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In the Wasteland of Your Mind: Criminology, Scientific Discoveries and the Criminal Process

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"IN THE WASTELAND OF YOUR MIND": CRIMINOLOGY, SCIENTIFIC DISCOVERIES AND THE CRIMINAL PROCESS

Michael L. Perlin & Alison J. Lynch*

ABSTRACT

This paper addresses a remarkably under-considered topic: the potential impact of scientific discoveries and an increased understanding of the biology of human behavior on sentencing decisions in the criminal justice system, specifically, the way that sentencing has the capacity to rely on scientific evidence (such as brain imaging) as a mitigating factor (or perhaps, in the mind of some, as an aggravating factor) in determining punishment.

Such a new method of evaluating criminality, we argue, can be beneficial not only for the defendant, but also for the attorneys and judge involved in the case. If used properly, it may help to provide a more truly objective set of factors

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that contribute to an individual’s particular offending patterns, rather than continuing reliance on sentencing schemes that are swayed by societal bias and prejudice. However, it can become problematic if a legal system relies too heavily on untested theories, and even more problematic in cases in which science does not support legal conclusions. Scientific discovery moves faster than the law, and it is critical to make sure that the legal system is given an opportunity to catch up, rather than risk allowing “junk science” to influence how a defendant is treated.

In this paper, we first examine criminal sentencing procedures, and discuss how a criminological view of a defendant’s offending behavior can work to mitigate harshly inappropriate sentences. In this context, we consider how Federal Sentencing Guidelines cases consider the significance of mental disability in sentencing decisions, especially in the aftermath of the Supreme Court’s decision in United States v. Booker. Then we review recent work on the biological bases of certain criminal behaviors and how it can be captured through brain imaging. Next, we consider how the use of such evidence continues to expand in the criminal trial process. Following this, we look at how the school of therapeutic jurisprudence can better inform how the legal system incorporates such evidence. Finally, we offer our
recommendations for ensuring that scientific evidence is introduced appropriately in the legal system.
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INTRODUCTION

The most important change in the structure of the criminal justice system in the past 40 years is in the area of sentencing. It is not simply that sentences are longer, are more likely to be determinate, and are more likely to be imposed for a far vaster range of crimes than were on the books in the 1970's. Those are all true, and are all extraordinarily troubling, and have combined to make the criminal justice system far "worse" (this descriptor cannot be accurately measured, but its point should be clear). But, the single most important change in the law of sentencing has been the adoption of sentencing guidelines with upward and downward departures, and the concomitant requirement that judges explain why they are imposing a sentence.

It comes as a surprise to many to learn that there were no published opinions from any court in the United States about the reasons why a certain sentence was being imposed before Judge Marvin Frankel's magisterial opinion in 1976 in United States v. Bergman, in which Judge Frankel relied heavily on section 7.01 of the Model Penal Code, in imposing a four-month sentence on the defendant—who ran a chain of

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3 United States v. Bergman, 416 F. Supp. 496, 501 (S.D.N.Y. 1976) ("Our sentencing system, deeply flawed, is characterized by disparity. We are to seek to 'individualize' sentences, but no clear or clearly agreed standards govern the individualization. The lack of meaningful criteria does indeed leave sentencing judges far too much at large.").
financially and morally corrupt hellish nursing homes, but who was never convicted of any offenses arising from that criminal enterprise—for tax fraud. Prior to the Bergman decision, in most jurisdictions, judges would (maybe) say a sentence or two, mouth a platitude or two, and impose a sentence that made sense to them but had no articulated penal or criminological rationale. The irony of Bob Dylan's song *Joey*, about the death of the mobster Joey Gallo, resonates:

“What time is it?” said the judge to Joey when they met  
“Five to ten,” said Joey. The judge says, “That’s exactly what you get.”

*Bergman* ushered in a new era in criminal sentencing. Courts, legislatures, scholars, and policy “think tanks” began, for the first time, to take seriously the whim and caprice of the sentencing process, a process previously supported by no valid or reliable criminological research or evidence. This led to the creation of the U.S. Sentencing Commission, the

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5 One of the authors (MLP) was a Public Defender in New Jersey from 1971 to 1974. This was his experience, and it was in accord with the experiences of colleagues in other states who reported precisely the same lack-of-explanations in the vast majority of their cases.


7 See generally Stith & Koh, *supra* note 2.

8 The Commission was created as part of the Comprehensive Crime Control Act of 1984, Pub. L. No. 98-473, § 991, 98 Stat. 1837, 2017 (codified as amended at 28 U.S.C. § 991 (2012)). It was charged with designing a sentencing structure that would avoid
adoption of the Federal Sentencing Guidelines\textsuperscript{9} [hereinafter “Guidelines”] (emulated subsequently by many, though not all states),\textsuperscript{10} and the Supreme Court’s controversial decisions in \textit{Mistretta v. United States} (initially making the Guidelines mandatory),\textsuperscript{11} and, later, its decision in \textit{United States v. Booker} (subsequently making them advisory).\textsuperscript{12}

\textsuperscript{9} U.S. SENTENCING COMM’N, GUIDELINES MANUAL §§ 1–2 (2014).


This background introduces the issues we address in this paper. Here, we focus on the potential impact of scientific discoveries and an increased understanding of the biology of human behavior on sentencing decisions in the criminal justice system. Specifically, we look at the way that sentencing has the capacity to rely on scientific evidence (such as brain imaging) as a mitigating factor (or perhaps, in the mind of some, as an aggravating factor) in determining punishment. Remarkably, these questions are still significantly “under the radar” for criminologists, that cohort of experts that we might logically expect to be the most interested in it.

In spite of Booker, a significant number of federal judges continue to make sentencing decisions “as if they were still under the thrall of Mistretta.” Michael L. Perlin, “I Expected It to Happen/I Knew He'd Lost Control”: The Impact of PTSD on Criminal Sentencing after the Promulgation of DSM-5, 2015 UTAH L. REV. 881, 886 & n.28 (2015) (discussing research reported upon in Alison Siegler, Symposium, Rebellion: The Courts of Appeals’ Latest Anti-Booker Backlash, 82 U. CHI. L. REV. 201, 201–03 (2015)).


Thus, a recent article revealed that a paltry 0.5% of all research articles in one of the leading criminology journals over the prior nine years had dealt with questions of biology or genetics. David J. Smith, Wider and Deeper: The Future of Criminology in Europe, 11 EUR. J. CRIMINOLOGY 3, 11 (2014). On the role of criminologists in the courtroom in general, see DANIEL B. KENNEDY, CRIMINOLOGISTS IN THE COURTROOM: CONSULTING AND FORENSIC CRIMINOLOGY (Oct. 4–6, 2007), available at www.forensiccriminology.com/pdf/AACS_with_page_10.pdf (paper presented at the annual conference of the Association for Applied and Clinical Sociology). On how criminologists are “uniquely situated to create evidence-based knowledge to assist policymakers . . . help close the justice gap,” see Richard A. Leo, The Justice Gap and the Promise of Criminological Research, 15 CRIMINOLOGY CRIM. JUST. L. & SOC’Y 1, 26
Such a new method of evaluating criminality can be beneficial not only for the defendant, but also for the attorneys and judge involved in the case. If used properly, it may help to provide a more truly objective set of factors that contribute to an individual’s particular offending patterns, rather than continuing reliance on sentencing schemes that are swayed by societal bias and prejudice. However, it can become problematic if a legal system relies too heavily on untested theories, and even more problematic in cases in which science does not support legal conclusions. Scientific discovery moves faster than the law, and it is critical to make sure that the legal system is given an opportunity to catch up, rather than risk allowing “junk science” to influence how a defendant is treated.


16 See, e.g., Polina M. Dostalik, Embryo “Adoption”? The Rhetoric, the Law, and the Legal Consequences, 55 N.Y.L. SCH. L. REV. 867, 893 (2010-11) (“Science is progressing faster and faster every day, but the law is not keeping up.”).

In this paper, we first examine criminal sentencing procedures and discuss how a criminological view of a defendant’s offending behavior can work to mitigate harshly inappropriate sentences. Then, we review recent work on the biological bases of certain criminal behaviors and how it can be captured through brain imaging. Next, we consider how the use of such evidence continues to expand in the criminal trial process. Following this, we look at how the school of therapeutic jurisprudence can better inform how the legal system incorporates such evidence. Finally, we offer our recommendations for ensuring that scientific evidence is introduced appropriately in the legal system.

Since 2008, one of the authors (MLP) has written multiple articles about neuroimaging in the context of the insanity defense, in the criminal trial process in general, and in inquiries about whether a death row case, see Howard Zonana, *Sex Offender Testimony: Junk Science or Unethical Testimony?*, 29 J. AM. ACAD. PSYCHIATRY & L. 386, 387 (2000). For an example of an ongoing debate about the validity of a type of scientific evidence (deception detection through neuroimaging), see Matthias Gamer, *Mind Reading Using Neuroimaging: Is This the Future of Deception Detection?*, 19 EUROPEAN PSYCHOLOGIST 172 (2014).

Beyond the scope of this paper is an analysis of cases and commentaries on the use of such evidence in incompetency to stand trial proceedings, insanity defense cases and in death penalty mitigation/clemency applications. See, e.g., Baumruk v. State, 364 S.W.3d 518, 530 (Mo. 2012) (incompetency); United States v. Montgomery, 635 F.3d 1074, 1090 (8th Cir. 2011) (insanity); Shellito v. State, 121 So.3d 445, 456–58 (Fla. 2013) (death penalty mitigation); Sanborn v. Parker, No. 99-678-C, 2011 WL 6152849, at *2–4 (W.D. Ky. 2011) (death penalty clemency application). We address these issues broadly in a paper-in-progress. See Michael L. Perlin & Alison J. Lynch, “My Brain Is So Wired”: Neuroimaging’s Role in Competency Cases Involving Persons with Mental Disabilities (work in progress; paper to be presented to the American Society of Criminology annual conference, November 2016). On its potential application in cases involving competency to be executed, see Michael L. Perlin, “‘Good and Bad, I Defined These Terms, Quite Clear No Doubt Somehow’: Neuroimaging and Competency to be Executed after Panetti,” 28 BEHAV. SCI. & L. 621, 688 (2010). On the potential admissibility of such evidence on questions of witness truthfulness, see William A. Woodruff, *Evidence of Lies and Rules of Evidence: The Admissibility of MRI-Based Expert Opinion of Witness Truthfulness*, 16 N.C. J. L. & TECH. 105, 249 (2014).
prisoner is competent to be executed. The other author (AJL) is currently working on an article about how attorneys can appropriately use neuroscience as mitigating evidence and work to combat stereotypes and prejudices against those with mental illness through therapeutic jurisprudence. When we started on this journey, there was very little in the legal literature to draw on, but this has changed dramatically over the past few years. We hope that this article will offer some food for thought as to how this "new science" may have an impact—either positive or negative—on the criminal sentencing enterprise.


22 On why neuroimaging evidence should be allowed as an aid to defendants, see Adam Teitcher, Weaving Functional Brain Imaging into the Tapestry of Evidence: A
Our title comes from Bob Dylan’s “apocalyptic” song, *When the Night Comes Falling from the Sky,* in which Dylan sings: “You’ll find me/In the wasteland of your mind/When the night comes falling from the sky.” Elsewhere in the song, Dylan sings, “I can see through your walls,” “This time I’m asking for freedom/Freedom from a world which you deny,” and “I can’t provide for you no easy answers.” Wastelands (or, per T.S. Eliot, “waste lands”) are vital in Dylan’s lyrics, and here, we have our own wasteland: the vast discrepancies between scientific findings and juror understanding.

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There is some empirical evidence that lay people are more likely to believe negative explanations of behavior when they are supported by neuroimages than positive explanations without neuroimages. See, e.g., Deena Weisberg et al., *The Seductive Allure of Neuroscience Explanations,* 20 J. COGNITIVE NEUROSCIENCE 470, 475 (2008).


25 Id.

and hypotheses and the legal interpretation of these findings. In this paper, we seek to close this gap and bring the legal field more into compliance with modern criminology and behavioral science. A large part of that work will be sorting through what is known about the biological nature of criminal behavior, and where that fits in sentencing, to provide answers to those hard questions and issues that Dylan references (as to lack of “easy answers,” the “denial” of the (real) world, the quest for freedom). Another part will be educating attorneys and researchers alike on how best to integrate these two worlds, and move beyond the wasteland to find clarity in the middle ground.

I. ON SENTENCING

As one author has written: “Concerns about arbitrariness and unjustifiable disparities in criminal sentencing prompted Congress to enact the Sentencing Reform Act of 1984, which eliminated nearly most of the [sentencing] discretion that federal judges had historically possessed.” Sentences were characterized as “unpredictable and unjustifiable” and judicial discretion was similarly characterized as “unfettered.” The 1984

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27 See, e.g., Daniel D. Langleben & Jane Campbell Moriarty, *Using Brain Imaging for Lie Detection: Where Science, Law, and Policy Collide*, 19 PSYCHOL. PUB. POL’Y & L. 222, 229 (2013) (discussing how “complications arise from discrepancies in the meaning of crucial terms such as validity and reliability between law and science.”). For a fascinating analysis in the field of environmental law and science, see Deborah M. Brosnan, *Symposium, Science, Law, and the Environment: The Making of a Modern Discipline*, 37 ENVTL. L. 987, 987 (2007) (calling for the recognition “that science and law are intertwined,” and advocating “the development of a new modern discipline that trains students to be fluent in science, law, and policy in order to better meet today’s environmental needs.”).


29 Id. at 812.
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Sentencing Reform Act\(^{30}\) was thus enacted in an attempt to bring about a measure of regularity and uniformity in federal sentencing procedures.\(^{31}\) Under the Act, a series of permissible sentencing ranges—via the Federal Sentencing Guidelines—was created for each federal criminal offense.\(^{32}\)

There were some departures allowed. Most importantly, for the purposes of this paper, the sentencing court initially was allowed to depart from the prescribed ranges where “(1) the defendant committed the offense while suffering from a significantly reduced mental capacity; and (2) the significantly reduced mental capacity contributed substantially to the commission of the offense.”\(^{33}\) ... [but not if] the significantly reduced mental capacity was caused by the voluntary use of drugs or other intoxicants.\(^{34}\) In such cases, a lower sentence “may be warranted” to


\(^{31}\) PERLIN & CUOCO, supra note 12, at § 16-2.1.


\(^{33}\) See, e.g., United States v. Quinones-Medina, 553 F.3d 19, 26 (1st Cir. 2009); United States v. Goossens, 84 F.3d 697, 702 (4th Cir. 1996).

\(^{34}\) GUIDELINES MANUAL, supra note 9, at § 5k2.13. The Commission has defined “reduced mental capacity” to include volitional impairments, meaning conditions affecting the ability to control behavior despite knowing that it is wrong.” See id. at cmt. n.1, as discussed in Amanda R. Evansburg, “But Your Honor, It’s in His Genes” The Case for Genetic Impairments as Grounds for a Downward Departure under the Federal Sentencing Guidelines, 38 AM. CRIM. L. REV. 1565, 1580 (2001). The case law is strangely unhelpful in fleshing out this definition. For rare examples in which courts have sought to clarify the term, see United States v. Harris, 1994 WL 683429, at *5 (S.D.N.Y. 1994) (“[A] recurrent failure to resist impulses, if carried to such an extreme as to be measurable by professionally articulated diagnostic criteria, may qualify for consideration under the Guideline”); United States v. Cotto, 793 F. Supp. 64, 67 (E.D.N.Y. 1992) (“[I]n combination, the defendant’s near retardation, his vulnerability, his efforts at rehabilitation, and the incompetence reflected in the execution of the crime warrant a downward departure.”).
reflect the extent to which the reduced mental capacity contributed to the commission of the offense, as long as the defendant's criminal history "does not indicate a need for incarceration to protect the public." The constitutionality of these Guidelines was then upheld in *Mistretta v. United States.*

In the years after the *Mistretta* decision, however, dissatisfaction emerged with regards to the rigidity of the Guidelines, and the Supreme Court subsequently "radically altered Guidelines practice." First, in *Blakely v. Washington,* the Supreme Court struck down the Washington state sentencing guidelines as unconstitutional. There, the Supreme Court applied its earlier ruling in *Apprendi v. New Jersey* to hold that a defendant's Sixth Amendment right to a jury trial was violated by a sentencing scheme that allowed a judge to impose a sentence above the statutory maximum based on facts neither admitted by the defendant nor found beyond a reasonable doubt by a jury. *Blakely* and *Apprendi* thus

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37 Perlin, supra note 12, at 900.


40 Blakely, 542 U.S. at 303–05.
paved the way for the Supreme Court’s rejection of the Mistretta standard in United States v. Booker, replacing it with a new formulation making the Guidelines “advisory.” Both scholars and congressional leaders saw Blakely and its progeny as a backlash against the severity of mandatory minimums and the Federal Sentencing Guidelines.

A. JUDICIAL INTERPRETATIONS OF THE GUIDELINES

How have courts dealt with these issues? In several pre-Booker cases, courts have invoked the Guidelines to reduce a defendant’s sentence based on his reduced mental capacity. In one case, a history of

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42 Perlin, supra note 12, at 885. For an important example of judicial dissatisfaction, see United States v. Delgado, 994 F. Supp. 143, 144 (E.D.N.Y. 1998) (Weinstein, J.) (“Placing this defendant with minimal mens rea in prison for the long period suggested by the Guidelines would not serve society well”).
44 The material infra accompanying notes 45–56 is largely adapted from Perlin, supra note 12, at 895–99.
45 See also United States v. Lighthall, 389 F.3d 791 (8th Cir. 2004) (stating that a finding of compulsive disorder in the defendant warranted a downward departure for diminished capacity under the Guidelines); United States v. Cantu, 12 F.3d 1506 (9th Cir. 1993) (holding posttraumatic stress disorder is type of mental disorder that can support mental disability-based downward departure); United States v. Lara, 905 F.2d 599 (2d Cir. 1990) (upholding departure from Guidelines based on defendant’s likely “extreme vulnerability” in a correctional facility); United States v. Cotto, 793 F. Supp. 64 (E.D.N.Y. 1992) (finding defendant’s near retardation, vulnerability, efforts at rehabilitation and incompetence warranted downward departure). But see United States v. Valdez, 426 F.3d 178 (2d Cir. 2005) (finding defendant’s IQ did not warrant a downward departure for diminished capacity under the Guidelines); United States v. Sheehan, 371 F.3d 1213 (10th Cir. 2004) (finding downward departure was not granted for diminished capacity under the Guidelines even though he had been diagnosed with substance
schizophrenia and other emotional disturbances was seen as sufficient to meet the Guidelines’ criteria, thus warranting a sentence reduction. In another case, the Ninth Circuit admonished that it was not necessary to find that the defendant’s reduced mental capacity amounted to “but-for causation” in order to reduce a sentence; what was necessary was that his diminished mental capacity “comprised a contributing factor in the commission of the offense.”

Other cases have found, variously:

- That the “precise degree” to which the defendant's mental illness contributed to his criminal activity need not be “pinpoint[ed] or quantif[ied].”

- That a defendant's assertion of the insanity defense did not preclude a downward departure; and

- That a defendant's post-arrest efforts at drug rehabilitation might warrant such a departure.

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48 United States v. Royal, 902 F. Supp. 268, 272 (D.D.C. 1995); see also United States v. Sutherland, 2001 WL 1502913, at *9 (W.D. Va. 2001) (finding no “foolproof method” to determine how much diminished capacity is needed to contribute to an offense); Leandre, 132 F.3d at 805 (Guidelines “require[] no more than that the defendant's reduced capacity be a contributing factor, to some degree, to his offense.”).

49 United States v. Waldman, 310 F.3d 1074, 1079 (8th Cir. 2002); United States v. Barnes, 46 F.3d 33 (8th Cir. 1995); United States v. Sam, 467 F.3d 857 (5th Cir. 2006); United States v. Valdez, 426 F.3d 178 (2d Cir. 2005); United States v. Taylor, 483 F. Appx. 992 (6th Cir. 2012) (finding that pleading the insanity defense does not preclude a downward departure for acceptance of responsibility). But see GUIDELINES MANUAL, supra note 9, at § 3E.1.1(a) (“If the defendant clearly demonstrates acceptance of responsibility for his offense, decrease the offense level by 2 levels.”).

In other words, some courts have taken seriously their power to mitigate sentences based on “reduced mental capacity.” But generally, determinations to not depart from the Guidelines are upheld, by way of example, in cases in which:

- The underlying crimes were violent and the defendant's violent criminal record raised the possibility that he would be a threat to public safety;\(^{51}\)
- The court did not find the defendant's disability so significant as to warrant such a reduction;\(^{52}\)
- The defendant's behavior was not sufficiently aberrant;\(^{53}\)
- The court did not find defendant's “extraordinary post-arrest efforts” at drug rehabilitation sufficient to warrant such a reduction;\(^{54}\)


\(^{53}\) See, e.g., United States v. Castano-Vasquez, 266 F.3d 228, 235 (3d Cir. 2001); United States v. Constantine, 263 F.3d 1122 (10th Cir. 2001); United States v. Benally, 215 F.3d 1068 (10th Cir. 2000); Thompson v. United States, 2000 WL 821711 (N.D. Ill. 2000).
• There was no connection demonstrated between the defendant's diminished capacity and the commission of the crime;\(^\text{55}\) or

• The court felt that the defendant did not take sufficient responsibility for his role in the criminal offenses in question.\(^\text{56}\)

In short, although mental capacity plays some role in criminal sentencing, it is by no means a dispositive factor. The cases that do take it into account appear to be idiosyncratic, unmoored by any overarching theory or by any uniform reliance on the sorts of external factors about which science potentially may offer some insights, other than the acknowledgment that there may be some biological basis for the behavior at issue.

II. BIOLOGICAL BASES OF CRIMINAL BEHAVIOR

While the possibility for incorporation of insights from the scientific community\(^\text{57}\) in the sentencing process is ever growing, it is

\(^{54}\) United States v. Zeigler, 1 F.3d 1044 (10th Cir. 1993); see also, e.g., United States v. Barton, 76 F.3d 499 (2d Cir. 1996); United States v. Williams, 37 F.3d 82 (2d Cir. 1994), vacated, 65 F.3d 301 (1995).


For a survey of representative cases in all instances, see Perlin, supra note 12, at 897–98 n. 78.

\(^{57}\) Here, we mean “scientific community” in its broadest relevant sense (psychiatry, psychology, neuroscience, and all related fields). This is an important reminder because of the fluidity and rapidity of scientific findings. While in some ways this may seem like semantics, the distinction is important: what we know is less likely to change as rapidly as
It is probably worth noting that, per Professor Stephen Morse, “neuroscience . . . is purely mechanistic and eschews folk-psychological concepts and discourse,” concepts that are frequently at the heart of criminal law policy and decision-making. Stephen Morse, Criminal Law and Common Sense: An Essay on the Perils and Promise of Neuroscience, 99 MARQUETTE L. REV. 39, 58 (2015).


The desire to understand the biological bases of violent or criminal behavior did not appear with the advent of neuroimaging technology. Scientific “trends” of assessing criminality began long before today’s technology with the introduction of phrenology, Franz Joseph Gall’s attempt to explain away complex behavior based on the size and location of skull protuberances. While we no longer introduce measurements of a defendant’s head during the mitigation phase of a sentencing hearing, attorneys still seek to offer physiological explanations for the criminal actions of their clients. The most notorious example of this was the alleged use of the “Twinkie defense” in the murder trial of Daniel White, who killed Harvey Milk in San Francisco and was subsequently convicted of manslaughter. Although the fact that the defendant ate excessive amounts of Twinkies was not purported to be the cause of the killing, “it

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attained the dubious status of an urban legend, which is repeatedly trotted to demonstrate the imagined bankruptcy of the criminal justice system.\textsuperscript{64}

Today, the argument can certainly be made that fMRIs, PET scans and SPECT scans\textsuperscript{65} constitute the tools of our “modern phrenology.” However, the researchers who posit that certain neurological characteristics may correlate to antisocial behavior are, by and large, not ready to take the stand and swear that this is the case for each individual defendant.\textsuperscript{66} This is the crux of the division between modern science and


\textsuperscript{65} Based on the type of evidence an attorney seeks to introduce (structural or functional), there are several different tools at his or her disposal. Functional magnetic resonance imaging (fMRI) most effectively measures function, in this case, blood flow and activity in the brain while a person is engaged in a task. See Teneille Brown & Emily R. Murphy, \textit{Through a Scanner Darkly: The Use of fMRI as Evidence of Mens Rea}, 22 J.L & HEALTH 319, 322 (2009). Positron emission tomography (PET) scans operate similarly to fMRIs, looking indirectly at functional assessments of cognitive activity while an individual engages in a task. See Jennifer Kulynych, \textit{Psychiatric Neuroimaging Evidence: A High-Tech Crystal Ball?}, 49 STAN. L. REV. 1249, 1255–56 (1997). Single-photon emission computerized tomography (SPECT) scans also measure blood flow to regions, and attempt to determine “active” areas of the brain. However, they have been deemed to not be “generally accepted” in some courts due to how little is known comparatively about the validity of SPECT for analyzing criminality. See People v. Yum, 3 Cal. Rptr. 3d 855, 857 (Cal. Ct. App. 2003) (depublished) (barring SPECT evidence offered to show diminished capacity because SPECT had not become “generally accepted” for that purpose).

the law: a researcher who publishes a paper speculating that a relationship may exist between two variables does not expect that paper to be the final word on the matter.\textsuperscript{67} Consider the contrast with Justice Jackson’s famous dictum from over sixty years ago: “We are not final because we are infallible, but we are infallible only because we are final.”\textsuperscript{68} A researcher will want replication studies with larger groups, more diverse groups, the same initial group, and randomized groups to validate his hypothesis, which will be fluid and easily changed throughout this process. This is not the case in the law. A judge issuing an order expects that order to be the final word, subject, of course, to further appeals. Unlike in scientific discovery, there is no room for, or encouragement of, consistent validation of a finding in the law.\textsuperscript{69}

\begin{flushright}
\footnotesize{\textsuperscript{67} See David S. Caudill & Richard E. Redding, Junk Philosophy of Science?: The Paradox of Expertise and Interdisciplinarity in Federal Courts, 57 WASH. & LEE L. REV. 685, 689 (2000) (explaining that the law must understand that “science is sometimes tentative and uncertain, that scientists often disagree, that scientists have other interests (in their careers, in helping a client, in getting paid), and that once-established theories are later replaced.”).}
\footnotesize{\textsuperscript{68} Brown v. Allen, 344 U.S. 443, 540 (1953).}
\footnotesize{\textsuperscript{69} Id.; see also Bennett L. Gershman, Now You See It, Now You Don’t: Depublication and Nonpublication of Opinions Raise Motive Questions, 73 N.Y. ST. B.J. 36 (Oct. 2001) (articulating the idea within the law that “[b]y authoritatively declaring and interpreting a general principle of law, the opinion promotes stability, certainty, and predictability.”).}
\end{flushright}
This difference between the disciplines creates problems when science continues to evolve and the law stays stagnant, which is precisely what has happened in the case of neuroimaging. Science has begun to understand when it is most appropriately used, based on the field's evolving knowledge of the relationship between structural and functional brain abnormalities, and antisocial behavior. The law has failed to take this into account because, by its very nature, it has been unable to issue decisions with the same rapidity as the neuroscientists. Also, our

70 Courts, of course, have inveighed against the notion that the law is stagnant. See, e.g., U.S. ex rel. Kimball v. Cathedral Rock Corp., 2010 WL 147810, at *1 (E.D. Mo. 2010) (“Assumption that the law has remained stagnant is neither wise nor satisfies an attorney’s ethical obligation to his client.”); Mercier v. Bradley Real Estate, 251 P.3d 673, at *4 (Kan. 2011) (“The law is never stagnant. It expands and contracts with the events of each case where it is applied.”).

71 Paradoxically, the Supreme Court has considered neuroscientific evidence in the narrow area of capital sentencing in the context of whether juveniles or certain persons with mental disabilities can be executed. See, e.g., Roper v. Simmons, 543 U.S. 551 (2005) (deciding those under the age of 18 are less morally culpable for their conduct because of neurological differences from adults, and so are ineligible for the death penalty); Atkins v. Virginia, 536 U.S. 304 (2002) (deciding those with intellectual disabilities are also ineligible for the death penalty based on neurological differences). But see Schriro v. Landrigan, 550 U.S. 465, 480–81 (2007) (reversing the decision granting a capital defendant an evidentiary hearing to explore, inter alia, the neurological damage the defendant likely suffered as a result of fetal alcohol syndrome, characterizing such mitigation evidence as “weak”). See generally Peggy Sasso, Implementing the Death Penalty: The Moral Implications of Recent Advances in Neuropsychology, 29 CARDOZO L. REV. 765 (2007). For a discussion of other problems with the law’s use of social science, see Owen D. Jones & Timothy H. Goldsmith, Law and Behavioral Biology, 105 COLUM. L. REV. 405, 407–08 (2005) (describing the law’s movement towards understanding the causes of human behavior as “haphazard, idiosyncratic and unsystematic.”). However, there has been little “spillover” from decisions such as Roper and Atkins to sentencing in “ordinary” cases. The developments in the law as it relates to the determination of intellectual disability for purposes of assessing whether an individual is competent to be executed speaks to this. See Hall v. Florida, 134 S.Ct. 1986 (2014), discussed in this context in Michael L. Perlin, “Merchants and Thieves, Hungry
federalist system means that, absent a constitutional decision by the U.S. Supreme Court, there is no likelihood of uniformity, and the notion of inter-rater reliability will inevitably be missing.

Today, what we understand about the biological bases of criminal behavior remains in flux. That is not to say that we do not have some generalities that can guide us, but, to borrow a term from the criminal law, we do not have “proof beyond a reasonable doubt.” In some cases, we may not even have “clear and convincing” evidence of the link between brain and behavior; all we may have is guessing and speculation.

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72 See, e.g., New State Ice Co. v. Liebmann, 285 U.S. 262, 311 (1932) (Brandeis, J., dissenting) (“[T]he happy incident[] of the federal system that a single courageous state may, if its citizens choose, serve as a laboratory.”).


74 Compare Richard E. Redding, The Brain-Disordered Defendant: Neuroscience and Legal Insanity in the Twenty-First Century, 56 AM. U. L. REV. 51, 56 (2006) (“Though criminal behavior seldom is 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.”), with Joan Vogel, Biological Theories of Human Behavior: Admonitions of a Skeptic, 22 VT. L. REV. 425, 426 (1997) (“How can we legitimately theorize about the biological roots of criminal behavior when the very concept of crime differs cross-culturally?”).

75 For a cautionary perspective, see Daniel Goldberg, Against Reductionism in Law & Neuroscience, 11 Hous. J. Health L. & Pol'y 321 (2012).
What follows is a brief primer on the current understanding of neuroscience as it relates to the neurophysiology of criminal or antisocial behavior, and why it is potentially so significant for the inquiries we address in this paper.  

First, it is important to understand that neurophysiology can refer to either structure or function of the brain. Generally used in the context of abnormalities, the term “structural” refers to a change or an existing abnormality in the gross anatomical structure of the brain, such as loss of volume or formation defect. Many studies have sought to examine whether structural abnormalities in various parts of the brain are connected to an increased likelihood of antisocial behavior.

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76 See Jana Buflkin & Vickie R. Luttrell, Neuroimaging Studies of Aggressive and Violent Behavior: Current Findings and Implications for Criminology and Criminal Justice, 6 TRAUMA, VIOLENCE & ABUSE 176, 186 (2005) (“Within an interdisciplinary framework that values neuroscience, virtually every essential sociological factor elaborated by criminologists, structural and processual, acquires a greater potential to explain aggression and/or violence and influence policy making.”). On the ways that law and neuroscience have become an “established interdisciplinary area of law,” see Oliver Goodenough & Micaela Tucker, Law and Cognitive Neuroscience, 6 ANN. REV. L & SOC. SCI. 61, 82 (2010).

77 For a more detailed explanation of the differences between structural and functional neurophysiology and imaging, see Choe, supra note 22, at 1510–11.

78 Id. at 1511.

79 See, e.g., David J. Schretlen & Anne M. Shapiro, A Quantitative Review of the Effects of Traumatic Brain Injury on Cognitive Functioning, 15 INT’L REV. PSYCHIATRY 341 (2003); Larry J. Siever, Neurobiology of Aggression and Violence, 165 AM. J. PSYCHIATRY 429, 432 (2008) (explaining that lesions and tumors in prefrontal cortex or temporal lobe have been implicated in aggressive and violent behavior); Joseph M. Tonkonogy & Jeffrey L. Geller, Hypothalamic Lesions and Intermittent Explosive Disorder, 4 J. NEUROPSYCHIATRY & CLINICAL NEUROSCIENCES 45, 45–47 (1992) (proposing hypothalamic lesions in the brain as factor in aggressive behavior); Sabrina Weber et al., Structural Brain Abnormalities in Psychopaths—A Review, 26 BEHAV. SCI. & L. 7, 13 (2008) (describing the link between frontal lobe damage and aggressive behavior). For the most recent research, see, e.g., V. Leutgeb et al., Brain Abnormalities in High-Risk Violent Offenders and Their Association with Psychopathic Traits and...
Functional abnormalities are defined as an abnormal neurophysiological reaction to a stimulus, like decreased or increased levels of neurological activation inconsistent with the activation levels observed in the general population. Researchers continue to focus on whether behavior may be consistent with observed functional abnormalities that are apparent through neuroimages.

While there is still an ongoing debate about the particular areas of the brain that can lead to criminal behavior, most research seems to focus on two particular areas: the prefrontal cortex and the amygdala. Based on the direction of current research, attorneys are more likely to introduce neuroimaging evidence that implicates abnormalities in these areas. However, as new research and understanding about neural activity emerges, areas such as the hippocampus, the angular gyrus, the anterior...

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80 Yaling Yang & Adrian Raine, Prefrontal Structural and Functional Brain Imaging Findings in Antisocial, Violent, and Psychopathic Individuals: A Meta-Analysis, 174 Psychiatry Res. 81 (2009); see also, Leutgeb et al., supra note 79.

81 See Choe, supra note 22, at 1511–12.


83 See generally Redding, supra note 74.

84 Choe, supra note 22, at 1510–15 (describing current research). For a review of studies revealing that areas associated with violent and/or aggressive behavioral histories are located in the prefrontal cortex and the medial temporal regions, see Bufkin & Luttrell, supra note 76.
cingulate, and the temporal cortex may also become more widely acknowledged as potentially related to criminal behavior.\(^8^5\)

The prefrontal cortex (PFC) is generally described as the structure that controls executive function, or “the ability to coordinate thought and action and direct it toward obtaining goals.”\(^8^6\) Coordinating thought and action is directly linked to making judgments and regulating behavior, which are both implicated in antisocial behavior.\(^8^7\) Additionally, many of the traits of antisocial personality disorder (ASPD), including moral decision-making, processing reward and punishment information, inhibiting responses, exhibiting proper social conduct, and processing social and emotional information are correlated with PFC activity.\(^8^8\)

Evidence linking a defendant’s particular behavior to abnormalities in the PFC may be used to demonstrate a physiological basis for the


\(^8^7\) Blair, supra note 82, at 5–6.

defendant’s antisocial behavior. Here, the issue is susceptibility and control. An individual with diminished or abnormal PFC activity could arguably be less culpable for his behavior, given that his impulse control is physiologically limited by a structural abnormality in the PFC.

Abnormalities in the PFC can be either structural or functional, and both can be measured by different types of neuroimaging studies. However, research has generally focused on structural abnormalities like a reduction in gray matter, rather than functional abnormalities throughout the PFC, with one study finding that individuals diagnosed with ASPD showed on average an 11% reduction in gray matter volume as compared to those without an ASPD diagnosis. This grows in importance in light of the reality that “jurors are less suspicious of expert testimony that is premised on organic (rather than psychodynamic) evidence.”

89 Choe, supra note 22, at 1511; see also id., at 1513–14 (reporting on studies that reveal that individuals with antisocial personality disorder have an 11 percent reduction in gray matter volume in comparison to normal controls, that repeat violent offenders also have reduced gray matter in the prefrontal cortex, that functional abnormalities in the prefrontal cortex are implicated in aberrant behavior, and that violent offenders who are nonpsychotic also show reduced blood flow in the prefrontal cortex) (citing, inter alia, Antonia S. New et al., Blunted Prefrontal Cortical 18Fluorodeoxyglucose Position Emission Tomography Response to Meta-Chlorophenylpiperazine in Impulsive Aggression, 59 ARCHIE GEN. PSYCHIATRY 621, 628 (2002); Henrik Soderstrom et al., Reduced Regional Cerebral Blood Flow in Non-Psychotic Violent Offenders, 98 PSYCHIATRY RES.: NEUROIMAGING 29, 40 (2000); Jari Tiihonen et al., Brain Anatomy of Persistent Violent Offenders: More Rather Than Less, 163 PSYCHIATRY RES.: NEUROIMAGING 201, 206 (2008)).

90 Choe, supra note 22, at 1512.

91 Id. at 1510.

92 Adrian Raine et al., Reduced Prefrontal Gray Matter Volume and Reduced Autonomic Activity in Antisocial Personality Disorder, 57 ARCHIE GEN. PSYCHIATRY 119, 125 (2000).

93 Perlin, Insanity Defense Cases, supra note 19, at 901 (citing, inter alia, Phoebe Ellsworth et al., The Death-Qualified Jury and the Defense of Insanity, 8 LAW & HUM. BEHAV. 81, 84 (1984)).
of finding is demonstrative of the type of evidence that may be introduced through neuroimaging. Generally, this kind of structural abnormality is fairly easy to demonstrate through the use of structural imaging like MRI, as it is static and does not depend on whether an individual is engaged in a task or behavior at the time of the scan.

There is reliable data that suggests that functional abnormalities in the PFC can also contribute to criminal or violent behavior. In one study, individuals with "impulsive aggression" demonstrated lower levels of neurological activation in the PFC during neuroimaging. Generally, activation and function refer to measurable blood flow to the area during the time an individual is performing a specific task that implicates that area.

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94 Alex B. Morgan & Scott O. Lilienfeld, A Meta-Analytic Review of the Relation Between Antisocial Behavior and Neuropsychological Measures of Executive Function, 20 CLINICAL PSYCHOL. REV. 113, 113 (2000) (finding that, on review of 39 studies, "[overall, antisocial groups performed .62 standard deviations worse on [executive function] tests than comparison groups; this effect size is in the medium to large range."). The PFC is responsible for executive functioning, and tests often refer to executive function scores to show someone's propensity to act violently or impulsively (traits which are frequently marked by lower scores on executive function tests and demonstrate functional abnormalities of executive function). See, e.g., Diana Fishbein, Neuropsychological Function, Drug Abuse, and Violence: A Conceptual Framework, 27 CRIM. JUST. & BEHAV. 139 (2000).


96 It is interesting to note that none of the articles cited supra in notes 89–95, virtually all written by individuals who are well known in the field of neuroscience for
In addition to the PFC, the amygdala is often studied in conjunction with antisocial behavior. Though the behaviors themselves may manifest in similar ways as those present in individuals with PFC abnormalities, the root cause is neurologically separate. One important and relevant function of the amygdala is its role in processing social emotions, like fear and guilt, rather than coordinating and executing behaviors, like the PFC.

The amygdala is key in helping an individual develop empathy, which is related to future behavior that an individual would perceive as harmful or hurtful to others. Dysfunction of the amygdala, either structural or functional, can potentially result in antisocial traits since the individual is unable to learn empathy if he is unable to understand the effect of his actions on others.

Besides empathy, the amygdala is also

this research, have been cited in any legal decision, including those cases that directly discuss the use of neuroimaging evidence.

97 Blair, supra note 82.
98 Id.
99 Glenn et al., supra note 88, at 86–87.
100 Id.

The authors find the most thoughtful legal commentator on the role of empathy in the law is Professor Susan Bandes. See, e.g., Susan A. Bandes, Empathy and Article III: Judge Weinstein, Cases and Controversies, 64 DEPAUL L. REV. 317 (2015); Susan A. Bandes, Empathy, Narrative, and Victim Impact Statements, 63 U. CHI. L. REV. 361 (1996).

linked to understanding remorse after taking actions that are perceived as harmful to others. Dysregulation can cause a lack of remorse that is frequently present in individuals diagnosed with ASPD.\textsuperscript{102}

Like those found in the PFC, abnormalities in the amygdala may be both structural and functional. One study found that individuals with antisocial traits had a demonstrably reduced volume in this area of the brain.\textsuperscript{103} There is also evidence to suggest that functional abnormalities in the amygdala contribute to antisocial behavior. One study found that individuals who scored higher on a test designed to predict antisocial tendencies also showed decreased activation in the amygdala while performing a specific task related to empathy than normal control subjects.\textsuperscript{104} Additionally, studies have shown that individuals who have been clinically diagnosed with ASPD or were found to demonstrate psychopathic traits showed less amygdala activation when processing

\textsuperscript{102} Glenn et al., \textit{supra} note 88, at 86–87.
\textsuperscript{103} Yaling Yang et al., \textit{Localization of Deformations Within the Amygdala in Individuals With Psychopathy}, 66 \textit{ARCHIVE GEN. PSYCHIATRY} 986, 990 (2009).
\textsuperscript{104} James K. Rilling et al., \textit{Neural Correlates of Social Cooperation and Non-Cooperation as a Function of Psychopathy}, 61 \textit{BIOLOGICAL PSYCHIATRY} 1260, 1270 (2007).
\textsuperscript{105} The term “psychopath” has a confusing, muddled history in clinical psychology and psychiatry. Often conflated with antisocial personality disorder (APD), psychopathy is not a recognized clinical diagnosis in the DSM-V (or any previous edition), but researchers have identified distinct traits, both behaviorally and neurophysiologically, that separate a “psychopathic” individual from an “antisocial” individual. Robert Hare’s Psychopathy Checklist Revised (PCL-R) is a widely recognized diagnostic tool that identifies three areas in which psychopaths manifest personality traits—interpersonal defects like grandiosity and deceitfulness, affective deficits like lack of empathy, and impulsive and criminal behaviors. Antisocial personality disorder, on the other hand, overlaps to some extent with psychopathy but is characterized by a history of criminal, often violent, behavior, which is not seen to the same extent in Hare’s psychopathy. For more on the distinctions between psychopathy and APD see Robert D. Hare, \textit{Hare Psychopathy Checklist-Revised (2d ed.) (PCL-R)}, in \textit{ENCYCLOPEDIA OF PSYCHOLOGY AND LAW} 348–50 (Brian Cutler ed., 2008), and R.J.R. Blair, \textit{Neurocognitive Models of
stimuli related to the affect of others. Those with this lower activation activity may have greater difficulty processing social emotions related to affect and response, like fear, guilt, and remorse.

Similar arguments for mitigation based on neuroimages exist for individuals with PFC abnormality and amygdala abnormality. These arguments in essence state that their particular structural or functional abnormality or irregular neurological activity makes them less culpable for their criminal behavior, perhaps analogizing from the Supreme Court’s decisions in \textit{Roper v. Simmons} and \textit{Atkins v. Virginia}. However, it is important to point out that there is no proven way of demonstrating

\textit{Aggression, the Antisocial Personality Disorders and Psychopathy}, 71 J. NEUROL., NEUROSURG. & PSYCHIATRY 727 (2001). However, there continues to be debate about the components of a psychopathy diagnosis, with some researchers, such as Jennifer Skeem, concluding that criminality is merely a correlate of psychopathy, rather than an ingrained component necessary for clinical diagnosis. See Jennifer L. Skeem & David J. Cooke, \textit{Is Criminal Behavior a Central Component of Psychopathy? Conceptual Directions for Resolving the Debate}, 22 PSYCHOLOGICAL ASSESSMENT 433 (2010). The authors presented a work-in-progress on this topic to the American Society of Criminology in Washington DC in November 2015, titled “I See What is Right and Approve, But I Do What is Wrong”: Psychopathy and Punishment in the Age of Neuroimaging.


\textsuperscript{107} Compare Middlebrooks v. Colson, No. 3:03-00814, 2014 WL 3817238 (M.D. Tenn. 2014) (denying habeas petition due to procedural defects—defendant offered habeas petition in support of claim of ineffectiveness of counsel claiming that defense counsel should have presented fMRI or PET scan evidence based on known neurophysiological abnormalities resulting from trauma in order to bolster mitigation case), with Gilley v. Morrow, 246 F. Appx. 519, 524 (9th Cir. 2007) (finding defense counsel rendered ineffective assistance of counsel when he failed to present evidence of defendant’s severe organic brain dysfunction as mitigating evidence during sentencing).

whether the dysfunction has existed since before the period of time when the crime in question was committed.\footnote{Brown & Murphy, supra note 65, at 1130 ("[W]e cannot presently read someone's mind to determine her mens rea at the time of the crime.").}

There are many other studies that focus on the PFC and amygdala, as well as other regions and subregions of brain structures that assist in regulation of emotion and behavior.\footnote{See, e.g., Raine & Yang, supra note 85, at 203.} Some other areas of the brain that researchers currently believe may influence antisocial behavior include the temporal cortex, the corpus callosum, the nucleus accumbens, the amygdala-hippocampal complex, and the angular gyrus.\footnote{Id.} These studies generally use some form of brain imaging to demonstrate either structural or functional abnormality, and that image is frequently what is presented to the judge and jury. While the data may be reliable in the scientific community, reliability in the context of the law requires a different set of standards, especially with the addition of laypeople being the decision-makers as to the validity of evidence as applied to an individual case.\footnote{A discussion of the scope of Daubert v. Merrell Dow Pharm. is beyond the scope of this paper. 509 U.S. 579, 586-89 (1993) (deciding that a scientific theory or instrument does not need to be generally accepted within the scientific community before it can be utilized by an expert witness). But it must be noted that there is a significant disparity in legal decision making in such cases; that is, in Daubert cases the prosecutor's position is sustained (either in support of the questioned expertise or in opposition to it) vastly more often than is that of defense counsel's. See Perlin, Insanity Defense Cases supra note 19, at 906-07 (citing D. Michael Risinger, Navigating Expert Reliability: Are Criminal Standards of Certainty Being Left on the Dock?, 64 ALB. L. REV. 99, 105-08 (2000)); see also Susan Rozelle, Daubert, Schmaubert: Criminal Defendants and the Short End of the Science Stick, 43 TULSA L. REV. 597, 598 (2007) ("The game of scientific evidence looks fixed.").}
When evidence is presented to jurors, it is crucial to underscore what exactly is being shown, and what is merely being implied. For example, attorneys must understand and communicate to jurors, that there is no definitive test to determine whether abnormalities like gray matter reduction or decreased activation levels were present at the time an individual engaged in the antisocial behavior in question, unless a separate MRI was done at that time. This is a critical issue for attorneys and judges to understand. Brain imaging can only provide information about the state of a defendant’s brain at the time that the imaging is done. Any further extrapolation about whether a particular abnormality was present at the time of the criminal action in question remains speculative, and falls well below the legal standard of “proof beyond a reasonable doubt.” It is significant here to keep in mind that “psychotropic drugs affect functional imaging of the brain,” and that the effects of such drugs “are not always short-lived.”

Recently there has been an even greater increase in cases seeking to introduce evidence of functional or structural abnormalities through the use of neuroimaging technology. Its use in this context raises its own series of questions and concerns about validity and reliability in a legal context, as well as its value as a persuasive tool. In a recent article,

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[114] See Brown & Murphy, *supra* note 65, at 1130. This is certainly not the only question that jurors need consider in this context, but it is inevitably a crucial one.


[116] A Westlaw search reveals over 350 criminal cases that reference neuroimaging, and shows that cases over the past three years have made up almost a third of all searchable criminal cases referencing neuroimaging. See *infra* note 139.

Professor Stephen Morse concludes firmly, “At present, neuroscience has little to contribute to more just and accurate criminal law policy, doctrine, and individual case adjudication.”

With the continuing improvements in the understanding of correlations between brain and behavior, it is likely that judges will see an increase in cases involving neuroimaging evidence. Attorneys may feel pressured to introduce this evidence by clients who have heard of its previous success, by other attorneys who begin to believe that this is a new standard of best practice, and even by professional associations that continue to tout the value and importance of this method of mitigation.

_Cases—Lessons from the Front, 62 Mercer L. Rev. 909, 910 (2011) (discussing “serious risks” in “overreliance on imaging” and concluding “neuroimaging is not an investigative tool; it is a confirmatory and explanatory tool.”); Walter Glannon, _The Limitations and Potential of Neuroimaging in the Criminal Law_, 18 J. ETHICS 153 (2014) (“[I]maging has questionable probative value because it does not directly capture brain function or a defendant’s mental states at the time of a criminal act.”); Stephen J. Morse, _Brain Overclaim Redux_, 31 LAW & INEQ. 509, 512 (2013) (“Despite the astonishing advances in neuroimaging and other neuroscientific methods, we still do not have sophisticated causal knowledge of how the brain works generally, and we have little information that is legally relevant.”); Nick J. Schweitzer et al., _Neuroimages as Evidence in a Mens Rea Defense: No Impact_, 17 PSYCHOL. PUB. POL’Y & L. 357, 382 (2011).

Morse, _supra_ note 58, at 74.

See, e.g., Alison K. Bennett & Jason Bloom, _Neurolaw: Brain Waves in the Courtroom_, 75 Tex. B.J. 280, 280 (2012) (“Neurolaw research—a combination of neuroscience and law—is positioned to change the law and its application, as we further our understanding of what drives behavior and how people make decisions, including judges and jurors.”).

See, e.g., John Matthew Fabian, _Forensic Neuropsychological Assessment and Death Penalty Litigation_, 33 Champion 24, 25 (April 2009) (The Champion is the lead publication of the National Association of Criminal Defense Lawyers); Kristen Garnatt Rogers & Alan DuBois, _The Present and Future Impact of Neuroscience Evidence on Criminal Law_, 33 Champion 18, 18 (April 2009) (“Functional magnetic resonance imaging (fMRI) is the latest and most promising technique for measuring and depicting brain function. If the technique’s potential is fully realized, it could transform our criminal justice system.”).
Used appropriately, with the understanding that it must only supplement other already-existing evidence rather than stand-alone as the only proof needed, neuroimaging based on what is known about the biological bases of behavior may be an effective strategy for mitigation.

However, while the science behind neuroimaging continues to improve, attorneys and judges must also continue to understand how neuroimaging evidence is perceived and internalized by jurors, and, at least in the cases of federal criminal sentencing, by judges. Here there is a gap between the current reality of the meager caselaw and the promise of what might come, especially if criminologists make an affirmative effort, in the words of Professor Leo as cited before, to help “close the justice gap.”

III. NEUROIMAGING IN THE COURTROOM

We now turn our attention to the singular role of neuroimaging evidence, to consider both the ambiguities and the ambivalences of such evidence.

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123 Leo, supra note 14, at 26.

124 Portions of the following section are adapted from Perlin & McClain, supra note 19.
A. THE AMBIGUITIES AND AMBIVALENCES OF NEUROIMAGING EVIDENCE

Although commentators bravely assert that neuroscience seems "advanced enough to enter forensic psychiatry,"\(^{125}\) that "[a]dvances in neurobiological research methods allow one to address the nature and biological basis of human behavior,"\(^{126}\) and that jurors can be counted on to critically evaluate such evidence,\(^{127}\) a cluster of other factors forces us to think seriously about how neuroimaging evidence will be construed by fact-finders,\(^{128}\) both in the context of the validity of the science and the validity of its application.

These factors can be identified as "visualization, reductionism, the attribution heuristic, and the impact of a belief in "the CSI effect."\(^{129}\) Visualization refers to the ways that the visual "allure"\(^{130}\) can "dazzle" and

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\(^{127}\) Dov Fox, Brain Imaging and the Bill of Rights: Memory Detection Technologies and American Criminal Justice, 8 AM. J. BIOETHICS 34, 36 (2008).

\(^{128}\) For a critical article related to the topic of this presentation expressing concern about the insertion of neuroscience into a criminal justice and sentencing system that "may be overburdened, overpoliticized, undertheorized, and lacking sufficient checks and balances on institutional competency and legitimacy," see Emily R. Murphy, Paved with Good Intentions: Sentencing Alternatives from Neuroscience and the Policy of Problem-Solving Courts, 37 LAW & PSYCHOL. REV. 83, 83 (2013).

\(^{129}\) Perlin, Criminal Trial Process, supra note 19, at 9–10. These factors are discussed in-depth in Perlin, Insanity Defense Cases, supra note 19, at 892–94.

\(^{130}\) Khoshbin & Khoshbin, supra note 62, at 182.
“seduc[e]” jurors\textsuperscript{131} in ways that are “inappropriately persuasive.”\textsuperscript{132} Reductionism refers to the ways that neuroimaging testimony has the meretricious capacity to “reduce[] psychosocial complexity.” The attribution heuristic refers to the way that we seek to attribute human behavior, in the words of Laura Khoshbin and Shahram Khoshbin, “to a physical source in the head.”\textsuperscript{134} The “CSI effect” refers “to the way that we believe that jurors demand the ‘money shot’ of hard forensic evidence in all trials, even though valid and reliable evidence as to the reality of that belief ‘is scant.’”\textsuperscript{135} Importantly, a recent study concluded that

\textsuperscript{131} Id. at 183, 185; see also Laurence R. Tancredi & Jonathan D. Brodie, The Brain and Behavior: Limitations in the Legal Use of Functional Magnetic Resonance Imaging, 33 AM. J. L. & MED. 271, 289 (2007). See generally Weisberg et al., supra note 22.


\textsuperscript{133} Id. at 248.

\textsuperscript{134} Khoshbin & Khoshbin, supra note 62, at 171. Heuristics are “cognitive-simplifying devices that distort our abilities to consider information rationally.” Michael L. Perlin, “Wisdom Is Thrown into Jail”: Using Therapeutic Jurisprudence to Remediate the Criminalization of Persons with Mental Illness, 17 MICH. ST. U. J. MED. & L. 343, 365 n.127 (2013), and sources cited. As an example, through the vividness heuristic, a “single vivid, memorable case overwhelms mountains of abstract, colorless data upon which rational choices should be made.” Michael L. Perlin, “The Borderline Which Separated You From Me”: The Insanity Defense, the Authoritarian Spirit, the Fear of Faking, and the Culture of Punishment, 82 IOWA L. REV. 1375, 1417 (1997). The attribution heuristic teaches that we “overattribute others’ behavior to the kinds of people they are rather than to the circumstances in which they find themselves.” Feigenson, supra note 132, at 248 (citing RICHARD NISBETT & LEE ROSS, HUMAN INFERENCE: STRATEGIES AND SHORTCOMINGS OF SOCIAL JUDGMENT (1980)). But see Weisberg et al., supra note 22, at 476 (suggesting that the “seductive details effect” is a more likely explanation for juror behavior than use of heuristic reasoning devices).

\textsuperscript{135} Perlin, Criminal Trial Process, supra note 19, at 9–10; see also Wendy Brickell, Is It the CSI Effect or Do We Just Distrust Juries?, 23 CRIM. JUST. 10 (2008); Tom Tyler, Viewing CSI and the Threshold of Guilt: Managing Truth and Justice in Reality and Fiction, 115 YALE L.J. 1050 (2006); Donald E. Shelton et al., A Study of Juror
neuroscience, like other types of scientific evidence, is subject to cognitive
dynamics. It is “subject to the same sort of cognitive dynamics as other
types of scientific evidence;” it is seen as persuasive when it is in line with
an individual’s prior beliefs, but is perceived negatively when it conflicts
with those beliefs. This is not unlike other research that demonstrates
how judges “teleologically” privilege evidence of mental illness “(where
that privileging serves what they perceive as a socially-beneficial value)
and subordinate (where that subordination serves what they perceive as a
similar value).” This remains, in the end, an area fraught with ambiguity
and contradiction.

B. EXPANDED USE OF NEUROIMAGING IN THE COURTS

While sentencing is an area where attorneys frequently use
neuroscience evidence as mitigation, it is clear that its popularity has
expanded well beyond the realm of sentencing. As of 2006, one study
found 133 reported state and federal opinions containing reference to PET

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Expectations and Demands Concerning Scientific Evidence: Does the “CSI Effect”

Nicholas Scurich & Adam Shniderman, The Selective Allure of Neuroscientific
Explanations, 9 PLOS ONE (Sept. 10, 2014),

Michael L. Perlin, “Baby, Look Inside Your Mirror”: The Legal Profession’s
Willful and Sanist Blindness to Lawyers with Mental Disabilities, 69 U. PITT. L. REV.
FOND & MARY L. DURHAM, BACK TO THE ASYLUM: THE FUTURE OF MENTAL HEALTH
LAW AND POLICY IN THE UNITED STATES 156 (1992)).

For recent experimental research, concluding that neuroscience evidence led
novices to judge “bad explanations” of behavior more favorably, see Weisberg et al.,
supra note 22, at 475, 477 (urging that there are “more reasons for caution” when
applying such evidence to “social issues.”).
and SPECT scans. Eight years later, that number is sure to have more than doubled. As of April 2016, a search on Westlaw (a legal database of all decided cases) found that there were at over 350 state and federal criminal cases that referenced neuroimaging evidence.

There is little doubt that jurors are inclined to accept certain types of scientific evidence without close scrutiny, and that many lawyers are not sufficiently prepared to cross-examine certain types of expert witnesses. By raising the issues that are the focal point of this paper, we

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139 Feigenson, supra note 132, at 237. It is also interesting to note that in 85 out of the 133 cases, the party presented or sought to present it to judges, not to juries. Additionally, in 89 of the 133 cases, the question of whether the SPECT or PET evidence should be admitted or excluded was addressed. Out of those eighty-nine cases, the neuroimaging evidence was admitted in seventy-three of them. Id.

140 List of State and Federal Criminal Cases Referring to Neuroimaging, WESTLAW NEXT, http://next.westlaw.com (search used the following criteria: (PET or SPECT or fMRI) /10 (scan or image!); next to “cases” followed the “view all” hyperlink; used filters to narrow to criminal cases) (accessed on Apr. 14, 2016). This number, of course, does not include civil cases.

141 Cf. Barefoot v. Estelle, 463 U.S. 880, 926 (1983) (Blackmun, J., dissenting) (expressing fear that testimony in death penalty case as to defendant's likely future dangerousness lends “an aura of scientific infallibility [that] may shroud the evidence and thus lead the jury to accept it without critical scrutiny.”). But see Brickell, supra note 135, at 16–17 (questioning the empirical evidence for the proposition that jurors inappropriately defer to forensic experts).

hope to rearticulate these concerns in a new context: that of neuroimaging evidence.143

It is obvious from this discussion that the law has yet to come to a clear understanding of when the use of neuroimaging evidence is appropriate.144 Since this is still a question that ethicists, scientists, and knowledgeable attorneys are debating, it is unsurprising that we see such dramatically different outcomes in each state, region and district. The danger in failing to adopt a unified set of standards is that “junk science” will continue to slip through the cracks, presented by attorneys who do not think about the implications of the evidence and allowed in by judges who do not understand the science.145

However, when used appropriately and introduced as supported by the weight of credible science behind it, neuroimaging evidence may provide alternatives for individuals otherwise already facing difficulties getting a fair hearing. People with brain injuries or neurological impairments leading to symptoms of mental illness already face additional biases.146 Leveling the playing field by introducing visible evidence of

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143 One of the authors considers this issue carefully in the context of the ways that jurors assess neuroscience evidence in insanity cases. See Perlin, Insanity Defense Cases, supra note 19, at 887 (questioning “to what extent will such evidence—apparently less inherently susceptible to falsification—have on jurors whose profound suspicion of mental state opinion testimony is well-documented.”).

144 Moreno, supra note 58, at 725–26.

145 On how judges can enhance appropriate uses of science in court, see, e.g., Joelle Moreno, Beyond The Polemic Against Junk Science: Navigating the Oceans That Divide Science and Law with Justice Breyer at the Helm, 81 B.U. L. Rev. 1033, 1088–91 (2001).

146 On the impact of such bias in cases involving the death penalty, see Saby Ghoshray, Capital Jury Decision Making: Looking Through the Prism of Social Conformity and Seduction to Symmetry, 67 U. MIAMI L. REV. 477, 499 n.93 (2013). On the meaning of and inherent bias in sanism, see infra note 151.
mental disorder, just like any other physical impairment, may help to provide a benefit to individuals seeking a fair hearing. 147

IV. THERAPEUTIC JURISPRUDENCE 148

Over the past two decades, one of the most significant legal theoretical developments has been the creation and dynamic growth of therapeutic jurisprudence. 149 One of the co-authors (MLP) has described this development:

[T]herapeutic jurisprudence presents a new model for assessing the impact of case law and legislation, recognizing that, as a therapeutic agent, the law [] can have therapeutic or anti-therapeutic consequences. 150 The

147 See supra text accompanying note 93 (discussing how jurors respond more favorably to organic than to psychodynamic evidence).


150 See Perlin, Insanity Defense Cases, supra note 19, at 912; see also, Kate Diesfeld & Ian Freckelton, Mental Health Law and Therapeutic Jurisprudence, in DISPUTES AND
The ultimate aim of therapeutic jurisprudence is to determine whether legal rules, procedures, and lawyer roles can or should be reshaped to enhance their therapeutic potential while not subordinating due process principles.\footnote{151} David Wexler clearly identifies how the inherent tension inherent in this inquiry must be resolved: “the law's use of mental health information to improve therapeutic functioning [cannot] impinge upon justice concerns.”\footnote{152} As one of us (MLP) has written elsewhere, “[A]n inquiry

\textit{Dilemmas in Health Law} 91 (Ian Freckelton & Kate Peterson eds., 2006) (for a transnational perspective).


Sanism is an irrational prejudice of the same quality and character of other irrational prejudices that cause (and are reflected in) prevailing social attitudes of racism, sexism, homophobia, and ethnic bigotry. See, e.g., Michael L. Perlin, On “Sanism”, 46 \textit{SMU L. Rev.} 373, 374–75 (1992). On how sanism “permeates all aspects of mental disability law and affects all participants in the mental disability law system,” see, e.g., Perlin & Lynch, \textit{supra} note 148, at 259.

into therapeutic outcomes does not mean that therapeutic concerns ‘trump’ civil rights and civil liberties.”

Therapeutic jurisprudence “look[s] at law as it actually impacts people’s lives” and assesses law’s influence on “emotional life and psychological well-being.” Therapeutic jurisprudence mandates that “law should value psychological health, should strive to avoid imposing anti-therapeutic consequences whenever possible, and when consistent with other values served by law, should attempt to bring about healing and wellness.” From therapeutic jurisprudence, we gain “a new and distinctive perspective utilizing socio-psychological insights into the law and its applications.” Therapeutic jurisprudence is “... a sea-change in ethical thinking about the role of law ... a movement towards a more distinctly relational approach to the practice of law ... [emphasizing] psychological wellness over adversarial triumphalism.” It thus supports an ethic of care.

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156 Bruce Winick, A Therapeutic Jurisprudence Model for Civil Commitment, in INVOLUNTARY DETENTION AND THERAPEUTIC JURISPRUDENCE: INTERNATIONAL PERSPECTIVE ON CIVIL COMMITMENT 23, 26 (Kate Diesfeld & Ian Freckelton eds., 2003).

157 Freckelton, supra note 151, at 576. It is also part of a growing comprehensive movement in the law towards establishing more humane and psychologically optimal ways of handling legal issues collaboratively, creatively, and respectfully. Susan Daicoff, Afterword: The Role of Therapeutic Jurisprudence Within The Comprehensive Law Movement, in PRACTICING THERAPEUTIC JURISPRUDENCE, supra note 155, at 465.

158 Warren Brookbanks, Therapeutic Jurisprudence: Conceiving an Ethical Framework, 8 J.L. & MED. 328, 329–30 (2001); see also, Bruce J. Winick, Overcoming
Professor Amy Ronner describes the “three Vs”: voice, validation and voluntariness, arguing:

What “the three Vs” commend is pretty basic: litigants must have a sense of voice or a chance to tell their story to a decision maker. If that litigant feels that the tribunal has genuinely listened to, heard, and taken seriously the litigant’s story, the litigant feels a sense of validation. When litigants emerge from a legal proceeding with a sense of voice and validation, they are more at peace with the outcome. Voice and validation create a sense of voluntary participation, one in which the litigant experiences the proceeding as less coercive. Specifically, the feeling on the part of litigants that they voluntarily partook in the very process that engendered the end result or the very judicial pronunciation that affects their own lives can initiate healing and bring about improved behavior in the future. In

159 See e.g., Winick & Wexler, supra note 158, at 605-07; David B. Wexler, Not Such a Party Pooper: An Attempt to Accommodate (Many of) Professor Quinn’s Concerns about Therapeutic Jurisprudence Criminal Defense Lawyering, 48 B.C. L. REV. 597, 599 (2007); Brookbanks, supra note 158. The use of the phrase dates to CAROL GILLIGAN, IN A DIFFERENT VOICE (1982).

general, human beings prosper when they feel that they are making, or at least participating in, their own decisions.\textsuperscript{161}

A core central principle of therapeutic jurisprudence is a commitment to dignity.\textsuperscript{162} In a recent article about dignity and the civil commitment process, Professors Jonathan Simon and Stephen Rosenbaum embrace therapeutic jurisprudence as a modality of analysis, and focus specifically on this issue of voice: “When procedures give people an opportunity to exercise voice, their words are given respect, decisions are explained to them their views taken into account, and they substantively feel less coercion.”\textsuperscript{163}

The question to be posed here is this: in those instances in which criminal sentencing decision-making considers neuroscientific tests and evidence, to what extent does it comport with therapeutic jurisprudence principles?\textsuperscript{164} In one of the first pieces about therapeutic jurisprudence ever published, David Wexler suggested that “sentencing guidelines and practices . . . be examined from a therapeutic jurisprudence perspective to


\textsuperscript{164} On how therapeutic justice can encourage the development of holistic treatment regimes that hold offenders to a “scientifically rational and legally appropriate degree of accountability,” see Richard L. Nygaard, The Dawn of Therapeutic Justice, in The Science, Treatment and Prevention of Antisocial Behaviors: Application to the Criminal Justice System, 23–1, 23–12 (Diana H. Fishbein ed., 2000).
shed light on whether they promote or impede rehabilitation.” 165 Subsequently, Georgia Zara has thoughtfully and carefully considered how biologically based criminological research can be integrated into a therapeutic jurisprudence perspective on studying the behavior of offenders, 166 but there has been virtually no scholarship written about this specific issue. 167 It is sadly clear that the entire body of scholarship


166 Georgia Zara, Therapeutic Jurisprudence as an Integrative Approach to Understanding the Socio-Psychological Reality of Young Offenders, 71 U. CIN. L. REV. 127, 128 (2002). There has been no follow-up in the legal literature to this insight of Professor Zara’s.

167 One of us (MLP) noted this, with regards to the insanity defense some seven years ago. See Perlin, Insanity Defense Cases, supra note 19, at 913 (“There has been, however, almost no therapeutic jurisprudence scholarship as of yet on the question that I am addressing here: what are the therapeutic jurisprudence implications of greater reliance on neuroimaging testimony in cases in which the defendant raises a non-responsibility defense?”). David Wexler has more recently called on researchers to consider the parallel question of neuropsychology and law as they relate to the solitary confinement for juvenile offenders. David B. Wexler, New Wine in New Bottles: The Need to Sketch a Therapeutic Jurisprudence “Code” of Proposed Criminal Processes and Practices, 7 ARIZ. SUMMIT L. REV. 463, 469 n.15 (2014). Issues that relate specifically to the relationship between the juvenile justice system and brain neuroscience are beyond the scope of this paper. See generally Perlin, supra note 148; Alison Burke, Under Construction: Brain Formation, Culpability, and the Criminal Justice System, 34 INT’L J.L. & PSYCHIATRY 381 (2011).
In the Wasteland of Your Mind

referred to in this section has fallen on deaf ears in the contexts of criminal sentencing. 168

Courts have regularly ignored the potential role of therapeutic jurisprudence in sentencing decisions. 169 The danger in failing to recognize the precedential value of decisions from other jurisdictions is the creation of an inevitably divided legal system, in which a person in one jurisdiction has the ability to introduce evidence that another individual elsewhere could not. 170


170 Judicial decisions about neuroimaging in the criminal trial process appear to all be the classic “n of 1”—judges decide these cases with little attention being paid to other similar cases or the scientific evidence that may support such testing (and subsequent testimony). See Perlin & Lynch, supra note 18. This is not uncommon in case law involving issues related to persons with mental disabilities in the criminal trial process.
This is especially troubling for individuals with mental illness and traumatic brain injury (TBI), since the recognition of a physical component of their disability could help to comport with therapeutic jurisprudence principles of dignity, voice and validation. The ability to adequately present evidence to represent physical illness is generally available to individuals who have a physical difference; it can even be used as mitigation evidence. The opportunity for individuals with mental illness and brain injury, who are already facing additional

See, e.g., Michael L. Perlin, Beyond Dusky and Godinez: Competency Before and After Trial, 21 BEHAV. SCI. & L. 297, 309–10 (2003) (discussing how “surprising” is the failure of most of the cases in these categories “to consider carefully” other decisions in the same substantive sub-areas of competency law).

While traumatic brain injury has long been a public health concern, it has also been recognized as having significant effects on the personality and behavior of individuals who sustain these injuries. While not necessarily appropriate as evidence for an insanity defense (for the same temporal reasons addressed above), introduction of a defendant’s TBI could prove to be an effective tool during mitigation, in order to provide a clue as to why he may have performed the crime with which he was charged. A finding of TBI can also help to demonstrate an individual’s current cognitive and emotional functioning, which will be important for a decision-maker to consider during sentencing. For a review of available techniques for imaging TBI and introducing it in criminal cases, see Lydia D. Johnson, Guilty or Innocent? Just Take a Look at My Brain—Analyzing the Nexus Between Traumatic Brain Injury and Criminal Responsibility, 37 S.U. L. REV. 25, 27–28 (2009). On the forensic significance of PET scans in TBI cases, see Jane Moriarty et al., Brain Trauma, PET Scans and Forensic Complexity, 31 BEHAV. SCI. & L. 702 (2013).

Lynch & Perlin, supra note 79. The only scholarship about the relationship between therapeutic jurisprudence and TBI appears to be Evan R. Seamone, Dismantling America’s Largest Sleeper Cell: The Imperative to Treat, Rather Than Merely Punish, Active Duty Offenders with PTSD Prior to Discharge from the Armed Forces, 37 NOVA L. REV. 479 (2013).

See, e.g., FLA. STAT. ANN. § 921.0026(2)(d) (West 2012) (treating as a mitigating circumstance when “[t]he defendant requires specialized treatment for a mental disorder that is unrelated to substance abuse or addiction or for a physical disability, and the defendant is amenable to treatment.”).
discrimination and bias,\textsuperscript{174} to have another avenue through which to present legitimate evidence should be granted in the appropriate cases. If used correctly, neuroimaging evidence could serve as a valuable tool for implementing therapeutic jurisprudence principles in these cases.\textsuperscript{175}

Scholars have recently called for greater and more sophisticated research in assessing how sentencing reforms have empirically affected the severity of punishment and how the exercise of discretion in sentencing relates to the structures of sentencing laws.\textsuperscript{176} This call for additional research must be contextualized with the reality that the Federal Sentencing Guidelines significantly increased the power of prosecutors, as the choices of what charge should be brought against a defendant would more conclusively determine the sentence.\textsuperscript{177} Similarly, others (including


\textsuperscript{175} See Murphy, supra note 128, at 117 (“With opportunities for invasive, long-lasting, and highly-impacting treatments coming soon from neuroscience, drug courts must revisit the true roots of a therapeutic jurisprudence framework: a focus on empirically verifiable results with respect for due process protections for personal liberty and autonomy.”) (citing Peggy Fulton Hora, William G. Schma & John T.A. Rosenthal, Therapeutic Jurisprudence and the Drug Treatment Court Movement: Revolutionizing the Criminal Justice System’s Response to Drug Abuse and Crime in America, 74 Notre Dame L. Rev. 439, 447 (1999)).


judges) have called for evidence-based sentencing to replace judicial discretion in the sentencing process, and have urged that risk assessment measures be incorporated into such decision-making.

How does this “fit” within the focus of this paper? Two years ago, Professor David Farrington noted that “[m]ost early longitudinal studies focused on individual, family, peer, and school factors, but in recent years there has been increased research on biological influences on offending,” adding that “dopamine transporter and receptor genes influenced neurocognitive skills (in males), which in turn influenced ADHD (attention deficit hyperactivity disorder) and antisocial behavior.” Interestingly, Farrington—one of the leading scholars in this field—does not otherwise mention neuroscience or neuroscientific

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180 David Farrington, Longitudinal and Experimental Research in Criminology, 42 CRIME & JUST. 453, 470 (2013).

181 Id. at 471.

182 See, e.g., David Farrington, Methodological Quality Standards for Evaluation Research, 587 ANNALS AM. ACAD. POL. & SOC. SCI. 49 (2003); Brandon Welsh & David Farrington, Toward an Evidence-Based Approach to Preventing Crime, 578 ANNALS AM. ACAD. POL. & SOC. SCI. 158 (2001); Georgia Zara & David P. Farrington, Assessment of
evidence elsewhere in this article. Perhaps even more interestingly, this article has only been cited once in a law review, and not at all in case law.\footnote{183}

Much of the literature that focuses on criminological evidence, predictor variables, and recidivism predictions, while considering criminal companions, criminogenic needs, criminal history, race, age, substance abuse history, family structure and criminality, gender, socio-economic status, and a host of other variables, makes no mention of neuroscientific tests of evidence.\footnote{184} Even though more and more cases, especially in the criminal context, continue to use this type of evidence, neuroscientific evidence has not been adequately taken into account from a criminological perspective. Failure to include this in contextual studies about the root causes of criminality hurts both researchers and attorneys.\footnote{185} Since judges and attorneys often use reliable, validated data in their presentations of evidence, comprehensive and peer-reviewed research on the

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\begin{itemize}
\item \footnote{185} For a review of the dangers posed by allowing the inclusion of junk science, see Joseph M. Price & Gretchen Gates Kelly, \textit{Junk Science in the Courtroom: Causes, Effects and Controls}, 19 Haml ine L. Rev. 395, 397 (1996) ("Introduction of unreliable scientific evidence increases the chance that a jury will arrive at an unjust verdict."). See generally Dennis, \textit{supra} note 17; Gianelli, \textit{supra} note 17.
\end{itemize}
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criminological validity of neuroscience would fill a void that continues to lead to confusion and misrepresentation of scientific data.

It is not controversial to say that our criminal law system is not aligned with an “ethic of care,”\(^\text{186}\) nor is it a surprise to learn that defendants feel they are often without voice in circumstances that are certainly not voluntary. We believe, however, that if the law were to embrace scientific discovery, not slavishly, but thoughtfully, the aims of therapeutic jurisprudence—to let us “look at law as it actually impacts people’s lives”\(^\text{187}\) and to focus on the law’s influence on emotional life and psychological well-being\(^\text{188}\)—would more likely be met.

V. CONCLUSION

Neuroscience, and our knowledge of neurophysiology, remains in flux. The legal profession needs to consider this when evaluating how novel scientific evidence is used to influence criminal cases.

The Federal Sentencing Guidelines propose a method of sentencing based on a grid, with little room for judicial opinion on the matter. However, neuroimaging may offer an opportunity for a more therapeutic sentencing framework that takes into account mitigating evidence. Evidence of traumatic brain injury or abnormalities found in the structure or function of brain regions associated with criminal behavior may offer insight to the defendant’s current mental state, or provide additional factors to take into account when exploring his mental state at the time of the crime.

However, the legal profession will need continuing education about the efficacy of this technology, especially given the differences

\(^{186}\) See GILLIGAN, supra note 159.

\(^{187}\) Winick, supra note 154, at 535.

\(^{188}\) Wexler, supra note 155, at 45.
between how scientific research works, with its constantly-changing theories and hypotheses, and how the law works, with a judge issuing a decision and creating a binding precedent.

Given the current research available, it is clear that fMRIs, PET scans, and SPECT scans still have a limited place in our criminal justice system. However, the law must anticipate and acclimate to the very real possibility that these technologies will continue to improve at a rapid rate. This will require a proactive effort on the part of judges and attorneys to become educated, and to apply *Daubert* and *Frye* tests appropriately\(^{189}\) and not teleologically\(^{190}\)—each time a new trend in neuroscience emerges. In this way, the legal profession can also ensure that individuals who already face extreme bias—those with mental illness—have the chance to present valid and reliable scientific evidence that may help to mitigate harsh criminal sentences.

The field of criminology can act as a bridge between science and the law;\(^ {191}\) criminologists can “translate” scientific discoveries about the

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\(^{189}\) *Daubert* is discussed *supra* note 112. Under the test created in *Frye v. United States*, 293 F. 1013, 1014 (D.C. Cir. 1923), novel scientific evidence is admissible when the relevant scientific community has generally accepted the reliability of the underlying theory or principle. See Cucolo & Perlin, *supra* note 179, at 139–41.

\(^{190}\) See Rozelle, *supra* note 112 (citing to Professor Rozelle’s conclusion that “the game of scientific evidence looks fixed.”). On the dangers of teleology in mental disability law decision-making, see Perlin, *Mirror*, *supra* note 137, at 599–600.

correlates of antisocial behavior into clear analyses that can be understood and incorporated by attorneys in their presentation of evidence to jurors or judges. The value of undertaking this evidence through a criminological lens is twofold: first, it will highlight important scientific findings and their relevance to the law, and second, good criminological research will serve as a filter, allowing only validated, reliable scientific evidence to influence legal decision-making. This may allow for faster evolution of the law where scientific evidence is concerned. The landscape can be changed, and the “wasteland”—channeling the Dylan lyric that helps provide the title for this paper—may not appear so vast if other disciplines are willing to work to educate and inform the legal system on its approach to scientific evidence.

192 On the potential role of criminologists doing research in the parallel area of false confessions, see Leo, supra note 14.