreases."[123] As Professor Snead further states, "[d]eoxygenated blood contains deoxyhemoglobin . . . [and] its presence causes a decrease in the magnetic resonance signal."[124] In contrast, "[w]hen oxygenated blood flows to a brain region (and the concentration of deoxyhemoglobin decreases), the magnetic resonance signal increases—a phenomenon referred to as the blood oxygenated level dependent ("BOLD") response."[125] In turn, researchers "interpret the increase in cerebral blood flow to a particular brain region (indicated by an increase in magnetic resonance signal strength) as an increase in cellular activity in that particular region."[126] Ultimately, therefore, fMRI is the most widely used method by which neuroscientists examine and

117. *Id*.
118. *Id*. at 1282–83. Snead explains that "fMRI has numerous advantages over PET and SPECT. It is noninvasive and seemingly harmless . . . Its temporal resolution is superior to other indirect methods of functional neuroimaging (e.g., PET and SPECT) . . . [i]t is widely thought that fMRI, among all neuroimaging techniques, best balances temporal and spatial resolution." *Id*. at 1285–86.
119. *Id*. at 1283.
120. *Id*. at 1284.
121. *Id*. at 1284–85.
122. *Id*. at 1285.
123. *Id*.
124. *Id*.
125. *Id*.
126. *Id*.

evaluate whether an individual suffers from certain brain abnormalities that have implications for criminal behavior.[127]

More specifically, fMRI studies have revealed significant aspects of brain activity that bear directly upon the abilities to reason, control behavior, make sound judgments, and understand the consequences of particular actions.

3. Brain Disorders that Can Lead to Criminal Behavior

a. Frontal Lobe Disorder

Before getting into the specifics of frontal lobe disorder and, concomitantly, behavioral and volitional impairment, it must be recognized that, for these individuals, early childhood development is very significant.[128] In other words, an individual's childhood *environment*, parental upbringing, and exposure to certain influences can—and does—affect whether he will have frontal lobe/pre-frontal cortex damage that affects his ability to control aggressive impulses, and make reasoned and informed moral judgments.[129] Specifically, "[m]ore often than not, defendants charged with homicide have been exposed to various risk factors in their environment that generate cognitive, neuropsychological, and organic brain impairment."[130] They are as follows:

- Young maternal age during pregnancy;
- Maternal alcohol, nicotine, drug use and poor diet and medical care during pregnancy;

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127. *Id*. at 1284.

128. John Matthew Fabian, *Forensic Neuropsychological Assessment and Death Penalty Litigation*, The Champion, Apr. 2009, at 24, 25, *available at* http://www.nacdl.org/public.nsf/$$searchChampion (enter article title in the "search for" field and click "search"). Fabian notes that "[a]lthough assessing juveniles in capital proceedings is now moot, neuropsychological assessment of juveniles germane to mitigation at sentencing is still critical."

129. *Id.* at 25–26.

130. *Id*. at 25. Fabian further notes that "any cognitive and neuro-psychological impairment may be mitigating even if it cannot be determined to have direct causative etiology with the homicidal behavior." *See also* John Matthew Fabian, *State Supreme Court Responses to* Atkins v. Virginia: *Adaptive Functioning Assessment in Light of Purposeful Planning, Premeditation, and the Behavioral Context of the Homicide,* 6 J. Forensic Psychol. Practice 1 (2006) (examining the role of adaptive functioning and intellectual deficits in sentencing).

- Fetal maldevelopment, minor physical abnormalities, fetal alcohol syndrome;
- Parental criminality and drug abuse;
- Domestic violence to mother during pregnancy;
- Poor offspring nutrition and medical care;
- Exposure to parental abuse and emotional neglect;
- Exposure to deplorable home conditions;
- Exposure to toxins, lead, parasites, infection;
- Poor socio-economic conditions; and
- Substance abuse and dependence history.[131]

Amazingly, in a study addressing the prevalence of head injuries among various groups of offenders, it was discovered that (1) 61% of habitually violent offenders had a history of head injuries, compared with (2) 67% of convicts on death row, (3) 58% of juvenile convicts on death row (before *Roper v. Simmons*[132] was decided), (4) 40% of severely psychopathic criminals, and (5) 36% of sexual offenders.[133] Indeed, it is on this basis that we "must consider the preceding mitigating environmental risk factors that spawn organic and neuropsychological impairment as having a cumulative effect on one's functional behavior and risk for violence."[134] Put differently, "the additive quality of both neurobiological and environmental factors places an individual at greatest risk for negative outcomes."[135]

Importantly, when studying the outcomes of these factors as they relate to violent behavior, there has been evidence of brain dysfunction in the areas associated with violence and aggression, namely, the frontal lobes and prefrontal cortex, temporal lobes, amygdala, and limbic system.[136] In fact, "about 100 percent of SPECT

131. Fabian, *supra* note 128, at 25–26.
132. Roper v. Simmons, 543 U.S. 551 (2005).
133. Fabian, *supra* note 128, at 26.
134. *Id*.
135. *Id*.
136. *Id*. Fabian continues,

> Decreases in prefrontal brain activity and increases in subcortical activity have been associated with antisocial behavior. Impairments in prefrontal lobe circuitry (ventromedial and orbitofrontal cortexes) have been linked with the understanding and processing of information; communication; understanding others' reactions; abstracting and reasoning; controlling impulses; stopping behavior and emotional regulation; using knowledge to regulate behavior; persisting with appropriate behavior; appreciating the impact

and PET studies reported deficits in prefrontal functioning (frontal lobe deficits), in violent, aggressive, and anti-social groups."[137]

Now, with respect to frontal lobe disorder, it is critical to point out that "[t]wo divisions of the frontal lobes are responsible for different executive functions."[138] The "dorsolateral (prefrontal cortex) is associated with cognitive functions including language, working memory, and selective and sustained attention."[139] Additionally, "[t]he ventral and polar frontal cortex assists in regulating emotions, self-awareness, decision-making and social awareness."[140] Thus, damage to the frontal lobe/pre-frontal cortex can impair the following functions, which directly influence criminal behavior and bear upon notions of criminal responsibility:

- Controlling impulses, stopping behavior, emotional regulation;
- Inhibiting inappropriate or impulsive behaviors;

> of behaviors onto others; and manipulating learned and stored information when making decisions.

Id. (citing M. Brower & H. Price, *Neuropsychiatry of Frontal Lobe Dysfunction in Violent and Criminal Behavior: A Critical Review*, 71 Neurological Neurosurgery Psychiatry 720 (2001)).

137. Fabian, *supra* note 128, at 25–26. Fabian discusses the results of a study involving criminal defendants with brain impairments:

> In one study of 41 defendants charged with murder or manslaughter assessing neurobiology related to mitigation, murderers as a group showed significant bilateral prefrontal metabolic decreases during a frontal lobe activation take. In another study with these same defendants, they were separated into affective versus predatory types and results indicated the affective types had sufficiently lower prefrontal metabolic activity as compared to the predatory types. Other data suggest that homicide frequently occurs because the individual responds to provocation with violent aggression that is out of proportion to the instigating stimulus, and the tendency for this process may be due to damage in the medial hypothalamic areas of the brain responsible for modulating defensive aggression.

Id. at 26 (citing A. Raine, M. Buchsbaum, & L. LaCasse, *Brain Abnormalities in Murderers Indicated by Positron Emission Tomography*, 42 Biological Psychiatry (1997); A. Raine, J. Meloy, S. Bihrle, et al., *Reduced Prefrontal and Increased Subcortical Brain Functioning Assessment Using Positron Emission Tomography in Predatory and Affective Murderers*, 16 Behav. Sci & L. 319 (1998); and D. Albert, M. Walsh, and R. Jonik, *Aggression in Humans: What is its Biological Foundation?*, 17 Neurosci. & Biobehav. Rev. 405 (1993)).

138. Fabian, *supra* note 128, at 27–28.

139. *Id.* at 27.

140. *Id.*

- Appreciating the impact of behaviors onto others;
- Using knowledge to regulate behavior;
- Understanding others' reactions;
- Understanding, processing, and communicating information;
- Planning, organizing, and initiating thoughts and behavior;
- Abstracting and reasoning;
- Sustaining attention and concentration;
- Modulating behavior in light of expected consequences;
- Formulating goals;
- Tolerating frustration; and
- Manipulating learned and stored information when making decisions.[141]

In fact, studies of frontal lobe disorder reveal that "many [defendants] experience neuropathological organic impairment [namely] 'underdeveloped brains' that reveal deficits in neuropsychological and cognitive assessment."[142]

To be sure, the consequences of frontal lobe disorder have far-reaching effects on criminal behavior.[143] First, "[i]t is the job of the

141. *Id.* at 27–28.

142. *Id*. at 28; Redding, *supra* note 64, at 59–60 ("[S]ome persons with FLD [frontal lobe disorder] show the patterns of behavioral responses associated with criminality."); *see also* Tom Valeo, *Scientists Point to Brain Region of 'Free Won't': Research Adds to the Evidence Suggesting that Brain Dysfunction Can Compromise Free Will*, http://www.dana.org/news/features/detail.aspx?id=9534 ("Damage to [the frontal lobes] can produce a striking loss of impulse control, resulting in inappropriate, belligerent or even aggressive behavior.").

143. *See* Redding, *supra* note 64, at 61–71. Redding explains further that

> [f]rontal lobe brain dysfunction, in particular, has long been recognized as a possible causal factor in violent crime. As early as 1835, medical case reports linked frontal lobe injury with violence. But the exponential growth in neuroscience research over the last several decades provides compelling explanatory evidence that frontal lobe dysfunction may play a causal role in a wide variety of impulsive criminal behaviors. Damage to the frontal lobes—the largest part of the brain—is the most common form of brain damage. Each year, nearly one hundred thousand Americans sustain traumatic brain injuries . . . or brain tumors severe enough to damage the frontal lobes . . . . Substance abuse, relatively common among those who sustain traumatic brain injury, exacerbates the degree of brain damage. In childhood, physical abuse may result in

frontal lobes to focus attention and to modify and inhibit behavioral impulses that surge up from other parts of the brain . . . [however] [f]rontally damaged people often cannot keep their behavior within the general rules of society."[144] As a result, there is a direct link between frontal lobe damage and criminal behavior, because "[a] person suffering from frontal lobe dysfunction could have an impairment in judgment, and could commit impulsive or violent acts even though such acts normally would be against that person's nature."[145] In addition, a defendant's frontal lobe damage could lead to "his inability to perceive social situations correctly and act accordingly, [and thus experience] an inability to control his behavior, and an inability to act rationally during stressful situations."[146] In essence, individuals with "frontal lobe damage often lose control over their own behavior and are prone to certain types of 'rage' attacks as the frontal lobe works [when not damaged] as a 'breaking mechanism for human behavior.'"[147]

Put another way, a defendant with frontal lobe damage experiences "impulse control [that] is so tenuous, so hair triggered, impaired by his dementia, that he would have . . . flown into a rage at the time and not handled a situation that someone with more reasoning ability might have handled with considerably less force."[148] In fact, "[e]ven minimal frontal lobe dysfunction may cause impulsive aggression, as studies have found relationships between sub-clinical frontal lobe deficits and aggression in normal populations."[149]

It is not surprising, therefore, that brain imaging studies have consistently revealed structural and functional abnormalities in

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> injury to the frontal lobes, the part of the brain most sensitive to brain injury.

Id. at 57–58 (internal citations omitted).

144. Redding, *supra* note 64, at 60 (quoting Jonathan H. Pincus, Base Instincts: What Makes Killers Kill? 217 (2001)).

145. *Id.* at 60–61 (citing Commonwealth v. Monico, 488 N.E.2d 1168, 1173 (Mass. 1986)).

146. Redding, *supra* note 64, at 61 (quoting Crook v. State, 813 So.2d 68, 71 (Fla. 2002)).

147. *Id*. at 61 (quoting *Crook*, 813 So.2d at 71).

148. State v. Stuard, 863 P.2d 881, 899 (Ariz. 1993); *see also* Peggy Sasso, *Criminal Responsibility in the Age of "Mind Reading*," 46 Am. Crim. L. Rev. 1191 (2009) (discussing how prefrontal cortex damage reduces impulse control and moral reasoning abilities and thus whether such conditions should come under consideration during criminal culpability assessments).

149. Redding, *supra* note 64, at 61.

the frontal lobes of violent and psychopathic individuals.[150] Redding explains as follows:

> One of the most well-known studies is the Vietnam Veterans Head Injury study. It examined aggressive behavior in 279 veterans with frontal lobe lesions as compared to a matched control group of 57 non-injured veterans. The brain-injured veterans were reported by family and friends to be significantly more aggressive; twenty percent became aggressive after their injury and fourteen percent were violent. Similarly, a study of prison inmates found that violent crimes were committed by seventy-three percent of the brain-damaged inmates but by only twenty-eight percent of the non-injured inmates, and . . . clinical case studies of eighteen inmates on death row in Texas revealed that fifteen displayed symptoms of FLD [frontal lobe disorder] on neuropsychological tests.[151]

Accordingly, "[t]he link between FLD and criminal behavior is not surprising when considering the functions of the frontal lobes, the so-called 'theater of the mind,' responsible for the executive brain functions of attention allocation, planning, decision making, judgment, behavioral monitoring, and impulse control." [152] Furthermore, although "people with frontal lobe damage usually retain their overall intellectual capacities and can reason rationally about social and moral situations, they frequently behave 'in a most unintelligent way.' Their real world judgment is impaired."[153] In fact, the "'inability to reason and decide advantageously in risky situations is likely to contribute to . . . impulsivity, rule breaking, reckless, [and] irresponsible behavior . . . ."[154] As such, "[t]he impaired impulse

150. *Id*. at 62.

151. *Id*.; *see also* Sasso, *supra* note 148, at 769 ("[E]merging neurological research suggests that adolescents, as well as many, if not all, individuals the criminal justice system currently labels as mentally retarded, mentally ill, or even psychopathic, share a dispositive characteristic: their brains, typically their prefrontal cortexes, are either damaged, defective and/or underdeveloped.").

152. Redding, *supra* note 64, at 67–68; *see also* Henry T. Greely, *Law and the Revolution in Neuroscience: An Early Look at the Field*, 42 Akron L. Rev. 687, 699 (2009) (observing that "neuroscience may well affect our sense of criminal (and civil) responsibility" in some cases).

153. Redding, *supra* note 64, at 68 (quoting Antonio R. Damasio & Steven W. Anderson, *The Frontal Lobes*, in Clinical Neuropsychology 404, 429–34 (Kenneth M. Heilman & Edward Velenstein eds., 4th ed. 2003)).

154. Redding, *supra* note 64, at 73 (quoting Adrian Raine, The Psychopathology of Crime: Criminal Behavior as a Clinical Disorder 3, 49 (1993);

control reflects 'a curious dissociation between knowing and doing . . . . Frontal lobe patients know their errors, but are unable to use that knowledge to modify [their] behavior.'"[155]

b. The Frontal Lobes and the Amygdala

Importantly, in the aspect of frontal lobe disorder that causes impulsive behavior, "there is a disruption in the neural circuit running between the limbic system (especially the *amygdala*) and the frontal lobes, which is a brain circuit responsible for fear conditioning, stress responses, mood regulation, and impulse control, and 'the meeting point between thought and emotion.'"[156] Specifically, the amygdala, "which stores emotional memories of past experiences and compares incoming stimuli against those stored memories, is responsible for the rapid evaluation of incoming perceptual stimuli."[157] This occurs "automatically and outside of conscious

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Adrian Raine, *Psychopathy, Violence and Brain Imaging, in* Violence and Psychopathy 35, 301 (Adrian Raine & Jose Sanmartin eds., 2001)).

155. Redding, *supra* note 64, at 68 (quoting Donald T. Stuss & D. Frank Benson, *Neurological Studies of the Frontal Lobes*, 95 Psychol. Bull. 3, 104 (1984)); *see also* Henry T. Greely, *Neuroscience and Criminal Justice*, 56 U. Kan. L. Rev. 1103 (2008) (discussing how a greater understanding of neuroscience may not change judgments of guilt, but could influence sentencing decisions).

156. Redding, *supra* note 64, at 69 (quoting Daniel Goleman, Emotional Intelligence: Why it Can Matter More than IQ 28 (1994)) (emphasis added).

157. Redding, *supra* note 64, at 69; *see also* Peggy Sasso, *Implementing the Death Penalty: The Moral Implications of Recent Advances in Neuropsychology*, 29 Cardozo L. Rev. 765 (2007). Sasso explains,

> [Discussing *Roper v. Simmons*], [t]he Simmons Court . . . acknowledged its use of "scientific and sociological studies" . . . in reaching its conclusion that . . . because adolescents do not have the same cognitive and emotional capacity as adults, they lack the same ability as an adult to be motivated by moral norms for moral reasons and thus are less culpable for failing to conduct their conduct accordingly . . . [t]he brief submitted by the AMA [American Medical Association] . . . explained that those regions of the brain that are associated with "impulse control, regulation of emotions, risk assessment, and moral reasoning" do not achieve full maturity until after the age of eighteen . . . the prefrontal cortex, the area of the brain "most associated with impulse control, regulation of emotions, risk assessment, and moral reasoning" is one of the last areas of the brain to mature and does not become fully developed until early adulthood . . . in the absence of a developed prefrontal cortex, adolescents rely much more heavily on the amygdala . . . [which is] "a neural system

awareness;" the amygdala is "'something like a psychological sentinel, challenging every situation, every perception . . . Is this something I hate? That hurts me? Something I fear? If so . . . the amygdala reacts instantaneously, like a neural tripwire, telegraphing a message of crisis to all parts of the brain autonomic nervous system.'"[158] Professor Redding describes the connections between the amygdala and the frontal lobe as "'the hub of battles or cooperative treaties struck between head and heart, thought and feeling.'"[159] He concludes,

> In many circumstances, the frontal lobes of the brain engage a stimulus at roughly the same time as the amygdala, producing a coordinated response that integrates emotional perceptions with rational decision making. But particularly in threatening or emotionally-charged situations, the amygdala's evaluation and response occurs before the higher cognitive processes in the frontal lobe can become fully engaged to rationally analyze the situation.[160]

In essence, disruption between the neural circuit running between the amygdala and frontal lobe causes individuals to "become perpetually responsive and literally overstimulated."[161] As a result, these individuals "'have lost the capacity to ignore their environment even when the response seems bizarre or inappropriate . . . [w]hen the frontal lobes are no longer in command . . . [w]e do not live reflectively but reflexively . . . [i]t's a sudden collapse of behavioral control.'"[162] In addition, "individuals with bilateral amygdala damage have demonstrated profound deficits in their ability to recognize certain emotions in others, such as fear, sadness, anger and disgust,

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> that evolved to detect danger and produce rapid protective responses without conscious participation." It dictates instinctive gut reactions, including fight or flight responses.

Id. at 797–99 (quoting and citing Roper v. Simmons, 543 U.S. 551, 569–70 (2005); Brief of American Medical Association et al. as Amici Curiae Supporting Respondent at 2–3, 12–13, 16, Roper v. Simmons, 543 U.S. 551 (2005) (No. 03-633), 2004 WL 1633549).

158. Redding, *supra* note 64, at 69 (quoting Goleman, *supra* note 156, at 16, 20).

159. Redding, *supra* note 64, at 70 (quoting Goleman, *supra* note 156, at 26–27).

160. Redding, *supra* note 64, at 70.

161. Redding, *supra* note 64, at 72 (citing Elissa Ely, *Physiology of Insight*, 12 Psychiatric Times 9 (1995), *available at* http://psychiatrictimes.com/p950929.html).

162. Redding, *supra* note 64, at 72.

and to identify trustworthy individuals from their facial appearances."[163] Ultimately, therefore, neuroscientific research has demonstrated that "when certain neural structures fail to operate properly the individual's capacity to engage in positive social behavior, and thus qualify as a moral agent capable of rejecting the community's moral and social norms, is severely impaired, if not eliminated altogether."[164]

C. Cognitive Neuroscience in the Criminal Courts

1. Adolescent Minds and *Roper v. Simmons*

Neuroscientific studies have revealed substantial and meaningful differences between the brains of adolescents and adults.[165] To begin with, during brain development a process called myelination occurs, whereby "'neuronal axons become wrapped in a fatty sheath to speed up transmission between neurons." [166]

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163. Sasso, *supra* note 148, at 1241. Based upon this and other evidence, Sasso concludes that

> [a]dvances in our understanding of how the brain works have profound implications for the criminal law. . . . The neurosciences clearly have a role to play at the definitional stage in terms of formulating tests designed to exclude those individuals who are outside our moral discourse altogether as well as identifying classes of individuals who can never qualify as our most morally culpable offenders . . . .

Id. at 1243.

164. *Id*. at 1227; *see generally* Owen D. Jones, *Behavioral Genetics and Crime, In Context*, 69-SPG Law & Contemp. Probs. 81 (2006) (demonstrating how behavioral genetics helps us to understand some of the important ways that genes influence behavior predispositions, including that which contributes to behavior that law classifies as criminal).

165. *See* Tracy Rightmer, *Arrested Development: Juveniles' Immature Brains Make Them Less Culpable Than Adults*, 9 Quinnipiac Health L.J. 1 (2005).

166. *Id*. at 11. Indeed, Rightmer notes that

> Dr. Elizabeth Sowell, a member of the UCLA brain research team, has led several studies of brain development from adolescence to adulthood . . . [t]he results of her studies . . . [reveal that] . . . "[b]etween adolescence and adulthood, a dramatic increase in gray matter density loss is observed in the frontal lobes." This suggests that even as adolescents' brains mature in other areas, they still cannot reason like adults because they lack a fully formed frontal lobe. "Maturation, particularly in the frontal lobes, has been shown to correlate with measures of cognitive functioning." Her studies also showed gray matter density reduction in the

Specifically, the teenage brain "undergoes an intense overproduction of *gray matter* (the brain tissue that does the 'thinking')." [167] Subsequently, a period of "pruning" occurs, whereby the brain rapidly discards the gray matter. [168] During the "pruning" period, "myelination" occurs, in which white matter develops, which "serves as insulation for the brain's circuitry, making the brain's operation more precise and efficient."[169] As a result of this process, myelinated neurons transmit information up to one hundred times faster than non-myelinated neurons, and scientists believe that the "the greater speed of neuronal processing may facilitate cognitive complexity and the ability to adeptly combine information from multiple sources."[170] Researchers have found that "the pace and severity of these changes . . . continue into a person's early 20s."[171]

Perhaps the most significant difference between the brains of adolescents and adults lies in the development of the frontal lobe/prefrontal cortex which, as stated above, correlates with measures of cognitive functioning.[172] Dr. Jay Geidd, a researcher in this area, explains that during adolescence "the part of the brain that is helping organization, planning and strategizing is not done being built yet . . . [i]t's sort of unfair to expect [adolescents] to have adult levels of organizational skills or decision making before their brain is finished being built."[173] Researchers in this area have also opined

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> frontal lobes occurring during the post adolescent years, suggesting that the brain is still undergoing changes into a person's twenties.

Id. at 13 (quoting Elizabeth Sowell, Paul M. Thompson, Kevin D. Tessner & Arthur W. Toga, *Mapping Continued Brain Growth and Gray Matter Density Reduction in Dorsal Frontal Cortex: Inverse Relationships During Postadolescent Brain Maturation*, 21 (22) J. Neuroscience 8819, 8821, 8828 (2001)).

167. Juvenile Justice Center, *Adolescence, Brain Development and Legal Culpability* 2 (Jan. 2004), *available at* www.abanet.org/crimjust/juvjus/Adolescence.pdf.

168. *See* Elizabeth R. Sowell et al., *In Vivo Evidence for Post-Adolescent Brain Maturation in Frontal and Striatal Regions*, 2 Nature Neuroscience 10, 860 (1999).

169. Juvenile Justice Center, *supra* note 167, at 2 (citing Sowell, *supra* note 168).

170. Jay N. Giedd, *Structural Magnetic Resonance Imaging of the Adolescent Brain*, 1021 Annals N.Y. Acad. Sci. 77, 80 (2004).

171. Juvenile Justice Center, *supra* note 167 at 2.

172. Rightmer, *supra* note 165, at 12–13.

173. *Id*. (quoting Adam Ortiz, *Cruel and Unusual Punishment: The Juvenile Death Penalty, Adolescence, Brain Development and Legal Culpability* (2004), *available at* http://www.abanet.org./crimjust/juvjus).

that "the relatively late development of the pre-frontal cortex, which is linked to the ability to inhibit impulses and weigh consequences of decisions, may be related to 'some of the behavioral manifestations of the teen years.'"[174] Indeed, Dr. Ruben C. Gur, a neuropsychologist at the University of Pennsylvania, writes,

> The evidence now is strong that the brain does not cease to mature until the early 20s in those relevant parts that govern impulsivity, judgment, planning for the future, foresight of consequences, and other characteristics that make people morally culpable . . . Indeed, age 21 or 22 would be closer to the 'biological' age of maturity.[175]

As a result of these findings, Dr. Deborah Yurgelun-Todd of Harvard Medical School explains that "adolescents often rely on emotional parts of the brain, rather than the frontal lobe . . . 'one of the things that teenagers seem to do is to respond more strongly with gut response than they do with evaluating the consequences of what they're doing.'"[176]

Studies of the amygdala also underscore the differences between the brains of adolescents and adults.[177] In a 1999 study at Harvard Medical School, teens were asked to identify the emotions

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174. Rightmer, *supra* note 165, at 13 (quoting Giedd, *supra* note 170, at 83). Rightmer also explains that "while the juvenile brain may look like an adult brain and may even have the ability to function like an adult brain, adolescents do not use their brains in the same way adults do." (citing Gargi Taukder, *Decision-Making is Still a Work in Progress for Teenagers*, Brain Connection (July 2000), http://brainconnection.positscience.com/topics/?main=news-in-rev/teen-frontal).

175. Juvenile Justice Center, *supra* note 167 (quoting Petition for Writ of Certiorari, Patterson v. Texas, 536 U.S. 984 (2002) (No. 02-6010)).

176. Juvenile Justice Center, *supra* note 167 at 2 (citing PBS Frontline, *Inside the Teenage Brain*, http://www.pbs.org/wgbh/pages/frontline/shows/teenbrain/ (last visited Jan. 31, 2011)); *see* PBS, Interview with Jay Giedd, *Frontline: Inside the Teenage Brain*, http://www.pbs.org/wgbh/pages/frontline/shows/teenbrain/interviews/giedd.html (last visited Jan. 31, 2011) (discussing brain development in adolescents; noting that adult levels of decision making may not be present when the adolescent brain is not fully developed, and that some parts of brain development may occur into the 20s); *see also* Mary Beckman, *Crime, Culpability, and the Adolescent Brain*, 305 Science 569 (2004), *available at* http://www.deathpenaltyinfo.org/node/1225 (discussing brain development in adolescents and defense lawyers' arguments for why defendants under 18 years of age are not as morally culpable as adults, suggesting, *inter alia*, that impulse control and risk evaluation mechanisms are less developed in the adolescent brain).

177. Beckman, *supra* note 176, at 599.

they perceived in pictures of faces that were shown to them.[178] Using functional fMRI, the amygdala of both teens and adults "burst with activity when presented with a face showing fear."[179] Critically, however, the pre-frontal cortex—which is responsible for higher cognitive functioning—did not "blaze"[180] in teens as it did in adults, suggesting that teens react emotionally, not rationally, when confronted with difficult situations.

In addition, "the teens kept mistaking fearful expressions for anger or other emotions."[181] Importantly, though, "subsequent experiments showed that in teenagers the prefrontal cortex buzzes when they view expressions of people they know."[182] The critical difference between adolescents and adults, however, is that while they "pay attention to things that matter to them," they "have difficulty interpreting images that are unfamiliar or seem remote in time."[183] Consequently, the combined process of slower frontal lobe development and maturation of the amygdala reveal that "an adolescent's brain is unstable,"[184] and if you "put stressors into a system that's already fragile . . . it can easily revert to a less mature state."[185]

Furthermore, it is important to recognize that the brain's chemistry alone is not entirely predictive of an individual's future behavior. As set forth *infra* in Part III, early childhood abuse can adversely affect brain development.[186] Indeed, it is not surprising, therefore, that "every [juvenile offender on death row] has been abused or neglected as a kid."[187]

Ultimately, the brain development of teens has revealed a maturation process that implicates and involves core notions of criminal responsibility and culpability, which directly affects how they should be treated in the criminal justice system, particularly at the sentencing stage. In what is a positive response to such studies, some courts have begun to rely upon this evidence when determining the proper punishment for a juvenile offender.

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178. *Id.*
179. *Id.*
180. *Id.*
181. *Id.*
182. *Id.*
183. *Id.*
184. *Id.*
185. *Id.*
186. *Id.*
187. *Id.*

For example, in *Roper v. Simmons*[188] the United States Supreme Court confronted the issue of whether it was permissible, under the Eighth and Fourteenth Amendments, to execute juveniles who were under eighteen at the time of the offense.[189] The Supreme Court answered this question in the negative, holding that the death penalty could not be applied to juvenile offenders.[190] In so holding, the Court implicitly, if not explicitly, relied upon neuroscientific evidence reflecting that juveniles were less culpable that their adult counterparts.[191] The Court cited three areas in which the juvenile mind differs from an adult's. First, juveniles have an underdeveloped sense of responsibility, resulting in "'impetuous and ill-considered actions and decisions.'" [192] Second, they exhibit enhanced susceptibility to negative influences.[193] Finally, "*the character of a juvenile is not as well formed as that of an adult*. The personality traits of juveniles are more transitory, less fixed."[194] The Court concluded that "[o]nce the diminished culpability of juveniles is recognized, it is evident that the penological justifications for the death penalty apply to them with lesser force than to adults."[195]

As the Court further held, "Retribution is not proportional if the law's most severe penalty is imposed on one whose culpability or blameworthiness is diminished. . . ."[196] In reflecting on the lesser culpability of juveniles, the Court recognized that "[t]he likelihood that the teenage offender has made the kind of cost-benefit analysis that attaches any weight to the possibility of execution is so remote as to be virtually non-existent."[197] As a result, the Court held that "[t]he differences between juvenile and adult offenders are too

188. Roper v. Simmons, 543 U.S. 551 (2005).

189. *Id*. at 555–56.

190. *Id.* at 568.

191. *Id.* at 561–62.

192. *Id.* at 569 (quoting Johnson v. Texas, 509 U.S. 350, 367 (1993)).

193. *Roper*, 543 U.S. at 569 (citing Eddings v. Oklahoma, 455 U.S. 104, 115 (1982)).

194. *Roper*, 543 U.S. at 570 (emphasis added) (citation omitted).

195. *Id.* at 571. The Court further held that even if a particular juvenile were indeed individually culpable, "[a]n unacceptable likelihood exists that the brutality or cold-blooded nature of any particular crime would overpower mitigating arguments based on youth as a matter of course, even where the juvenile offender's objective immaturity, vulnerability, and lack of true depravity should require a sentence less severe than death." *Id.* at 573.

196. *Id.* at 571.

197. *Id.* at 572 (quoting Thompson v. Oklahoma, 487 U.S. 815, 837 (1988)).

marked and well understood to risk allowing a youthful person to receive the death penalty despite insufficient culpability."[198]

Roper demonstrates that evidence regarding the adolescent brain has been recognized by the Courts as having strong implications for notions of criminal responsibility, particularly at the sentencing level.[199] However, the courts have nonetheless been reticent to recognize that adult criminal defendants with diagnostic brain disorders, including frontal lobe disorder, are also less culpable and deserving of different treatment at the sentencing process.

2. Use of Cognitive Neuroscience by Adults

To begin with, the introduction of neuroimaging is no stranger to the civil or criminal justice system, as it has been used, inter alia, for purposes of competency to waive Miranda rights, subjective experience of pain in tort cases, custody determinations, and mens rea defenses for fraud, kidnapping, burglary, and even murder.[200] While this Article does not address these specific areas, they demonstrate that neuroscience is slowly making its way into the courtroom as a valid theory upon which to assess criminal responsibility and predict future dangerousness. This is due to the fact that "neuroscience research has resulted in a better understanding of the neural basis of psychiatric disorders, addiction, and cognitive and emotional processes across individuals."[201] Indeed,

198. *Roper*, 543 U.S. at 572–73; *see also* Atkins v. Virginia, 536 U.S. 304, 317–18 (2002) (barring execution of the mentally retarded because of insufficient culpability due to disabilities); Abraham S. Barth, *A Double-Edged Sword: The Role of Neuroimaging in Federal Capital Sentencing*, 33 Am. J.L. & Med. 501 (2007) (discussing the use of brain-imaging in federal courts' consideration of aggravating and mitigating circumstances in capital murder cases).

199. *See also* Graham v. Florida, 130 S. Ct. 2011 (2010) (barring the sentencing of a juvenile non-homicide offender to life imprisonment without the opportunity for parole).

200. 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, 1132 (2010) (internal citations omitted). Brown and Murphy further state that "[w]hile prosecutors may one day introduce fMRI as evidence of future dangerousness, presently defense teams appear to be the dominant users of neuroimaging in the courtroom. One practical reason for this is that is that it would be physically difficult for the state to compel a brain scan of an unwilling person." *Id.* at 1133.

201. *Id.* at 1135 (emphasis in original). Brown & Murphy also explain that "[n]euroimaging has seen the courtroom in the sentencing phase of capital cases, where evidentiary hurdles are much lower and a capital defendant *may have a*

"[t]his improved understanding will likely inform the law first through the development of programs and policies . . . . [O]ne practical application may be to craft better treatment options for use by drug courts and parole boards. . . . [N]euroscience will have varying degrees of utility for legal scholars and practitioners."[202] The reason that neuroscience will play a substantial role in future legal discourse is that we now have a better understanding of the particular brain disorders and/or damage that affect human behavior. What matters most, now, is not simply what the neuroscientific evidence demonstrates, but how it should, if at all, be used in the criminal justice system. First, by diagnosing brain injuries such as frontal lobe disorder and damage to the neural circuit connecting the amygdala to the pre-frontal cortex, neuroscience has revealed that those individuals so afflicted have a serious and cognizable mental illness. In addition, the symptoms and manifestation of this illness, namely, impulse control problems, aggression, and rage attacks, undoubtedly cause the individual to be a threat to himself or others. By diagnosing brain injuries, neuroscience can more accurately predict whether an individual is likely to engage in further acts of violence upon termination of his sentence.

Thus, this Article proposes that offenders with brain injuries who manifest violent tendencies be subject to involuntary confinement either during or after their sentence. This procedure will serve to confine those individuals who represent the greatest danger to the public upon release, while observing all procedural due process safeguards. Importantly, as stated above, this Article is not in any way proposing or addressing insanity or mens rea.[203] Instead, it is

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constitutional entitlement to a psychiatric evaluation. *Id.* at 1133–34 (emphasis added); *see also* Brent Garland & Mark S. Frankel, *Considering Convergence: A Policy Dialogue About Behavioral Genetics, Neuroscience, and Law*, 68 Law & Contemp. Probs. 101 (2006) (discussing the relation of behavioral genetics and neuroscience to criminal law and encouraging policy dialogue between scientists, lawyers, courts, and lawmakers about the impact of science on criminal law).

202. Brown & Murphy, *supra* note 200, at 1135; *see generally* Jones, *supra* note 164, at 83–84 (discussing the upcoming challenges behavioral genetics will pose to the criminal justice system); Amanda C. Pustilnik, *Violence on the Brain: A Critique of Neuroscience in Criminal Law*, 44 Wake Forest L. Rev. 183 (2009) (finding attempts to link acts of violence to localized brain dysfunction overly simplistic and arguing that neuroscience can instead shed light on complex interactions between the brain, the individual, and society).

203. Fabian, *supra* note 128, at 27–28; *see also* Stephen J. Morse & Morris B. Hoffman, *The Uneasy Entente Between Legal Insanity and Mens Rea: Beyond*

recognizing that brain-injured offenders can—and should—remain confined until they no longer remain a threat to the community.

IV. COGNITIVE NEUROSCIENCE, FUTURE DANGEROUSNESS, AND INVOLUNTARY CONFINEMENT

This proposal is predicated upon the findings (beneficial yet limited) of neuroscientific evidence, relevant evidentiary rules, and, most importantly, the belief that criminal sentencing should be structured on a more individualized basis to reflect not only retributive but also rehabilitative and utilitarian concerns. Before proceeding, it is critical to point out that this Article endeavors to use this information responsibly; that is, it relies only on those neuroscientific findings where a near-consensus has been reached. All other extrapolations of what neuroimaging may—or could—demonstrate in the future, or even possibly in a particular case, lie outside the scope of this Article. This proposal is based upon what we know now, not what we may know in the future.

Put another way, neuroscientific evidence must be used responsibly by defense attorneys lest it become yet another strategic tool that is used in every possible way to vindicate their clients. Such use would not only be irresponsible, but it would compromise the field, findings, and future potential of neuroscientific evidence in the courtroom. This proposal, therefore, examines the stages of the criminal process and addresses how neuroscientific evidence can be used in: a) pre-trial proceedings, b) the guilt or innocence phase, c) sentencing, and d) post-sentencing proceedings.

Specifically, this Article proposes that individuals convicted of violent offenses who are diagnosed with, *inter alia*, frontal lobe damage, can be subject to a post-sentence hearing that could result in their involuntary confinement if: (1) rehabilitative efforts during the defendant's sentence have been unsuccessful or only partially successful; (2) it is determined that the defendant does not have adequate control over his behavior (the "volitional" component); and (3) he is likely to commit violent or other offenses (the "future dangerousness" component). Such a statute would require strict

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Clark v. Arizona, 97 J. Crim. L. & Criminology 1071, 1132–46 (2007) (arguing that despite advances in neuroscience that challenge the moral premise of criminal responsibility "criminal law must continue to emphasize the importance of mens rea and rationality").

procedural and substantive controls, such as those that allow for the involuntary confinement of sexual offenders/pedophiles.

A. Pre-Trial Proceedings

At this stage, defense counsel could potentially assert that an individual is incompetent to stand trial because he does not understand the nature or basis of the charges that have been filed.[204] Based upon neuroscientific findings, this argument should be rejected because individuals with frontal lobe disorder along with the neural circuit disruption between the amygdala and frontal lobes experience *behavioral*, not *cognitive* impairments.

Importantly, competency to stand trial is "essential to a fair trial,"[205] and is governed by a four-pronged test. It is as follows:

> [T]o be competent, a defendant must be able to (1) consult with the lawyer with a reasonable degree of rational understanding; (2) otherwise assist in the defense; (3) have a rational understanding of the criminal proceedings and (4) have a factual understanding of the proceedings.[206]

There can be no doubt that a defendant with frontal lobe disorder and amygdala neural disruption has the ability to understand, both rationally, factually and legally, the nature of the relevant proceedings. Instead, the neuroscientific evidence speaks more to problems with behaviors, particularly with controlling impulses, urges, and aggression. In other words, frontal lobe disorder affects your ability to act, but not your ability to know right from wrong. Thus, when looking at the manifestations of frontal lobe disorder, none suggest that there is a problem of "understanding,"

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204. *See, e.g.*, McMurtrey v. Ryan, 539 F.3d 1112 (9th Cir. 2008) (holding that failure to request a competency hearing to determine whether the defendant was able to understand the nature of the proceedings constituted ineffective assistance); United States v. Gigante, 982 F. Supp. 140 (S.D.N.Y. 1997) (evaluating the competency of defendant suffering from dementia, paranoia, and Alzheimer's disease).

205. United States v. Duhon, 104 F. Supp. 2d 663, 670 (W.D. La. 2000) (citing Riggins v. Nevada, 504 U.S. 127, 139–40 (1992)). In *Duhon*, the court found that the defendant was incompetent to stand trial on the basis that he was mentally retarded. In support of this holding, the court noted that the defendant "obtained a Verbal I.Q. score of 70, a Performance I.Q. of 65, and a Full Scale I.Q. of 67, which indicated the classification of Mild Mental Retardation." 104 F. Supp. 2d at 667.

206. *Id*. (quoting Drope v. Missouri, 420 U.S. 162, 171–72 (1975)).

that is, of being able to rationally understand the nature of a particular action.

Put differently, analogizing to sexual offenders, the problem lies with volition, not cognition. The individual may have difficulty making the "right" or "legal" choice, but he knows the difference. Thus, because these individuals "usually retain their overall intellectual capacities and can reason rationally about social and moral situations"[207] any challenge to competency, based purely on neuroscientific evidence, should be rejected.

To be sure, in *McMurtrey v. Ryan*,[208] the Ninth Circuit detailed precisely the type of conduct that is appropriate for a finding of incompetency, which is informative in the neuroscientific context. In *McMurtrey*, doctors who examined the defendant testified that he had neither neurological damage nor disease.[209] Instead, expert testimony revealed that McMurtrey "had a history of head injuries and mental health problems, along with a longstanding history of psychological problems that stemmed from unresolved issues surrounding McMurtrey's father's fatal shooting of McMurtrey's mother and her lover when McMurtrey was seventeen."[210] He was also diagnosed with "schizoid personality"[211] disorder, prescribed "Thorazine and Atarax . . . for seizures and anxiety,"[212] and had "'experienced auditory and visual hallucinations since age fifteen.'"[213] Additionally, McMurtrey had "been moved to the psychiatric unit of a local hospital because of 'suicidal ideation and a psychotic breakdown.'"[214] Finally, there was testimony that McMurtrey suffered from "'high anxiety level[s],'[215] . . . 'mixed neuroses,'[216] 'depression,'[217] and 'atypical dissociative disorder.'"[218] Based on these findings, the Ninth Circuit reversed the state court and ordered that

207. Redding, *supra* note 64, at 68 (quoting Damasio & Anderson, *supra* note 153, at 429–34).
208. McMurtrey v. Ryan, 539 F.3d. 1112, 1118–19 (9th Cir. 2008).
209. *Id*. at 1121.
210. *Id*. at 1119.
211. *Id*.
212. *Id*. at 1120.
213. *Id*. (citation omitted).
214. *Id*. at 1121 (citation omitted).
215. *Id*. (citation omitted).
216. *Id*. (citation omitted).
217. *Id*. (citation omitted).
218. *Id*. at 1122 (citation omitted).

a hearing be held to determine whether McMurtrey was competent to stand trial.[219]

As stated above, individuals with frontal lobe disorder and neural circuit disruption with the amygdala do not suffer from these impairments. McMurtrey's illnesses affected his cognitive abilities, resulting in hallucinations, and mood or personality disorders. Now, if defense counsel were to introduce neuroscientific evidence of frontal lobe disorder at a competency hearing, and persuasively assert that it led to symptoms affecting the defendant's cognitive abilities, then it may bear upon the issue of competency. To date, however, there is no consensus in the scientific community for this proposition. As such, neuroscientific evidence of frontal lobe disorder should not—and does not—support the position that an individual may not be competent to stand trial.

B. The Guilt/Innocence Phase

The guilt or innocence phase implicates two specific elements relevant to neuroscientific data—the issue of mens rea, and the admissibility of such evidence into the adjudicatory phase of the criminal process. The argument that a defendant, based upon the foregoing neuroscientific evidence, lacked the requisite mental state to commit a particular crime is without merit. Because defendants with frontal lobe disorder retain their "overall intellectual capacities"[220] and ability to "reason rationally,"[221] it follows that they know that their actions are wrongful and can likely act on some level with intent. Again, when examining the consequences of frontal lobe disorder, the vast majority of symptoms involves behavioral and volitional aspects, and do not suggest impairment of cognitive functioning. One cannot legitimately argue that a frontal lobe disorder can prevent a defendant from obtaining the requisite mental state to commit a particular criminal act. Rather, it *can* be argued that an individual had extreme volitional difficulty, that is, difficulty

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219. *Id*. at 1132.

220. Redding, *supra* note 64, at 68 (quoting Damasio & Anderson, *supra* note 153, at 429–34) (Redding does explain, however, that "[t]heir [people with frontal lobe damage] real-world judgment is impaired. The impaired impulse control reflects 'a curious dissociation between knowing and doing . . . . Frontal lobe patients know their errors, but are unable to use that knowledge to modify [their] behavior.'" *Id*. (quoting Donald T. Stuss and D. Frank Benson, *Neuropsychological Studies of the Frontal Lobes*, 95 Psychol. Bull. 3, 18 (1984)).

221. Redding, *supra* note 64, at 68 (quoting Damasio & Anderson, *supra* note 153, at 429–34).

resisting the urge to engage, purposely or otherwise, in a specific action. This is especially true if there is a neural dysfunction between the amygdala and frontal lobes. Then, a person can become prone to aggression or "rage" attacks, because the amygdala's initial response to outside stimuli is not mitigated by the higher functions of the frontal lobe/pre-frontal cortex. But to argue that someone has extreme difficulty *controlling their actions* does not mean that they do not have the ability to act with a *specific level of intent* when failing to resist the impulses from which they are affected.[222] That is precisely the difference between volitional impairment and cognitive awareness. Individuals with frontal lobe disorder still act with intent, purpose and knowledge, but they do so within a context where it is much more difficult to control the urge to commit specific illegal conduct. That may make them less culpable, but it does not affect their guilt, nor does it render them insane.

In addition, there would exist legitimate issues, both at the state and federal level, concerning the admissibility of neuroscientific evidence at the guilt/innocence phase of the trial. At the state level, the admission of expert testimony is generally governed by the principle set forth in *Frye v. United States,*[223] where the court held that expert testimony, to be admissible, must be based in science that is "sufficiently established to have gained general acceptance in the particular field in which it belongs."[224] Thus, under *Frye*, "'[t]he proponent of the evidence bears the burden of establishing by a preponderance of the evidence the general acceptance of the underlying scientific principles and methodology.'"[225]

At the federal level, as set forth above, the test for admitting expert testimony is governed by the five-factor test of *Daubert v. Merrell Dow Pharmaceuticals*.[226]

Here, as an evidentiary matter, the introduction of frontal lobe disorder and/or other brain damage data, i.e., disruption of neural circuits, will be problematic because of the specific purpose for which the evidence is being presented. In other words, the

222. Redding, *supra* note 64, at 70 (quoting Goleman, *supra* note 156, at 26–27).

223. Frye v. United States, 293 F. 1013 (D.C. Cir. 1923).

224. *Id.* at 1014.

225. Marsh v. Valyou, 977 So.2d 543, 547 (Fla. 2008) (quoting Castillo v. E.I. Du Pont De Nemours & Co., Inc., 854 So. 2d 1264, 1268 (Fla. 1983)).

226. Daubert v. Merrell Dow Pharms., 509 U.S. 579, 587 (1993). *See supra* note 50.

admissibility of neuroscientific evidence does not exist in a vacuum; its admissibility depends heavily upon the proposition for which it is being used to support. In the guilt/innocence phase, the most likely reasons for introducing neuroscientific studies concerning a particular defendant would be to either negate mens rea or support an insanity defense.

However, using neuroscience for these purposes is not likely to pass the admissibility threshold under *Frye* or *Daubert* because, inter alia, there is no consensus among the scientific community that neuroscientific studies negate mens rea or prohibit an individual from discerning right from wrong. Although, as set forth below, there may be a consensus among the scientific community that frontal lobe disorder causes the symptoms and manifestations listed above, because they are generally behavioral in nature, the use of such information as a *cognitive* matter to negate mens rea or establish an insanity defense has not been generally accepted by the scientific community. Put differently, the problem is not that the neuroscientific evidence is deficient; rather, admissibility problems arise when such information is connected to and used for a particular purpose. As a result, because there currently exists no consensus establishing that frontal lobe disorder and/or amygdala neural circuit malfunction results in *cognitive deficiencies*, this evidence should not be admitted at the guilt/innocence phase.

B. The Sentencing Phase

The next issues then become whether, after the adjudicatory phase, the defendant may introduce precisely the type of neuroscientific evidence that was excluded at the underlying trial. Indeed, the defendant should be allowed to proffer all relevant neuroscientific evidence, i.e., frontal lobe syndrome, because the *purpose* here is not to negate mens rea, but instead to demonstrate that the defendant was *less culpable* or *less responsible* than an ordinary defendant that did not suffer from this type of brain damage. Put differently, the connection between the evidence itself, and the purpose that it seeks to establish, renders it both relevant and probative of the defendant's responsibility for the commission of a particular crime. Therefore, this evidence performs a mitigating function because it provides an explanation, rather than a justification, regarding the circumstances surrounding the criminal act.

Viewed in this context, it is highly likely that, under both *Daubert* and *Frye*, a defendant can demonstrate a scientific consensus connecting the criminal behavior to the relevant brain injury. As set forth *supra* in Part II, frontal lobe disorder and disruption of the neural circuit between, among other things, the amygdala and frontal lobes, can result in impulse control problems, rage attacks, aggressive behavior, and lack of conformity to societal values.[227] This type of behavior can cause an individual to engage in behaviors that transgress criminal laws, even though, as a cognitive matter, the individual still knows that such behavior is prohibited. In other words, the science concerning the manifestations of frontal lobe disorder is consistent and well-accepted within the scientific community. Additionally, the behavioral consequences of this and other brain disorders will likely bear upon the defendant's criminal culpability or responsibility, but not serve as a justification for a particular crime or support an insanity defense. The latter does not have consensus within the scientific community, but the former does, and thus should be admissible at the sentencing phase.

The admission of this evidence is permissible, *a fortiori*, because the relevant rules of evidence, as a general matter, are less stringent at the sentencing phase of a trial. By way of analogy, in federal capital cases, "[t]he Federal Death Penalty Act (FDPA) erects very low barriers to the admission of evidence at capital sentencing hearings."[228] Indeed, "[s]ince the need to regulate the scope of testimony is less at the penalty phase than at the guilt phase of trial, parties may present evidence 'as to any matter relevant to the sentence.'"[229] In fact, at the federal level, the *Daubert* factors do not even apply at the capital sentencing phase, as expert testimony is admissible if "it 'is the product of reliable principles and methods' that are applied 'reliably to the facts of the case.'"[230] In *United States v. Fields*, the court noted that "[n]o Circuit we are aware of has applied *Daubert* to sentencing."[231] The justification underlying the lower standards for admissibility is the notion that "'it is desirable for

227. Fabian, *supra* note 128, at 27–28.

228. United States v. Lee, 274 F.3d 485, 494 (8th Cir. 2001).

229. *Id*. at 494 (quoting 18 U.S.C. § 3593(c)).

230. United States v. Fields, 483 F.3d 313, 341–42 (5th Cir. 2007) (quoting Fed. R. Evid. 702).

231. *Fields*, 483 F.3d at 342.

the jury to have as much information before it as possible when it makes the sentencing decision.'"[232]

The same rationale should apply to sentencing hearings where the defendant suffers from brain damage or injuries that affect behaviors bearing directly upon and relevant to a particular criminal act. The sentencing decision is based upon and reflective of the defendant's culpability for a particular crime. The ramifications of frontal lobe disorder or neural circuit disruption with the amygdala impact a defendant's responsibility because they affect, among other things, an individual's ability to control his behavior and exercise impulse control. On this basis, expert testimony concerning neuroscientific data should be admitted.

The remaining issue concerns the impact the presence of these brain disorders should have on sentencing decisions. The sentence, of course, implicates and reflects the defendant's criminal responsibility, and the type of sentence, whether retributive, rehabilitative, or for incapacitory purposes, ultimately reflects a judgment about the defendant's actions. Based upon the totality of the circumstances, the defendant should receive a mixed sentence that reflects both retributive and rehabilitative ends. First, because the defendant retains the ability to think rationally, despite impulse control issues, he retains the ability to distinguish legal from illegal conduct. Furthermore, particularly with violent offenders, there must be an acknowledgment both that the defendant is still responsible and that the victim is entitled to redress for injuries suffered. Moreover, the community at large, as a matter of public policy and the court's institutional legitimacy, has a responsibility to punish individuals who transgress the law with knowledge of both its illegality and potential consequences. Therefore, the defendant should receive a sentence within the statutory range promulgated for a particular criminal offense.

The sentence, however, should differ from a typical punishment for a similar crime in two respects. First, recognizing the defendant's reduced culpability as a mitigating factor, the court should impose a sentence at the lower end of the statutory range. If there is no statute, and the sentence is entirely entrusted to the court, then such sentence should be influenced by and reflected in the

232. *Lee*, 274 F.3d at 494 (quoting Gregg v. Georgia, 428 U.S. 153, 203–04 (1976)); *see also* United States. v. Jackson, 327 F.3d 273 (4th Cir. 2003) (finding the lower court's admission of defendant's videotaped magazine interview at the sentencing phase was not error).

specific term of imprisonment. In other words, where there is reduced culpability, there should be reduced punishment, but not to the degree that the defendant receives a sentence disproportional to others that have committed similar crimes. Because brain-disordered defendants have a cognitive understanding of their behaviors, punishment—albeit reduced—is warranted.

The sentence should also seek to treat the defendant, because a defendant with frontal lobe disorder has a legitimate ailment that makes him not only less culpable, but less able to function normally within the community. This would further benefit public safety because it would reduce the recidivism rate. Thus, as a significant part of any sentence, the court should order the defendant to undergo ongoing treatment for the specific brain disorder that is the focal point of a behavioral malfunction. The treatment may involve psychological counseling and cognitive behavioral therapy, to assist the defendant in becoming aware of his actions and how to manage them in particular situations. Additionally, psychiatric intervention and environmental modification may be required, since medications used to treat various manifestations of frontal lobe disorder may be beneficial, but also can cause side effects.[233] As part of the treatment plan, the defendant may spend portions of his sentence in an in-patient institution designed to treat similarly situated individuals, subject to, of course, a court order approving such request. The purpose of the rehabilitative aspect of the sentence is twofold: it serves to promote public safety by reducing recidivism rates, and it strives to effectuate the defendant's successful transition into the community upon completion of his sentence. These goals, therefore, connect public safety with individual reform, and in that way, the sentence can truly be tailored to realize these objectives.

D. Involuntary Commitment Post-Sentence

1. Introduction

Finally, there will invariably arise situations where a defendant completes his sentence yet treatment has not been successful, or where he has had partial success but requires more time for full rehabilitative purposes. In these instances, upon the defendant's release, there will exist the likelihood that, due to

233. S.P. Salloway, *Diagnosis and Treatment of Patients with "Frontal Lobe" Syndromes*, 6 J. Neuropsychiatry Clin. Neurosci. 388, 389 (1994).

untreated or unaddressed behavioral issues, he may commit further crimes of violence. This poses a dilemma for the State and an ongoing threat to public safety.

Therefore, this Article proposes that the State may petition the Court for a hearing to determine whether the defendant—who continues to suffer from a particular brain disorder—remains a danger to the community. At such a hearing, if it is determined, based upon all relevant evidence, that the defendant's treatment has been unsuccessful, or that further treatment is needed because the defendant suffers from a particular brain disorder, *and* that he remains a danger to the public, then involuntary commitment *post-sentence* may be warranted. This type of involuntary commitment procedure should be statutory in nature and contain stringent procedural protections to ensure that the defendant is treated fairly and not held for any further time than necessary to successfully treat, for example, frontal lobe disorder.

By way of analogy, this type of procedure is already utilized to order the post-sentence involuntary commitment of sexual predators.[234] For example, in 2002, New Jersey enacted the Sexually Violent Predators Act (SVPA).[235] When enacting the SVPA, the legislature stated that "'[c]ertain individuals who commit sex offenses suffer from mental abnormalities or personality disorders which make them likely to engage in repeat acts of predatory sexual violence if not treated.'"[236] The legislature further declared that "'[t]he nature of the mental condition from which a sexually violent predator may suffer may not always lend itself to characterization' under existing standards for mental commitment, 'although civil commitment may nonetheless be warranted due to the danger the person may pose to others as a result of the mental condition.'"[237] In upholding the statute, the New Jersey Supreme Court described the procedure as follows:

> The SVPA authorizes the Attorney General to initiate a court proceeding for the involuntary commitment of an individual believed to be a 'sexually violent

234. *See, e.g.*, Kansas v. Hendricks, 521 U.S. 346, 350–58 (1997) (upholding the constitutionality of a Kansas statute that ordered the civil commitment of sexual predators who pose a danger to themselves or others and have a mental abnormality).

235. *See* N.J. Stat. Ann. §§ 30:4-27.24 to 27.28 (West 2008).

236. In the Matter of Commitment of W.Z., 173 N.J. 109, 119 (2002) (quoting § 30:4-27.25(a)).

237. *W.Z.*, 173 N.J. at 119–20 (quoting § 30:4-27.25(b)).

> predator' as defined by the Act . . . Clear and convincing proof is required for commitment . . . The definition of 'sexually violent predator' requires proof that the individual has been convicted, adjudicated delinquent or found not guilty by reason of insanity of a 'sexually violent offense' . . . and 'suffers from a mental abnormality or personality disorder that makes the person likely to engage in acts of sexual violence if not confined to a secure facility for control, care and treatment.' 'Mental abnormality' is 'a mental condition that affects a person's emotional, cognitive or *volitional* capacity in a manner that predisposes that person to commit acts of sexual violence.' The phrase 'likely to engage in acts of sexual violence' is defined further to mean that 'the propensity of a person to commit acts of sexual violence is of such a degree as to pose a threat to the health and safety of others.[238]

The SVPA, however, has strict procedural protections to ensure that an individual is guaranteed treatment and held for no longer than necessary. For example, the Department of Corrections "is required to provide a safe and secure facility to house involuntarily committed sexually violent predators separate from other offenders in the Department's custody."[239] Additionally, "[w]hile an individual is committed, the Division of Mental Health Services in the Department of Human Services must provide treatment tailored to address the specific needs of sexually violent predators."[240] There are also "annual reviews of a committed individual to assess his or her need for continued commitment or conditional discharge."[241] Finally, the SVPA provides that "if at any time during the involuntary commitment the committee's treatment team determines that the committee is no longer 'likely to engage in acts of sexual violence if released,' the Act allows the treatment team to recommend to the Department of Human Services that the committee be authorized to petition the court for discharge."[242]

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238. *W.Z.*, 173 N.J. at 120 (quoting §§ 30:4-27.28, 30:4-27.32(a), & 30:4-27.26) (emphasis added).

239. *W.Z.*, 173 N.J. at 120.

240. *Id*.

241. *Id*. (citing § 30:4-27.35).

242. *W.Z.*, 173 N.J at 120–21 (quoting § 30:4-27.36).

Similarly, Kansas has also enacted a Sexually Violent Predator Act,[243] (Kansas SVPA) which allows for the involuntary confinement of a person who "suffers from a mental abnormality or personality disorder which makes the person likely to engage in repeat acts of sexual violence."[244] In addition, it defines the term "mental abnormality" as a "congenital or acquired condition affecting the emotional or *volitional* capacity which predisposes the person to commit sexually violent offenses in a degree constituting such person a menace to the health and safety of others."[245] The Kansas SVPA also provides similar procedural protections for a committee.[246]

Perhaps the most important factor common to both the New Jersey and Kansas statutes is that an individual may be committed if he is unable *to control his behavior*.[247] As the *Crane* court held, "[i]t is enough to say that there must be proof of serious difficulty in controlling behavior."[248] This determination, of course, assists in determining whether an individual is likely to commit further criminal acts if not committed and treated for a specific amount of time.

2. A Proposed Statute

Based upon the above discussion of statutes involving sexual predators, there can—and should—be statutes promulgated to allow for the involuntary post-sentence commitment of violent offenders who: (1) have not been successfully treated while incarcerated; (2) are likely to or at risk of committing another violent offense; and (3) exhibit signs that they have impulse control problems, that is, that they lack the ability to inhibit the type of aggressive responses that led to their initial conviction. Such a statute, however, would have to contain stringent procedural protections for the individual and be non-punitive in nature. Namely, it must allow for release when it is determined that the individual is no longer a threat to himself or others, and can control and comport his behavior to societal norms.

Thus, hypothetically, a state may enact a statute entitled "The Violent Offender Post-Sentence Commitment Act," containing

243. Kan. Stat. Ann. § 59-29a02 (2005).
244. § 59-29a02(a).
245. § 59-29a02(b) (emphasis added).
246. *See* Kansas v. Hendricks, 521 U.S. 346, 352–53 (1997).
247. *See* Kansas v. Crane, 534 U.S. 407, 412–13 (2002).
248. *Id*. at 413.

the language suggested below. The legislative purpose underlying this statute would be:

1. To successfully treat an individual with violent tendencies as a result of frontal lobe syndrome or other brain, personality or mental disorders that affects such individual's ability to control behavior and thus conform to community norms.
2. To promote public safety by rehabilitating a particular offender and thus reduce the risk for repeat violent offenses, while also providing the necessary treatment to facilitate the defendant's successful re-entry into society.

The legislature should then emphasize:

3. This statute is non-punitive in nature, and all procedures set forth herein are designed to ensure efficacious treatment of the individual for a time no longer than necessary as determined by the relevant treatment team.

The next part of the statute should set forth the specific procedures for post-sentence involuntary commitment. To begin with, as a defendant nears the completion of his sentence, the State must file a petition with the Court declaring that the individual (1) has not been successfully treated while incarcerated; (2) is likely to commit another violent offense upon release (the "future dangerousness" element); and (3) lacks volitional control and thus continues to have difficulties with impulse control. The burden will be on the State to prove each of these factors by clear and convincing evidence, so that the statute does not sweep too broadly and encompass individuals who truly are not in need of additional treatment.

The next issue will concern the test for admissibility of evidence at the commitment hearing. Importantly, because the defendant's liberty is at stake for non-punitive purposes *after* completion of his sentence, the evidentiary standard should be very low, as all relevant, probative and non-prejudicial evidence should be admitted. In this instance, in proffering evidence to prove the "future dangerousness" element, the State should be allowed to introduce expert testimony from those individuals who have treated the defendant in prison, *as well as* neuroscientific data showing that untreated or partially treated individuals with a particular brain disorder are likely to engage in aggressive behavior due to impulse control or other impairments. Significantly, this framework underscores that cognitive neuroscientific studies can not only help a

defendant, but can also be quite valuable to the State in commitment proceedings. Additionally, at this proceeding, the defendant should be allowed to introduce all relevant evidence, including expert testimony, demonstrating that the State has failed to prove one or more of the three elements required for involuntary commitment.

At the conclusion of this hearing, if the court finds that the State has satisfied its burden, then the defendant shall be committed to an institution for treatment purposes no longer than necessary to effectuate successful rehabilitation. Importantly, to ensure that the defendant's constitutional and substantive due process rights are not being violated, the State will be required to report to the Court every thirty days, providing an affidavit setting forth (1) the specific treatment that the defendant is receiving; and (2) the particular reasons why continued confinement is necessary. The Court shall also allow the defendant to be present at this hearing to rebut the State's findings and demonstrate that he has volitional control and is no longer likely to commit acts of violence. If he can show that he has been successfully treated, he would be entitled to immediate release. The thirty-day hearings shall occur up to and until the defendant is released from the institution to which he is committed.

In addition, after each thirty-day treatment period, the defendant will be permitted to petition the Court for relief on the ground that (1) he is not receiving proper or sufficient treatment; or (2) that treatment has been successful and that he is therefore entitled to immediate and unconditional release. The defendant may introduce any relevant evidence, including testimony from his treatment team, and the State will again be required to establish, by clear and convincing evidence, that further commitment is necessary. This type of hypothetical statute has two objectives: to promote rehabilitation of the individual and thus allow him to transition successfully into the community, and to promote public safety by reducing recidivism rates and acts of violence.

E. Objections

It is inevitable that this type of statute will engender a variety of objections ranging from its constitutionality to its effectiveness. This part will address some of the common objections that are likely to arise.

1. The Statute Is Unconstitutional

An important objection is likely to be that the statute violates the due process clause of the Fourteenth Amendment as well as the ex post facto clause. This argument, however, is without merit because the commitment statute is for non-punitive purposes and therefore does not constitute punishment. In *Kansas v. Hendricks*,[249] the Supreme Court considered and rejected both of these objections in its analysis of a Kansas involuntary commitment statute for violent sexual predators. Finding that "commitment under the Act does not implicate either of the two primary objectives of criminal punishment: retribution or deterrence," [250] the Court further explained that "the fact that the Act may be 'tied to criminal activity' is 'insufficient to render the statut[e] punitive.'" [251] The Court distinguished this type of confinement, stating that "an individual confined under the Act is not subject to the more restrictive conditions placed on state prisoners, but instead experiences essentially the same conditions as any involuntarily committed patient in the state mental institution."[252] Because those confined are not "subject to punitive conditions,"[253] the Court found that "it is difficult to conclude that persons under this Act are being 'punished.'"[254]

Thus, "[a]lthough the [Kansas] civil commitment scheme at issue here does involve an affirmative restraint, 'the mere fact that a person is detained does not inexorably lead to the conclusion that the government has imposed punishment.'" [255] Rather, it found that "measures to restrict the freedom of the dangerously mentally ill" represent "a legitimate nonpunitive governmental objective." [256] In fact, the Court described confinement of "'mentally unstable individuals who present a danger to the public' as one classic example of nonpunitive detention."[257] Moreover, the Court found that "commitment under the statute is only *potentially* indefinite" because "[f]ar from any punitive objectives, the confinement's duration is

249. Kansas v. Hendricks, 521 U.S. 346 (1997).
250. *Id*. at 361–62.
251. *Id*. at 362 (quoting United States v. Ursery, 518 U.S. 267 (1996)).
252. *Hendricks*, 521 U.S. at 363.
253. *Id.*
254. *Id.*
255. *Id.* (quoting United States v. Salerno, 481 U.S. 739, 746 (1987)).
256. *Hendricks*, 521 U.S., at 362–63 (citing *Salerno*, 481 U.S. at 747).
257. *Hendricks*, 521 U.S. at 363 (emphasis added) (quoting *Salerno*, 481 U.S. at 748–49).

instead linked to the stated purpose of commitment, namely, to hold the person until his mental abnormality no longer causes him to be a threat to others."[258]

The hypothetical statute at issue here is similarly non-punitive and has as its sole objective the rehabilitation of individuals with frontal lobe disorder, neural disruption between the frontal lobes and amygdala, and/or other brain and personality disorders. There is nothing punitive about this statute. The State must initiate treatment immediately upon confinement and report to the Court every thirty days to specify in detail the treatment that the defendant is receiving, and explain why further confinement is necessary. The defendant also has the right, every thirty days, to petition the Court for release should he believe that he is no longer suffering from the particular disorder resulting in his confinement, thus rendering him no threat to himself or others. These protections are designed to ensure that the confinement is rehabilitative, no longer than necessary, and void of any retributive or deterrence-based objectives. Based upon *Hendricks*, the argument that such confinement violates the due process clause of the Fourteenth Amendment and/or the ex post facto clause is likely to fail.

2. Many Individuals with Frontal Lobe Disorder or Other Brain Abnormalities Do Not Engage in Criminal Behavior

A second objection is that many individuals suffer from frontal lobe disorder or other brain, mental or personality disorders yet function adequately in society and do not engage in criminal behavior. Thus, the argument that there is a causal connection between these conditions and criminal behavior is meritless.

Certainly, this assertion is true—there are individuals who suffer from various brain disorders, mental illnesses, and/or personality disorders that do not engage in any type of criminal behavior, and in fact contribute meaningfully to the community in which they reside. The problem with this argument, however, is that it does not follow that because some individuals with these disorders do not engage in criminal activity, it must be concluded that *all* individuals can control their behavior and comport with societal and legal norms. By way of analogy, it has been well-established that smoking causes lung cancer. However, not all individuals who

258. *Hendricks*, 521 U.S. at 364, 363.

smoke—even for prolonged periods of time—develop lung cancer. The fact remains, however, that smoking causes lung cancer in some smokers, and any assertion otherwise is contrary to the scientific evidence.

In other words, this argument is far too general and misconstrues the complexity of cognitive neuroscience. Rather than arguing that, because some people with brain disorders do not engage in criminal behavior, therefore *no one* with a brain disorder engages in criminal conduct, it is imperative to make these determinations on a case-by-case basis. In addition, it is critical to examine the specific proposition which the neuroscientific evidence seeks to establish. For example, if defense counsel seeks to introduce evidence that severe parental abuse resulted in damage to an individual's pre-frontal cortex, and thus has compromised his reasoning capacities, such evidence may have significant probative value because there is a general consensus of a linkage between prefrontal cortex damage and impaired reasoning.

Additionally, if a defendant suffers from frontal lobe disorder, caused by a severe automobile accident when he was a child, then evidence of impulse control problems will also be relevant to that individual's culpability, because there is a well-known connection between frontal lobe disorder and volitional control. Thus, simply because some individuals with similar injuries may not engage in criminal conduct, it does not follow that the science is faulty or that an individual will engage in illicit conduct as a result, at least in part, of such injuries.

3. It Is Too Costly and Unrealistic to Conduct Neuroimaging Studies of Every Defendant That Is Accused or Convicted of a Violent Criminal Offense

This argument is not without merit—it would be both impractical and unnecessary to subject every criminal defendant to neuroimaging examinations to determine if underlying brain disorders may have influenced a particular criminal act. However, this argument does not mean that *some* defendants cannot be subject to neuroimaging studies in an attempt to demonstrate reduced culpability for a particular crime. The method by which to separate those defendants that should or should not have such examinations is to look for the risk factors set forth *supra* in Part II, namely: (1) young maternal age during pregnancy; (2) maternal alcohol, nicotine, drug use and poor diet and medical care during pregnancy;

(3) fetal mal-development, minor physical abnormalities, fetal alcohol syndrome; (4) parental criminality and drug abuse; (5) poor offspring nutrition and medical care; (6) domestic violence to the mother during pregnancy; (7) exposure to parental abuse and emotional neglect; (8) exposure to deplorable home conditions; (9) exposure to toxins, lead, parasites, infection; (10) poor socio-economic conditions; and (11) substance abuse and dependence history.

Importantly, if defense counsel is aware that the defendant's background includes one or several of these factors, then he should petition the Court to require that neuroimaging studies be performed, because there exists a higher likelihood that the defendant may suffer from a type of brain damage that bears directly upon his culpability. Furthermore, the Court should then order, and the State should provide the resources for, such examinations, the results of which can be used at the sentencing phase of the trial. This procedure is particularly important because, as set forth above, a high percentage of habitually violent offenders, convicts on death row, sexual offenders, and severely psychopathic criminals have a history of head injuries.[259] As a result, neuroscientific evidence can prove very valuable to those individuals with brain injuries because it is relevant to culpability.

4. There Is No Evidence That the Frontal Lobes, the Amygdala, or Any Other Aspect of the Brain Is the Sole Cause of Impulse Control and Other Behavioral Problems

This assertion is also meritorious, and requires careful use of neuroscientific evidence in the courtroom. The fact is that there are a myriad of factors that influence and result in criminal behavior, and cognitive neuroscience cannot—and has not—definitively answered the question as to all of the causal factors that drive criminal decision-making. Indeed, there are both internal and external influences that result in criminal conduct, and neuroscience cannot simply assert that it has all of the answers to explain why individuals act as they do. If that were true, then it would be very easy to treat those convicted of crimes and reduce the recidivism rate. It is obvious, however, that this is not the case.

Significantly, however, what this argument ignores is that neuroscientific findings have established that frontal lobe syndrome

259. *See supra* note 133 and accompanying text.

and neural disruption involving the amygdala and frontal lobes/prefrontal cortex do have substantial consequences that affect judgment, volition, decision-making, and response to external stimuli. As such, neuroscience has established that these injuries/disorders are, at the very least, a causal factor in the commission of criminal behavior. Thus, while it may only be one cause among the multi-factorial aspects that influence criminal behavior, it is nonetheless a valuable discovery that connects brain disorders with human action. Consequently, because it is at least one of many causes, the admission of neuroscientific data in the courtroom is both relevant and probative.

However, the introduction of neuroscientific evidence should be subject to the following caveat: it should be limited only to those findings that thus far have engendered a consensus within the scientific community. There are a vast amount of studies being conducted concerning brain chemistry and human behavior. In the field of cognitive neuroscience, there is a separation between what scientists know and what they do not know: there is a consensus for certain issues and not others. Accordingly, since evidence that, for example, frontal lobe disorder is a causal factor in behavioral control problems—and there is a consensus among scientists for this proposition—then such evidence should be admitted for the purpose of demonstrating a causal connection between the frontal lobes and the specific crime with which the defendant is being charged. Ultimately, the problem with the above argument is that it requires too much from the neuroscientific data and fails to recognize that there are certain limited yet material circumstances in which the use of this evidence can be valuable and persuasive.

5. Neuroscientific Studies in General Are Not Reflective of the Individual's Brain Images

A strong argument can be made that the *general* findings of neuroscientific studies from fMRI brain images do not necessarily mean that the *individual's brain* is consistent with such findings. For example, expert testimony that frontal lobe disorder causes impulse control problems may be evidenced by repeated brain-imaging studies, but that does not mean that a particular individual's brain suffers from the same disorders with the same consequences.

The solution to this problem, as stated above, is to provide for individual neuroimaging for those defendants whose background suggests that they may have suffered, or are suffering from, a brain

injury that is relevant to culpability. This procedure is particularly important considering the startling rates of head injuries among habitually violent offenders, convicted death row inmates, and severely psychopathic criminals described above.[260] Thus, it is neither necessary nor expected that defense counsel should have to rely upon general neuroscientific findings. Instead, should there exist factors indicating a likelihood of frontal lobe or other brain disorders, then as a matter of due process a neurological examination should be conducted.

V. CONCLUSION

Cognitive neuroscience is assisting the criminal law in understanding why individuals make certain choices and decisions that transgress societal norms and community standards. There could be no greater goal for criminal law, and law generally, than to understand how the brain contributes to human action, because our system of criminal justice relies on the premise that individuals' choices are the subject of free will and autonomy. If this were not the case, even to a limited extent, the criminal law must re-think the justifications for punishing those convicted of crimes, how we treat such individuals, and what specific reforms are necessary to reflect the true nature of human behavior.

In this way, cognitive neuroscience has tremendous potential to challenge our most basic assumptions about what it means to be moral agents: namely, that we are capable of making reasoned choices not due to certain predispositions or internal maladies, but because we can think cognitively apart from the brain's influences or affects. Ultimately, the very essence of mind/brain dualism will be debated, and the philosophical and ontological underpinnings of this argument, when viewed in light of the available data, will hopefully allow us to make choices that are consistent with who we are as humans and what we represent as rational decision makers.

260. Fabian, *supra* note 128, at 26.