NOTES

THE NEUROLOGICAL IMPRINT OF INCARCERATION AND ITS EFFECT ON RECIDIVISM

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INTRODUCTION

The idea that incarceration ultimately increases crime is not new.[1] This effect is often attributed to the collateral consequences of conviction: former inmates face disenfranchisement, a loss of employment opportunities, and a restriction of civil rights.[2] But prison takes a neurological toll as well. Like the social and economic penalties that accompany a prison sentence, this too can contribute to reincarceration.

For many, the experience of confinement causes behavioral changes that persist even after release. Institutionalization causes some to struggle with the unstructured reality of life on the outside. Harsh prison conditions are psychologically damaging: inmates placed in solitary confinement can develop psychological disorders; those who witness or experience violence may become traumatized; and all are affected by the chronic and repeated stress of prison.[3] It is an environment "so stark and psychologically painful that it represents a form of traumatic stress severe enough to produce post-traumatic stress reactions once released."[4] Such reactions include impulsivity, abuse of drugs and alcohol, and increased aggression. Outside of prison, these are the behaviors most likely to lead to rearrest. This Note explores those behaviors, their inception, and how they relate to criminal activity. Research in neuroscience and psychology has shown that traumatic environments like prison can change the brain; applying these findings to data on crime and recidivism, I argue that these changes ultimately increase the risk of reoffending.

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1. *See, e.g.*, MICHEL FOUCAULT, DISCIPLINE AND PUNISH 278 (Alan Sheridan trans., Vintage Books 1979) (1975) ("Detention causes recidivism; those leaving prison have more chance than before of going back to it . . . ."); THOMAS FOWELL BUXTON, AN INQUIRY, WHETHER CRIME AND MISERY ARE PRODUCED OR PREVENTED, BY OUR PRESENT SYSTEM OF PRISON DISCIPLINE 91 (3d ed. 1903) (1818) ("[T]he general state of our jails is a principal cause of the increase of crime.").

2. *See* CRAIG HANEY, CRIMINALITY IN CONTEXT: THE PSYCHOLOGICAL FOUNDATIONS OF CRIMINAL JUSTICE REFORM 380 (2020) (pointing to the staggering number of collateral effects of conviction, many of which can have significant criminogenic consequences).

3. *See infra* Parts II and III.

4. Craig Haney, *The Psychological Impact of Incarceration: Implications for Postprison Adjustment*, *in* PRISONERS ONCE REMOVED: THE IMPACT OF INCARCERATION AND REENTRY ON CHILDREN, FAMILIES AND COMMUNITIES 33, 45 (Jeremy Travis & Michelle Waul eds., 2003).

We have a vested interest in the long-term effects of prisons on those inside. Since over 95% of inmates will eventually be released, [5] incarceration should not make them *more* likely to commit crime.[6] But by exposing inmates to the negative neurological effects of toxic stress and trauma, incarceration may have a criminogenic effect.[7] This is supported by a large body of research showing that prison does not reduce subsequent offending, and may actually increase it.[8] However, despite some researchers attributing this consequence directly to the harsh conditions of imprisonment,[9] the relationship is rarely explored on a neurological level.[10]

It is important to first emphasize what this Note is not arguing. It will not equate criminal behavior with a "dysfunctional" brain. Pseudoscientific explanations have long been used to justify egregious treatment of those suspected and convicted of crimes.[11] Mindful of that troubled history, the goal is to use neuroscience "not to craft attractive simplifications, but to shed a measure of light on complex and multifaceted realities."[12] Accordingly, links

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5. NATHAN JAMES, CONG. RSCH. SERV., OFFENDER REENTRY: CORRECTIONAL STATISTICS, REINTEGRATION INTO THE COMMUNITY, AND RECIDIVISM 1 (2015), https://sgp.fas.org/crs/misc/RL34287.pdf.

6. *Cf.* Martin H. Pritikin, *Is Prison Increasing Crime?*, 2008 WIS. L. REV. 1049, 1051 (2008) ("[T]he chief instrumental goal of incarceration is, of course, to *prevent* crime, not cause it.").

7. A criminogenic effect is one tending to cause crime or criminality. *Criminogenic*, BLACK'S LAW DICTIONARY (11th ed. 2019). This Note focuses on the criminogenic effect that "stems from the collateral consequences of imprisonment" and forms "barriers to the process of reintegrating formerly incarcerated individuals into society." Sarah Tahamont & Aaron Chalfin, *The Effect of Prisons on Crime*, *in* THE OXFORD HANDBOOK OF PRISONS AND IMPRISONMENT 627, 631 (2016).

8. *See* Lila Kazemian & Allyson Walker, *Effects of Incarceration*, *in* THE OXFORD HANDBOOK OF DEVELOPMENTAL AND LIFE-COURSE CRIMINOLOGY 576, 578 (2018) ("Most empirical studies . . . have found that imprisonment has either no impact or undesirable effects on subsequent offending.").

9. Jane C. Daquin et al., *Vicarious Victimization in Prison: Examining the Effects of Witnessing Victimization While Incarcerated on Offender Reentry*, 43 CRIM. JUST. & BEHAV. 1018, 1019 (2016). One study compared "the causal impact of prison conditions on recidivism," specifically finding "that harsher prison conditions do not reduce post-release criminal behavior, and may even increase it." M. Keith Chen & Jesse M. Shapiro, *Do Harsher Prison Conditions Reduce Recidivism? A Discontinuity-Based Approach*, 9 AM. L. & ECON. REV. 1, 24 (2007).

10. The field of criminology has largely steered away from developments in biology, genetics, and evolutionary psychology. J.C. Barnes et al., *Contemporary Biosocial Criminology: A Systematic Review of the Literature, 2000–2012*, *in* THE HANDBOOK OF CRIMINOLOGICAL THEORY 75, 75 (2016); *see also* Lee Ellis, *A Theory Explaining Biological Correlates of Criminality*, 2 EUR. J. CRIMINOLOGY 287, 287 (2005) (observing that popular criminological theories "have difficulty explaining why neurological, hormonal, and other biological factors would be related to criminal behaviour, yet evidence for links between such biological factors and criminality has grown").

11. For an overview of biology's checkered history with criminology, see Sheldon Gelman, *Looking Backward: The Twentieth Century Revolutions in Psychiatry, Law, and Public Mental Health*, 29 OHIO N.U. L. REV. 531 (2003); *see also* BANDY X. LEE, VIOLENCE: AN INTERDISCIPLINARY APPROACH TO CAUSES, CONSEQUENCES, AND CURES 25–28 (2019).

12. Amanda C. Pustilnik, *Violence on the Brain: A Critique of Neuroscience in Criminal Law*, 44 WAKE FOREST L. REV. 183, 237 (2009).

between brain science and criminality should not be drawn on an *individual* basis.[13] Nor does this Note suggest that offenders go without penal consequences. If conduct is to be punished—and if that punishment is to be effective—we must attempt to understand the variety of "influences that converge to promote" criminal behavior.[14] Incarceration itself is one such influence.

Part I will focus on the nature of the prison experience and its high potential for exposure to traumatic stress. Part II will address the neurological effects of that experience and highlight risk factors that predispose certain inmates to trauma. Young adults and people with mental disorders are disproportionately represented in prison, and both factors carry additional risk.[15] Part III explores how the neurological imprint of that experience can trigger behavioral changes, increasing the likelihood of rearrest. Finally, Part IV seeks solutions. As it stands, over eighty percent of inmates released at or before the age of twenty-four are arrested again within five years.[16] As their arrest count increases, so too does their likelihood of recidivating.[17] Prisons are creating prisoners.

I. THE EXPERIENCE OF CONFINEMENT

Throughout the 1950s and 1960s, the concept of prisons as rehabilitative facilities led mainstream political discourse.[18] Eventually, belief in the ability of prisons to rehabilitate began to wane as a multitude of factors "contributed to declining economic opportunities in many neighborhoods and too often to

13. *See id.* at 187 ("[O]verreaching claims about the relationship between individual neurobiology and criminal violence can undo the productive contributions that neuroscience could otherwise make to the criminal law."). At the same time, there is "significant variation from person to person," so brain science should not be overgeneralized. U.S. SENT'G COMM'N, YOUTHFUL OFFENDERS IN THE FEDERAL SYSTEM 7 (2017).

14. Nathaniel E. Anderson & Kent A. Kiehl, *Re-wiring Guilt: How Advancing Neuroscience Encourages Strategic Interventions Over Retributive Justice*, FRONTIERS PSYCH., Mar. 2020, at 7, https://www.frontiersin.org/articles/10.3389/fpsyg.2020.00390/full; *see also* Cara M. Altimus, *Neuroscience Has the Power to Change the Criminal Justice System*, ENEURO (Feb. 2017), https://www.eneuro.org/content/eneuro/4/1/ENEURO.0362-16.2016.full.pdf ("As a society, we need to understand and explain the underlying biological systems controlling the complex behaviors that the criminal justice system must deal with.").

15. *See* Josh Gupta-Kagan, *The Intersection Between Young Adult Sentencing and Mass Incarceration*, 2018 WIS. L. REV. 669, 728 (2018); Sarah M. Manchak & Robert D. Morgan, *Offenders with Mental Illness in Prison*, *in* THE OXFORD HANDBOOK OF PRISONS AND IMPRISONMENT 579 (2016).

16. MATTHEW R. DUROSE & LEONARDO ANTENANGELI, U.S. DEP'T OF JUST., RECIDIVISM OF PRISONERS RELEASED IN 34 STATES IN 2012: A 5-YEAR FOLLOW-UP PERIOD 1 (2012–2017) (2021), https://bjs.ojp.gov/sites/g/files/xyckuh236/files/media/document/rpr34s125yfup1217.pdf.

17. *Id.* at 7.

18. *See* William Wesley Johnson, *Rethinking the Interface Between Mental Illness, Criminal Justice and Academia*, 28 JUST. Q. 15, 17 (2011).

greater fear of crime."[19] Out of this fear emerged the "tough on crime" rhetoric of the 1970s and 1980s and its accompanying goals of retribution for victims and society at large.[20] As a result, "incarceration rates started to rise nationally . . . and continued to rise for 40 years, stabilizing only recently."[21] Attention has since turned to new concepts of rehabilitation and reintegration,[22] but the impact of that era's policy looms large. Over 1.2 million people are currently incarcerated in state and federal prisons,[23] compared with just over 200,000 in 1973.[24] The resulting overcrowding, along with the abandonment of rehabilitative goals, has had a tangible effect on the prison environment, leading to conditions that threaten greater psychological distress and potential long-term dysfunction.[25] Prison conditions impact post-release outcomes, because the environment in which people are confined affects the psychological condition in which they return.[26]

Incarceration involves a loss of identity and autonomy, and life in prison carries a constant risk of victimization. For some, witnessing and experiencing physical violence causes them to respond with aggression; for others, the extreme social deprivation produces symptoms of anxiety, paranoia, and an overall deterioration of mental and physical health.[27] This Section focuses on that experience.

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19. NAT'L RSCH. COUNCIL, THE GROWTH OF INCARCERATION IN THE UNITED STATES: EXPLORING CAUSES AND CONSEQUENCES 24–25 (2014).

20. *See* Johnson, *supra* note 18, at 17. However, "'tough on crime' policies are deeply rooted in political, social, and economic traditions that were entrenched in American society well before" then. Mirko Bagaric et al., *Bringing Sentencing into the 21st Century: Closing the Gap Between Practice and Knowledge by Introducing Expertise into Sentencing Law*, 45 HOFSTRA L. REV. 785, 787 (2017).

21. NAT'L RSCH. COUNCIL, *supra* note 19, at 27.

22. *See* Susan Turner, *The Multiple Faces of Reentry*, *in* THE OXFORD HANDBOOK OF PRISONS AND IMPRISONMENT 502, 505 (2016) ("[S]urveys suggest that 'reentry' programs—life skills, parenting, and employment programs—have been on the rise.").

23. E. ANN CARSON, U.S. DEP'T OF JUST., PRISONERS IN 2020 – STATISTICAL TABLES 1 (2021), https://bjs.ojp.gov/content/pub/pdf/p20st.pdf. This number does not include the "roughly 735,000 in the custody of locally run jails." John Gramlich, *America's Incarceration Rate Falls to Lowest Level Since 1995*, PEW RSCH. CTR. (Aug. 16, 2021), https://www.pewresearch.org/fact-tank/2021/08/16/americas-incarceration-rate-lowest-since-1995/#:~:text=At%20the%20end%20of%202019,custody%20of%20locally%20run%20jails.

24. *Prisoners 1925–81*, U.S. DEP'T OF JUST, BUREAU OF JUSTICE STATISTICS: BULLETIN 2 tbl.1 (Dec. 1982), https://bjs.ojp.gov/content/pub/pdf/p2581.pdf.

25. Haney, *supra* note 4, at 36 (noting that "[a]bandoning the once-avowed goal of rehabilitation" has resulted in poorer treatment by staff and an increase in sentence length).

26. Mika'il DeVeaux, *The Trauma of the Incarceration Experience*, 48 HARV. C.R.-C.L. L. REV. 257, 264 (2013).

27. Haney, *supra* note 4, at 14.

A. Deprivation and Forced Routine

To be sentenced to prison is to be sentenced to "social death."[28] It is no secret that prison inflicts more than mere physical punishment; indeed, some have argued that "the psychological pain of incarceration is not inadvertent but inflicted by design."[29]

By its nature, confinement involves deprivations. Prisoners experience a loss of liberty, security, privacy, and identity.[30] The accompanying losses of "personal control and autonomy are linked to psychological consequences, such as depression, anxiety, and feelings of helplessness"—consequences which "may translate into antisocial behaviors, including criminal behavior."[31] Being deprived of autonomy is especially taxing when that deprivation serves as a reminder of "their compromised social status and stigmatized social role as prisoners."[32] The deprivations experienced while incarcerated thus degrade an inmate's sense of self on both the social and psychological level.

Solitary confinement illustrates the effects of deprivation. Intended to be reserved for the worst offenders,[33] high-security prisons house inmates in small concrete cells where they spend as much as 23 hours a day alone.[34] Inmates are denied virtually any human interaction with fellow prisoners or the guards, and many are forced to spend their entire sentence indoors.[35] In some high-security facilities, isolated prisoners are "confined in constantly bright or constantly dim spaces without any meaningful human contact—torturous conditions that are proven to cause mental deterioration."[36] Numerous studies have confirmed that solitary confinement directly causes negative psychiatric symptoms.[37] Though

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28. JOSHUA M. PRICE, PRISON AND SOCIAL DEATH 5 (2015). There are "three basic qualities of incarceration: generalized humiliation, institutional violence, and natal alienation. The conjunction of the three yields the peculiar contours of social death." *Id.* at 6.

29. DeVeaux, *supra* note 26, at 260.

30. *See id.* at 259–60.

31. Daquin et al., *supra* note 9, at 1028.

32. Haney, *supra* note 4, at 10.

33. In reality, supermax facilities house many nonviolent inmates. In overcrowded prison systems, empty supermax cells are often filled with "'nuisance prisoners," those who file lawsuits, violate minor prison rules, or otherwise annoy staff. David Fathi, *Supermax Prisons: Cruel, Inhuman and Degrading*, ACLU (July 9, 2010), https://www.aclu.org/blog/national-security/supermax-prisons-cruel-inhuman-and-degrading. Thus, "in Wisconsin's supermax, one of the 'worst of the worst' was a 16-year-old car thief"; in a Virginia supermax, a twenty-year-old hanged himself during a two-and-a-half-year sentence for selling drugs. *Id.*

34. Ray Sanchez & Alexandra Field, *What's Life Like in Supermax Prison?*, CNN (June 25, 2015, 8:21 PM), https://www.cnn.com/2015/06/25/us/dzhokhar-tsarnaev-supermax-prison.

35. Sean-Michael Pigeon, *The Problem with Supermax Prisons*, NATIONAL REVIEW (Aug. 23, 2021, 6:30 AM), https://www.nationalreview.com/2021/08/the-problem-with-supermax-prisons/ ("Buttons controlled by security guards allow individual prisoners to move, to shower, or to go 'outside.' However, 'outside' for these prisoners is a large concrete garage where the sun is allowed to shine only through steel bars.").

36. JOHN J. GIBBONS & NICHOLAS DE B. KATZENBACH, COMMISSION ON SAFETY AND ABUSE IN AMERICA'S PRISONS, CONFRONTING CONFINEMENT 14 (2006).

37. *See id.* at 58.

there is only one remaining federal "supermax" facility, more than thirty states continue to operate either supermax prisons or high-security wings within normal security prisons.[38] Additionally, many prisons employ "disciplinary" segregation to punish inmates who break prison rules.[39] This form of segregation is intended, at least in theory, to be relatively brief. In reality, stays in disciplinary segregation are likely to last for months or even years, rather than weeks or days.[40]

Over a hundred years ago, the Supreme Court cast harsh criticism on the practice of solitary confinement, observing that "[a] considerable number of [those confined to solitude] fell, after even a short confinement, into a semi-fatuous condition," while "others became violently insane," and "others, still, committed suicide."[41] Nor did the Court believe that solitary confinement served rehabilitative or deterrent purposes: even "those who stood the ordeal better were not generally reformed, and in most cases did not recover sufficient mental activity to be of any subsequent service to the community."[42] These observations are backed by scientific research providing strong evidence that solitary confinement is a form of psychological torture, and recidivism data showing that in some cases, supermax inmates have a *higher* chance of returning to crime than those housed in normal security prisons.[43] Despite Supreme Court criticism of the practice dating back to 1890, and our modern understanding of the psychological effects of isolation, the continual re-branding of solitary confinement has ensured that it continues to be used throughout the United States.[44] An estimated one hundred thousand people are confined in isolation on any given day.[45]

Even for those confined in the general population, the emotional toll of incarceration is so widely acknowledged to have gained the shorthand expressions *institutionalization* and *prisonization*. Whereas institutionalization refers to a process of increasing conformity to institutional norms, prisonization is focused on the changes that create a more oppositional and institutionally subversive stance or perspective.[46] Psychological processes cannot be understood solely by their observable effects, however. An individual may appear to be institutionalized—exhibiting less defiance and an increased acceptance of confinement—due to social withdrawal, psychological

38. Pigeon, *supra* note 35; Fathi, *supra* note 33.

39. Even minor rule violations like possessing tobacco or talking back to an officer may land an inmate in disciplinary segregation. GIBBONS & KATZENBACH, *supra* note 36, at 53.

40. *Id.*

41. In re Medley, 134 U.S. 160, 168 (1890).

42. *Id.*

43. Pigeon, *supra* note 35.

44. Danika Jo Anderson, *Solitary Confinement as Illegitimately Proscribed and Disproportional Punishment: Another Angle from Which to Attack the Inhumane Practice*, 35 NOTRE DAME J.L. ETHICS & PUB. POL'Y 301, 307 (2021).

45. Jules Lobel & Huda Akil, *Law & Neuroscience: The Case of Solitary Confinement*, 147 DAEDALUS 61, 64 (2018).

46. Haney, *supra* note 4, at 6 n.8.

distancing, or suppressed emotional reactions.[47] Thus, "the most negative consequences of institutionalization may first occur in the form of *internal* chaos, disorganization, stress, and fear."[48] In many cases, institutionalization is a learned facade; when the "external structure and supports upon which they relied to keep themselves controlled, directed, and balanced have been removed," these individuals "may behave in dysfunctional or even destructive ways."[49] It is therefore important to address the reality of prison and the potential effects of that environment, rather than looking to prisoners' outward appearance of conformity as evidence that all is well.[50]

A new inmate enters a restrictive environment with few material possessions, in which they are deprived of privacy and liberty and forced to adapt to an often harsh and rigid institutional routine.[51] Being subjected to exceedingly sparse material conditions and a stigmatized social status is stressful, unpleasant, and challenging.[52] For some inmates, such a regimented environment creates dependency; they can become so reliant on external constraints that they cease to use their own self-imposed internal organization to guide their actions and behavior.[53] Promoting dependency in already socially stigmatized adults is a form of degradation that can have severe consequences upon release.[54] Simply put, "[t]he experience 'can create habits of thinking and acting that are extremely dysfunctional' and permanently change those made to endure it."[55]

B. Victimization

Prisoners housed with other inmates may avoid some of the psychological trauma of isolation, but this proximity has a negative consequence as well—placement in the general population carries a high risk of victimization by other prisoners and guards. The psychological effects of the incarceration experience are "compounded by the knowledge of violence, the witnessing of violence, or

47. *Id.* at 8.

48. *Id.* at 12.

49. *Id.*

50. Many studies into the effect of prison on criminal behavior look only to inmates' conformity with prison norms, such as whether they refrained from misconduct and rule violations. *See, e.g.*, SCOTT D. CAMP & GERALD G. GAES, *Criminogenic Effects of the Prison Environment on Inmate Behavior: Some Experimental Evidence*, 51 CRIME & DELINQ'CY 425, 438 (2005). The study found that inmates did not exhibit increased misconduct in higher security prisons and concluded that such conformity negated claims of prison as criminogenic. However, because misconduct in the prison environment may be due to temporary institutionalization, such observations tell us little about the actual long-term effects of prison.

51. Haney, *supra* note 4, at 39.

52. *Id.*

53. *Id.* at 41.

54. When the external structures of prison are taken away, dependent former inmates "may find that they no longer know how to do things on their own, or know how to refrain from doing those things that are ultimately harmful or self-destructive." *Id.*

55. DeVeaux, *supra* note 26, at 261 (quoting Haney, *supra* note 4).

the experience of violence, all too common during incarceration."[56] This is supported by research showing that the rates of physical violence in prison are up to twenty-seven times higher than those in the general population,[57] and nearly half of all inmates experience direct physical victimization such as assault.[58] These inmates have worse post-release outcomes and higher recidivism rates.[59]

Overcrowding plays a role in the high rate of violence in prisons. On an administrative level, crowding pushes officers to rely on forceful means of control, which may lead to inmate-on-inmate violence.[60] A high prison population dilutes vital services like dental and medical care, and limits or eliminates the ability of prisoners to be productive.[61] These too may contribute to aggression and violence among inmates.[62] Overcrowding also takes a psychological toll; the excessive noise, heat, and tension create a hostile atmosphere and provide fertile ground for violence.[63]

Additionally, a lack of any meaningful prison programming may increase violence.[64] As the prison population grew in the 1970s, "politicians began to rhetorically devalue rehabilitation."[65] The resulting expectation was that prisons would protect society through incapacitation and punishment rather than seeking to help and treat inmates.[66] While the prison population continued to grow, funding for education, vocational training, and rehabilitative programming did not keep pace.[67] An overcrowded prison population with no meaningful programming is prone to physical violence.

While being physically victimized has a clear traumatic potential, repeatedly witnessing the victimization of other inmates contributes to the

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56. *Id.* at 259.

57. Alicia Piper & David Berle, *The Association Between Trauma Experienced During Incarceration and PTSD Outcomes: A Systematic Review and Meta-Analysis*, 30 J. FORENSIC PSYCHIATRY & PSYCH. 854, 855 (2019).

58. *See* Daquin et al., *supra* note 9, at 1018 (citing to research finding that between 32% and 66% of prison inmates experience direct physical victimization such as assault).

59. *Id.* at 1019.

60. GIBBONS & KATZENBACH, *supra* note 36, at 23 ("[T]here appears to be a strong correlation between reported levels of violence by staff against prisoners and violence among prisoners.").

61. *Id.*

62. *Id.*

63. *Id.*

64. *See id.* at 27 ("Few conditions compromise the safety and security of a correctional institution more than idle prisoners."); *see also* Katie Rose Quandt & Alexi Jones, *Research Roundup: Incarceration Can Cause Lasting Damage to Mental Health*, PRISON POL'Y INITIATIVE (May 13, 2021) https://www.prisonpolicy.org/blog/2021/05/13/mentalhealthimpacts/ (citing a survey in which inmates reported that lack of activity and mental stimulation leads to extreme stress, anger, and frustration).

65. GIBBONS & KATZENBACH, *supra* note 36, at 27.

66. *Id.*

67. *Id.*

chronic stress of prison and may itself be traumatic.[68] It is also extremely common.[69] Just as overcrowding leads to an increased likelihood of being physically victimized, it also increases exposure to "vicarious victimization." Witnessing inmates being assaulted impacts a person's perception of the likelihood that they too will be assaulted.[70] The resulting fear and worry create a state of chronic stress, and even vicarious victimization can have serious consequences: exposure to violence has been linked to depression and substance abuse, PTSD, anxiety, violence perpetration, and future victimization."[71] The following two Parts discuss the neurological bases for these consequences.

II. THE NEUROLOGICAL IMPACT OF THE PRISON EXPERIENCE

Numerous studies have shown that incarceration has adverse effects on mental and physical health.[72] However, few have considered the relationship between these negative effects and future criminal behavior.[73] Section A summarizes the neurological and psychological impact of chronic and traumatic stress, and Section B considers risk factors associated with worse outcomes from that exposure.

A. Stress and Trauma Change the Brain

Until recently, studies of the effects of prison were limited by the lack of meaningful techniques with which to measure psychological harm.[74] Attempts were further complicated by the fact that people adapt to the suffering they endure, thus exhibiting fewer signs of damage over time.[75] Neuroscience now allows us to evaluate the physical expressions of psychological harm and understand how the process of adapting to stress is itself harmful. As addressed

68. *See* Janine M. Zweig et al., *Using General Strain Theory to Explore the Effects of Prison Victimization Experiences on Later Offending and Substance Use*, 95 PRISON J. 84, 88 (2015) (referencing a study showing that both witnessing and being threatened with violence were related to lower well-being in the community and trauma symptoms"). For a discussion of the author's own experience witnessing victimization of other inmates while incarcerated, see DeVeaux, *supra* note 26, at 265.

69. A study of recently released inmates found that nearly all parolees reported witnessing at least one type of victimization during their incarceration, with witnessing emotional victimization (94%) and fighting (92%) being the most common, followed by witnessing stealing (82%) and sexual victimization (23%). Daquin et al., *supra* note 9, at 1026.

70. *Id.* at 1021.

71. *Id.* at 1020 (citations omitted).

72. *See, e.g.*, Diego Borbón, *Neurosociology and Penal Neuroabolitionism: Rethinking Justice with Neuroscience*, 7 FRONTIERS IN SOCIO. 2 (2022) (citing twelve studies that found impoverished spaces, punitive practices, and the prison environment correlate with poorer mental health).

73. *See* Jesse Meijers et al., *Reduced Self-Control after 3 Months of Imprisonment; A Pilot Study*, 9 FRONTIERS IN PSYCH. 5 (2018) ("[R]emarkably little is known about the . . . influence of imprisonment on reoffending and its possible underlying mechanisms").

74. Craig Haney, *Psychology and the Limits to Prison Pain: Confronting the Coming Crisis in Eighth Amendment Law*, 3 PSYCH., PUB. POL'Y & L. 499, 531 (1997).

75. *See id.*

in Part I, the prison experience is characterized by environmental stressors. This constant strain may take the form of "toxic stress," which is a persistent activation of the stress response that causes direct and physical damage to the brain.[76] Inmates who experience or witness physical victimization may develop Post-Traumatic Stress Disorder, which is also associated with neurological damage and behavioral changes.

1. Toxic Stress

Many inmates spend their incarceration feeling tense and always on guard due to the ever-present threat of violence and the general strain of confinement.[77] In most environments, stress serves an important and beneficial function: it primes the body to respond to perceived threats and prepares us for "fight or flight."[78] Once the threat has passed, the body returns to its baseline state. However, when exposed to prolonged stress, the body becomes unable to turn off the stress response.[79] This is because the hormones released during the stress response have receptors throughout the brain, allowing them to transcribe DNA and regulate gene expression.[80] Thus, on a physical level, stress changes the brain. When exposure to stress is prolonged, the brain begins to treat the elevated state as normal; in an environment marked by ever-present threats, "fight or flight" eventually becomes the baseline. Behaviors associated with the stress response become the default reaction to perceived threats.

At the same time, our ability to differentiate harmless stimuli from threatening ones is damaged.[81] This is due, in part, to the toxic effect of stress hormones. Prolonged exposure to these hormones over a period of weeks or months can cause a permanent loss of neurons.[82] Some of the brain regions most sensitive to this effect are the areas associated with aggression, memory, fear, and impulsivity.[83] When these regions are damaged, an individual may lose the ability to manage fear responses or to appropriately react to environmental stimuli.[84] Harmless stimuli are perceived as threats, and the

76. Andrea K. Blanch et al., *Toxic Stress, Behavioral Health, and the Next Major Era in Public Health*, 86 MENTAL HEALTH AM 6 (Sept. 17, 2014).

77. DeVeaux, *supra* note 26, at 265.

78. Hillary A. Franke, *Toxic Stress: Effects, Prevention and Treatment*, 1 CHILD. 390, 390 (2014), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4928741/pdf/children-01-00390.pdf.

79. *Id.* at 391 ("Th[e] abnormal stress response" results in "prolonged cortisol activation and a persistent inflammatory state, with failure of the body to normalize these changes after the stressor is removed.").

80. Sonia J. Lupien et al., *Effects of Stress Throughout the Lifespan on the Brain, Behaviour and Cognition*, 10 NATURE REVS.: NEUROSCIENCE 434, 434 (2009).

81. *See* Blanch et al., *supra* note 76, at 6 (noting that exposure to toxic stress can change our ability to control emotion and respond to fear or stress).

82. *See* Robert M. Sapolsky, *Why Stress is Bad for Your Brain*, 273 SCIENCE 749, 750 (Aug. 9, 1996).

83. *See id.* at 749 (finding stress-induced atrophy in the hippocampus, amygdala, and temporal lobe).

84. Samantha Walls, *The Need for Special Veterans Courts*, 39 DENV. J. INT'L L. & POL'Y 695, 710 (2011).

individual reacts accordingly. The result is a state of chronic stress that persists—and continues to harm the brain—after the stressor has been removed.

It is possible to reduce the negative effects of toxic stress. An individual's resilience—their ability to "maintain positive mental health . . . despite the presence of toxic stress"—is not innate or predetermined.[85] Rather, it can be strengthened or weakened over time depending on the availability of certain resources. Resources that promote resilience include "family cohesion, stimulating environments, social support, and adequate income."[86] As addressed in Part I, however, the prison environment is characterized by its deprivations. Thus, not only does incarceration expose inmates to toxic stress, but it also deprives them of the resources they need to build resilience.

As an impoverished environment, prison can have adverse effects beyond those caused by prolonged stress. Inmates are less physically active, experience social isolation, and are rarely challenged cognitively; such impoverished environments negatively affect the prefrontal cortex, impacting executive functions like self-control and impulsivity.[87] Compounding these are the indirect consequences of an impoverished environment, such as chronic stress and sleep disturbances.[88] Sleep disturbances, in turn, are a risk factor for aggressive behavior, especially in a high-risk population.[89] Victimization, stress, and aggression are interrelated; in an impoverished environment, the effects are worsened.

2. Traumatic Experiences and PTSD

Much like toxic stress, trauma can force the brain to remain in survival mode long after the stressor is removed, causing biological changes in the brain and body. Trauma can result from singular events, but it can also develop after repeated stress-inducing experiences. Post-Traumatic Stress Disorder ("PTSD") is defined as "the development of characteristic and persistent symptoms, along with difficulty functioning after exposure to" dangerous or life-threatening experiences or events.[90] PTSD has been studied extensively in combat veterans, but it can also result from experiencing or witnessing violent crime, abuse, and personal assaults.[91] Research has estimated that as much as 48% of the incarcerated population has PTSD,[92] a prevalence rate far eclipsing that of the general U.S. population (6%), as well as high-risk occupations like

85. Blanch et al., *supra* note 76, at 10.

86. *Id.*

87. *See* Jesse Meijers et al., *supra* note 73, at 2.

88. *Id.*

89. *Id.*

90. U.S DEP'T OF VETERANS AFFS. & U.S. DEP'T OF DEF., VA/DOD CLINICAL PRACTICE GUIDELINE FOR MANAGEMENT OF POST-TRAUMATIC STRESS 58 (Oct. 2010), https://www.healthquality.va.gov/PTSD-FULL-2010c.pdf.

91. *See* Miriam Reisman, *PTSD Treatment for Veterans: What's Working, What's New, and What's Next*, 41 P&T 623 (2016), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5047000/pdf/ptj4110623.pdf.

92. Piper & Berle, *supra* note 57, at 855.

rescue workers (10%), police officers (13.6%), and combat personnel (between 10-20%).[93]

Studies of combat veterans have found several factors that increase the risk of PTSD, including younger age at the time of the trauma, prior psychological problems, racial minority status, low socioeconomic status, and lack of social support from family, friends, and community.[94] These same characteristics are overrepresented in the prison population. So too is the prevalence of prior trauma higher in the prison population than in the general population. Prior exposure to trauma greatly increases the likelihood of developing PTSD when exposed to trauma later in life.[95] As research has shown, "incarceration compounds the effects of previous [traumatic events], leading to a cumulative effect of traumatic experiences."[96]

B. Risk Factors

Certain factors—such as young age, a history of prior trauma, and preexisting mental disorders—are associated with worse reactions to trauma. All of these are overrepresented in the prison population. Given the high rate of victimization in prison—and the disproportionate number of young offenders and inmates with mental disorders—the incarcerated population comprises many of the groups most vulnerable to neurological damage from the experience.

1. Young Age

Following a surge in youth violence during the late 1980s, policymakers began to prioritize a "get tough" approach to youthful offending.[97] Accompanying this approach was an increasing commitment to the ideals of punishment and retribution, which led to a dramatic increase in the number of young people arrested and the length of sentences they received.[98] Despite reforms in juvenile justice over the past two decades, and the growing body of research showing that development continues into our twenties, young

93. U.S. DEP'T OF VETERANS AFFS., *How Common Is PTSD in Adults?*, https://www.ptsd.va.gov/understand/common/common_adults.asp (general population); Piper & Berle, *supra* note 57, at 855 (rescue workers and police officers); U.S DEP'T OF VETERANS AFFS. & U.S. DEP'T OF DEF, *supra* note 90, at 5 (combat personnel).

94. Reisman, *supra* note 91, at 624.

95. Piper & Berle, *supra* note 57, at 856 ("[T]he theory of cumulative trauma stipulates that individuals who experience greater numbers of trauma types or events are more likely to develop PTSD.").

96. *Id.*

97. *See* Maddy Troilo, *Locking Up Youth with Adults: An Update*, PRISON POL'Y INITIATIVE (Feb. 27, 2018), https://www.prisonpolicy.org/blog/2018/02/27/youth/; *see also* Laurence Steinberg et al., *Reentry of Young Offenders from the Justice System: A Developmental Perspective*, 2 YOUTH VIOLENCE & JUV. JUST. 21, 27 (2004).

98. *Id.*

offenders continue to receive *harsher* sentences than older adults.[99] The individuals most prone to "transitory" crime—criminal behavior from which they will desist naturally—therefore receive the harshest sentences as a penalty for their young age.[100]

Importantly, young offenders have a heightened risk of experiencing trauma in prison for multiple and compounding reasons. First, this period of brain development involves cognitive processes being formed in direct response to the environment; a deprived or stressful environment can hinder this process and damage the brain.[101] Second, those who offend at a young age are more likely to have already experienced a traumatic event than their older counterparts.[102] Trauma is cumulative, and "individuals who experience greater numbers of trauma types or events are more likely to develop PTSD."[103] Third, youthful offenders are at an even greater risk in prison, where they are frequently victimized by older offenders.[104]

The impact of prison on young offenders is of major importance—the vast majority of current inmates were first arrested before age twenty-five.[105] Consistent with the "age-crime curve," an individual's risk of committing crime peaks in adolescence and early adulthood, before declining naturally as they age. On average, an individual is most likely to commit a crime between the

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99. *See* Gupta-Kagan, *supra* note 15, at 698–699. This "young adult penalty" in sentencing is most severe for young Black and Latino men. *Id.* at 699.

100. *See id.*

101. Some of the brain areas still developing in early adulthood are also those most damaged by trauma and toxic stress. "The hippocampus, a brain region known for its involvement in memory including of specific experiences and events (episodic memory), continues to mature into adolescence," and its connectivity with the prefrontal cortex "shows protracted growth into the thirties." UNICEF OFF. OF RSCH., THE ADOLESCENT BRAIN: A SECOND WINDOW OF OPPORTUNITY 32 (2017), https://reliefweb.int/sites/reliefweb.int/files/resources/adolescent_brain_a_second_window_of_opportunity_a_compendium.pdf. "But under conditions of severe and sustained stress, the hippocampus . . . begins to fail in its functioning, with loss of emotional and stress control, loss of stress regulation . . . and in extreme cases, lasting changes in mood." Lobel & Akil, *supra* note 45, at 69–70; *see also* Jonathan E. Sherin & Charles B. Nemeroff, *Post-Traumatic Stress Disorder: The Neurobiological Impact of Psychological Trauma*, 13 DIALOGUES IN CLINICAL NEUROSCIENCE 263, 270–71 (2011) ("[P]rolonged exposure to stress and high levels of glucocorticoids . . . damages the hippocampus," potentially causing "deficits in discriminating between safe and unsafe environmental contexts.").

102. *See* Tiegan Mercer, *Young Adult Men in Prison: The Case for a Dedicated Approach*, PENAL REFORM INT'L (Nov. 23, 2020), https://www.penalreform.org/blog/young-adult-men-in-prison-the-case-for/#_ftnref10 (referencing a study which "concluded that all young people in custody are vulnerable with a high rate of complex and traumatic backgrounds, further compounded by mental health issues and a lack of maturity.").

103. Piper & Berle, *supra* note 57, at 856.

104. A study of young adult offenders in the UK "found that people in prison aged 18 to 24 were more likely to experience abuse and attempt suicide." Mercer, *supra* note 102; *see also* Steinberg et al., *supra* note 97, at 31.

105. Of state prisoners released in 2012, "[a]n estimated 85% were first arrested when they were age 24 or younger." DUROSE & ANTENANGELI, *supra* note 16, at 3.

age of seventeen and twenty-four; over time, their propensity for criminal behavior declines naturally.[106] Simply put, most young people "age out of crime."[107] This phenomenon corresponds with brain maturity, and the curve parallels those behaviors that define young adulthood: increased risk-taking, susceptibility to peer influence, and heightened emotional reactivity.

This period of increased risk-taking behavior is marked by dramatic changes in the brain, as it sheds surplus grey matter and begins to build the connections that will carry into adulthood.[108] Additionally, this is an important time of social and psychological development, when the skills needed to transition from "the dependency of adolescence to the self-sufficiency of adulthood" are gained and utilized.[109] Thus, the period from late adolescence to early adulthood is both criminologically and developmentally distinct. The potential for harm due to toxic stress is especially high during this time. Some regions of the brain are still developing well into our twenties, and those regions are vulnerable to the greatest changes due to chronic exposure to stress hormones.[110]

Indeed, late adolescence and early adulthood has been called a "second window of opportunity" to positively influence a person's life trajectory.[111] Like the first window in early childhood, the period is marked by important neurological changes and a shift in social awareness. These changes are part of an overall "sculpting of the brain . . . to fit the demands of its environment in order to promote optimal survival."[112] An individual's environment, therefore, directly impacts how the brain is molded; "maladaptive experiences" in young adulthood "can disrupt normative trajectories and establish abnormal ones such as criminality."[113] One explanation for the strong influence of environment on life course trajectory is that external shifts and disruptions cause an internal response, as the brain modifies and changes the connections between cells to best adapt.[114] The young adult brain is still highly plastic, and the pathways that are formed and reinforced during these years become a part of its permanent

106. *See generally* Caitlin V. M. Cornelius et al., Aging Out of Crime: Exploring the Relationship Between Age and Crime with Agent Based Modeling (SpringSim-ADS Conference, 2017), https://scs.org/wp-content/uploads/2017/06/6_Final_Manuscript.pdf. "The age and crime relationship is one of the strongest and most well tested in criminology." *Id.* at 26.

107. *Id.* at 26, 30.

108. *See* Emily Graham, *Emerging Adults in the Federal System: A Case for Implementing the Federal Youth Corrections Act*, 11 HARV. L. & POL'Y REV. 619, 623 (2017); Terry A. Maroney, *The False Promise of Adolescent Brain Science in Juvenile Justice*, 85 NOTRE DAME L. REV. 89, 98–99 (2013).

109. Steinberg et al., *supra* note 97, at 24.

110. Lupien et al., *supra* note 80, at 440 (noting that stress may affect amygdala and frontal cortex volume, since these regions are still developing until our late twenties).

111. *See generally* UNICEF, *supra* note 101.

112. *Id.* at 30.

113. *Id.* at 33.

114. *Id.* at 40.

architecture.[115] An environment marked by stressors molds the brain, priming it to respond to danger; even in the absence of a threat, otherwise harmless stimuli follow the same pathways as dangerous stimuli, resulting in dysregulated responses like aggression.

Young adult offenders have a heightened risk of being victimized while incarcerated.[116] This, combined with the heightened influence of environment during the second window of brain development, makes incarceration particularly harmful for young offenders. As that is also the age range most likely to be arrested, the potential for harm is expansive.

2. Mental Disorders and Prior Trauma

Similarly, those with preexisting mental disorders are known to have worse reactions to chronic stress.[117] Incarceration can "exacerbate their psychiatric conditions—sometimes irreparably—and subject them to extreme retraumatization."[118] The prevalence of psychiatric disorders in the prison population far exceeds that of the general population. A 2006 survey by the Bureau of Justice Statistics revealed that "more than half of all inmates had some kind of mental health problem."[119] This is more than twice the rate of mental illness in the United States generally.[120] Furthermore, many mentally ill prisoners have experienced trauma or abuse in the past.[121] Research has shown

115. *Id.* ("Cortical plasticity refers to the brain's ability to reorganize and adjust its neural connections in response to environmental stimuli.").

116. *See* Steinberg et al., *supra* note 97, at 31.

117. *See* Blanch et al., *supra* note 76, at 7 (noting "the heightened sensitivity to stress often found in people diagnosed with psychotic disorders, including schizophrenia"); Heather M. Burke et al., *Depression and Cortisol Responses to Psychological Stress: A Meta-Analysis*, 30 PSYCHONEUROENDOCRINOLOGY 846 (2005) (finding that depression is associated with impaired recovery from a state of stress).

118. HANEY, supra note 2, at 387.

119. NAT'L RSCH. COUNCIL, *supra* note 19, at 204. Far from being a new problem, "[t]he presence of large concentrations of mentally ill persons within prisons and jails has been noted for almost a hundred years." *Id.* at 205.

120. According to the National Alliance on Mental Illness, 21% of U.S. adults experienced mental illness in 2020. NAT'L ALL. MENTAL ILLNESS, *Mental Health by the Numbers*, https://www.nami.org/mhstats (last updated June 2022). The difference is even greater for serious mental illness: whereas 5.6% of adults in the U.S. experienced serious mental illness in 2020, *id.*, an estimated "10-25 percent of prisoners" deal with the same serious diagnoses. NAT'L RSCH. COUNCIL, *supra* note 19, at 205.

121. *See* Sandy Gibson, *Exploring the Influence of Ethnicity, Age, and Trauma on Prisoners' World Assumptions*, 50 J. OFFENDER REHAB. 142, 143 (2011) ("[R]esearch on U.S. prisoners repeatedly identifies a high prevalence of trauma, such as child abuse and neglect, suggesting that many individuals with trauma history end up in prison."); *see also* Nancy Wolff & Jing Shi, *Childhood and Adult Trauma Experiences of Incarcerated Persons and Their Relationship to Adult Behavioral Health Problems and Treatment*, 9 INT'L J. ENV'T RSCH. & PUB. HEALTH 1908, 1910 (2012) ("The association between childhood trauma and behavioral health and aggressive behavior in adulthood is well-established in the literature."). Indeed, "[o]ne study found that child[hood] abuse increases the risk of criminality by 50%." Blanch et al., *supra* note 76, at 8.

that "upwards of 93% of criminal offenders" have experienced trauma, "such as being a victim of and/or witness to physical or sexual assault."[122]

Inmates with mental disorders have higher rates of substance abuse disorders, which are exacerbated by stressful and unpredictable environments.[123] They are more likely to be victimized or harm themselves in prison.[124] They are often placed in administrative segregation for their safety; as discussed in Part I, however, this form of solitary confinement has severe negative psychological consequences. Additionally, inmates with mental illness commit more disciplinary infractions than those without.[125] Infractions are punished with further solitary confinement and can lead to increased prison time, as they are less likely to be released or paroled early.[126] Overall, "offenders with mental illness are disproportionately assigned to solitary confinement," where they are placed for "longer, more indefinite periods of time relative to other inmates."[127] Once admitted back into the general population, these inmates will have more psychiatric symptoms and be more likely to commit further crime.

Offenders with mental illness may be overrepresented in prisons because of their mental illness. That is not to say that psychological disorders *cause* criminality; rather, the attendant consequences of mental illness—substance abuse, homelessness, and social instability—are "more strongly and proximately related to both crime and violence" than disorders alone.[128] By exacerbating mental illness, incarceration increases the likelihood of experiencing these consequences, creating a cycle of recidivism. A conviction and prison sentence lead to further convictions, longer sentences, and greater psychological harm.

III. STRESS, TRAUMA, AND CRIMINAL BEHAVIOR

Exposure to trauma and toxic stress correlate with an increase in criminal behavior.[129] Whether "witnessed, threatened, or experienced," exposure to violence—a routine occurrence in prison—is "positively and significantly

122. Deborah Courtney & Tina Maschi, *Trauma and Stress Among Older Adults in Prison: Breaking the Cycle of Silence*, 19 TRAUMATOLOGY 73, 73 (2012).

123. *See* HANEY, *supra* note 2, at 386.

124. *See* Manchak & Morgan, *supra* note 15, at 588.

125. *See id.* at 584.

126. *See id.* at 585.

127. *Id.* at 589.

128. *Id.* at 582.

129. *See* Naomi Sadeh & Dale E. McNiel, *Posttraumatic Stress Disorder Increases Risk of Criminal Recidivism Among Justice-Involved Persons with Mental Disorders*, 42 CRIM. JUST. & BEHAV. 573, 574 (June 2015) ("PTSD and victimization experiences have been associated with increased rates of violent behavior and drug use."); Daquin et al., *supra* note 9, at 1020 ("Exposure to violence has been linked to depression and substance abuse . . . violence perpetration, and future victimization."); Zweig et al., *supra* note 68, at 108 (finding that "in-prison victimization leads to negative emotional reactions (hostility or depression), which, in turn, lead to negative behavioral outcomes in the community (criminal behavior and illegal use of drugs)").

associated with property crime, violent offending, and substance use."[130] The interaction between trauma and crime is far from linear, and there is no universal response to adversity; it involves a cyclic interplay between environmental factors, neurological effects, and behavioral responses that lead to new environmental factors.[131] Nevertheless, many researchers agree that "there is an obvious link between trauma and offending behavior," and the ramifications of chronic stress may "intersect with the cycle of offending and recidivism."[132]

Seeking neurological explanations for violence can be a slippery slope.[133] However, "criminal behavior" refers to a far broader category of arrestable offenses. Indeed, 92% of inmates in federal prisons and 42% of inmates in state prisons are serving time for a nonviolent offense.[134] Chief among these are drug crimes—nearly half of the federal prison population is incarcerated for a drug offense.[135] Thus, although links between trauma and violent behavior exist and will be explored, equally important is the strong correlation between trauma and substance abuse. Section A explores the former, Section B the latter.

A. Trauma and Violent Offending

The phrase "violent crime" brings to mind assault and homicide, but one of the largest categories classified as a violent offense is robbery.[136] Thus, behavior that leads to violent offending need not be motivated by aggression or hostility, but instead may result from economic need or impulsivity. As discussed in Part II, impoverished environments and chronic stress can damage parts of the brain involved in executive functioning. This leads to reduced self-control and an increase in "impulsive risk-taking behavior."[137] Our ability to weigh the potential benefits of an action against its perceived risk depends on executive functioning; without it, many former inmates become "less capable than they were before imprisonment to live a lawful life outside of crime."[138]

Relatedly, one of the reasons criminal behavior declines as people age is that with increased maturity comes the ability to make better, more calculated decisions under stress.[139] When a young person's environment is one of constant stress, however, that ability cannot develop. As the "fight or flight"

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130. Chelsea Farrell & Gregory M. Zimmerman, *Does Offending Intensify as Exposure to Violence Aggregates? Reconsidering the Effects of Repeat Victimization, Types of Exposure to Violence, and Polyvictimization on Property Crime, Violent Offending, and Substance Use*, 53 J. CRIM. JUST. 25, 29 (2017).

131. *Cf.* DeVeaux, *supra* note 26, at 262 ("The conceptualization of trauma is created by the relationship between the event, the individual involved, and her reaction to it.").

132. Courtney & Maschi, *supra* note 122, at 80.

133. *See, e.g.*, Pustilnik, *supra* note 12 (comparing current efforts to locate a neurological explanation for violence to the damaging pseudoscientific attempts of the past).

134. Carson, *supra* note 23, at 28, 32.

135. *See id.* at 32.

136. HANEY, *supra* note 2, at 382.

137. Meijers et al., *supra* note 73, at 5.

138. *Id.*

139. *See* Gupta-Kagan, *supra* note 15, at 672.

response becomes ingrained, aggressive behaviors replace the calculated responses that would have matured during that period. Violence is most significantly related to a condition known as complex trauma. This can develop from exposure to stressors in contexts like prolonged isolation or captivity, which compromises the ability to self-regulate emotions.[140] Stressful conditions of captivity lead to "maladaptive ways of thinking, and aggressive, antisocial, and delinquent behaviors."[141]

The incarcerated population has a high risk of developing complex trauma and PTSD. Individuals diagnosed with these disorders, like those subjected to chronic stress, often exhibit a heightened reactivity to stress, decreased ability to separate harmless stimuli from threats, and dysregulated behavioral responses like aggression.[142] Once released from prison, these traits may persist, increasing the likelihood of arrest for violent crimes like assault. In conjunction with the risk-taking and impulsive behavior that may develop after trauma, the conditions within prison have the potential to increase violent crime after release.

B. Trauma and Substance Abuse

Substance abuse is among the most common reactions to chronic stress and trauma.[143] It also increases the risk of recidivism.[144] "The relationship between substance abuse and crime, including violence, is well documented."[145] On a psychological level, it has been theorized that victimization in prison can lead to externalized feelings (like anger and hostility) or internalized feelings (like depression and anxiety).[146] Externalized feelings are alleviated by criminal behavior involving violence, while internalized feelings are alleviated by criminal behavior involving substance abuse.[147]

This connection is elucidated by neuroscience research. GABA, a neurotransmitter that has "profound anxiolytic effects and dampens behavioral and physiological responses to stressors," is also the main target for alcohol and

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140. John Matthew Fabian, *Forensic Neuropsychology and Violence*, *in* THE WILEY BLACKWELL HANDBOOK OF FORENSIC NEUROSCIENCE 855 (2018).

141. *Id.*

142. Wolff & Shi, *supra* note 121, at 1920 ("Trauma exposure, in general, was positively associated with psychopathology" as well as aggressive behavior).

143. Numerous studies have shown a strong link between childhood trauma and substance abuse, but this effect is not limited to early stress, and "exposure to trauma in adulthood also increases risk for substance use." Blanch et al., *supra* note 76, at 8.

144. "Multiple causal roles link involvement with drugs to criminal behavior." Beth M. Huebner & Mark T. Berg, *Examining the Sources of Variation in Risk for Recidivism*, 28 JUST. Q. 146, 149 (2011) (referencing the direct pharmacological effects of drugs and the consequences of substance abuse on employment and relationships); *see also* Wagdy Loza, *Predicting Violent and Nonviolent Recidivism of Incarcerated Male Offenders*, 8 AGGRESSION & VIOLENT BEHAV. 175, 184 (2003).

145. Loza, *supra* note 144.

146. Zweig et al., *supra* note 68, at 85.

147. *Id.*

other substances.[148] Because prolonged, uncontrolled stress leads to alterations in GABA receptors, it is possible that self-medication is an attempt to correct this neurological deficit.[149] Similarly, the neurotransmitters dopamine, serotonin, and opioid peptides are involved in regulating the stress response; these are also the neurotransmitters targeted by opioids and other substances of abuse.[150] Chronic stress can permanently change neural pathways, "resulting in a drug-prone state that is independent of the actual presence of the stressor."[151] In this way, the stress of prison may lead to addictive behavior that persists after release, even in inmates with no prior history of substance abuse. Without access to mental health resources in the community, many former inmates fall into patterns of substance abuse that are likely to lead to rearrest.

IV. PROPOSAL

A beneficial environment can foster resilience and reduce the negative effects of chronic stress and trauma.[152] Accordingly, Section A focuses on improving post-release outcomes by improving prison conditions. Research shows that long sentences don't decrease recidivism and, especially in the case of young offenders, are associated with greater psychological harm. Criminal justice policy decisions should be made with these effects in mind. Section B proposes changes to the way we implement and think about sentencing.

A. Improving the Current Prison System

Research in psychology has shown that "variations in social setting and context play an extremely important causal role in the incidence of criminality."[153] When ninety-five percent of the 1.2 million people currently incarcerated will eventually be released, and when multiple studies have found "a relationship between harsher prison environments and higher reoffending rates," the conditions of incarceration may have a direct impact on crime rates.[154]

1. Substance Abuse Counseling

As addressed in Section III.B, people often respond to trauma and toxic stress by self-medicating through substance abuse. Drug addiction can have direct criminogenic consequences (like dealing to support a habit), and indirect ones (like increased paranoia and aggression).[155] On the whole, inmates are

148. Sherin & Nemerof, *supra* note 101, at 269.

149. *Id.*

150. *See* Kathleen T. Brady & Susan C. Sonne, *The Role of Stress in Alcohol Use, Alcoholism Treatment, and Relapse*, 23 ALCOHOL RSCH. & HEALTH 263, 264 (1999).

151. *Id.* at 266.

152. *See supra* Section II.A.1.

153. Craig Haney, *Psychology and the Limits to Prison Pain: Confronting the Coming Crisis in Eighth Amendment Law*, 3 PSYCH., PUB. POL'Y & L. 499, 502 (1997).

154. Meijers et al., *supra* note 73, at 5

155. *See* HANEY, *supra* note 2, at 190–91.

especially likely to respond to trauma with substance abuse behaviors, because they are more likely to already have a substance use disorder (SUD) when they enter prison.[156] These inmates rarely receive effective treatment while incarcerated. The treatment that is available usually consists of behavioral counseling or detoxification without follow-up treatment.[157] However, "detoxification alone is rarely sufficient to help addicted individuals achieve long-term abstinence."[158] Studies show that using medication to treat inmates with SUDs decreases their criminal activity post-incarceration.[159] Despite the proven efficacy of this treatment, only 5% of inmates receive medication for SUDs; indeed, a survey of prison medical directors found that "most are not aware of the benefits of using medications with treatment."[160]

Prison is not a normal treatment environment. While receiving treatment for SUDs, inmates continue to be exposed to high levels of stress, which is "a major cause of continued drug dependence."[161] An effective treatment plan, then, would work to mitigate the effects of stress on relapse behavior, rather than treating SUDs in isolation. Additionally, treatment should continue after release, possibly through participation in a community-based therapy program. A study of California's post-release program found a recidivism rate of only 25% for those who received treatment both during and after incarceration; in contrast, inmates who received neither had a recidivism rate of 67%.[162] Inmates are highly likely to voluntarily participate in psychiatric services if offered.[163]

2. Prison Programming and Community Resources

Behavior is a response to environmental stimuli mediated by a wide range of variables. Even those with a family history of violence, or who have experienced formative traumatic events, "can be very resilient in bouncing back from adversity, given the right conditions."[164] A beneficial environment, while

156. Approximately 85% of inmates have an active SUD or were incarcerated for a drug offense. *Criminal Justice DrugFacts*, NAT'L INST. ON DRUG ABUSE, https://nida.nih.gov/publications/drugfacts/criminal-justice#:~:text=There%20are%20high%20rates%20of,overdose%20following%20release%20from%20incarceration.

157. *Id.*

158. NAT'L INST. ON DRUG ABUSE, PRINCIPLES OF DRUG ADDICTION TREATMENT: A RESEARCH-BASED GUIDE 5 (3rd ed. 2018), https://nida.nih.gov/download/675/principles-drug-addiction-treatment-research-based-guide-third-edition.pdf?v=74dad603627bab89b93193918330c223.

159. *Criminal Justice DrugFacts*, *supra* note 156.

160. *Id.*

161. Gabor Maté, *Addiction: Childhood Trauma, Stress and the Biology of Addiction*, 1 J. OF RESTORATIVE MED. 56, 61 (2012).

162. Matthew L. Hiller et al., *Prison-Based Substance Abuse Treatment, Residential Aftercare and Recidivism*, 94 ADDICTION 833, 834 (1999).

163. Manchak & Morgan, *supra* note 15, at 587 (referencing studies to show that about 75% of inmates currently receiving psychiatric services chose to do so independently or after being referred).

164. LEE, *supra* note 11, at 36.

not outcome-determinative, can be the difference between resilience and vulnerability to toxic stress.

Educational and vocational programs can help inmates avoid some of the deprivations of prison. Programming can provide a sense of fulfillment, as well as access to resources that directly improve post-release outcomes. Educational programs reduce rule-breaking in prison and "can cut recidivism rates by nearly half."[165] Importantly, obtaining a degree while incarcerated provides financial and social benefits after release. Vocational programs also improve post-release outcomes; inmates gain work experience and earn wages which allow them to support family and transition back into society.[166] Programming also eases the psychological harms of incarceration. By providing productive outlets for physical energy, prison programs decrease inmate-on-inmate violence, thereby reducing traumatic victimization experiences.[167] Similarly, educational programs allow inmates to focus their mental energy on tangible goals, thus reducing the emotional toll of isolation. The result is an improvement in quality of life and a decreased likelihood of suffering from trauma and toxic stress. The most effective prison programming would also include mental health interventions. Cognitive-behavioral programs, which encourage inmates to understand the causes and consequences of their behavior, "can reduce misconduct in correctional facilities and lower recidivism rates by at least 10 percent."[168]

Programming should continue after release, providing community resources to ease the transition from prison. After serving their sentences, people convicted of crimes still face a significant loss of civil rights and personal freedom. Former inmates lose employment and educational opportunities, parental rights, and the ability to choose where they live and work.[169] The result is that they are more often poor, cut off from social and family ties, and restricted to impoverished neighborhoods where criminal activity is commonplace.[170] These collateral consequences dramatically increase the likelihood of rearrest, and when combined with the psychological toll of incarceration, make a successful transition from prison difficult. Executive

165. GIBBONS & KATZENBACH, *supra* note 36, at 28. A study of released federal prisoners found that those without a high school diploma had a recidivism rate of 60.4%, compared with a rate of 50.7% for high school graduates and 19.1% for college graduates. U.S. SENT'G COMM'N, RECIDIVISM AMONG FEDERAL OFFENDERS: A COMPREHENSIVE OVERVIEW 24 (Mar. 2016), ussc.gov/sites/default/files/pdf/research-and-publications/research-publications/2016/recidivism_overview.pdf.

166. *See* Marilyn C. Moses & Cindy J. Smith, *Factories Behind Fences: Do Prison 'Real Work' Programs Work?*, 257 NAT'L INST. JUST. J. 32, 33 (June 2007).

167. GIBBONS & KATZENBACH, *supra* note 36, at 29 (recommending greater investment in educational, vocational, and behavioral programs, which "have been demonstrated to promote safety in the short and long term").

168. *Id.* at 28.

169. *See* Gabriel J. Chin, *The New Civil Death: Rethinking Punishment in the Era of Mass Conviction*, 160 U. PA. L. REV. 1789, 1790 (2012).

170. *See* HANEY, *supra* note 2, at 198–99.

functioning and self-regulation are "crucial for a successful return to society."[171] Former inmates need to find housing and secure an income; make and adjust plans when necessary; and "resist temptations and control their emotions."[172] Achieving these goals requires overcoming the psychological effects of their incarceration experience. By providing a beneficial environment after release, community resources can minimize the collateral social and psychological consequences of a criminal conviction. The most valuable resources would include counseling, assistance with parenting and family obligations, and education and employment services.[173]

B. Sentencing Reform

Sentencing determinations should take into account the potential criminogenic effects of prison. We must consider which inmates are most likely to experience trauma while incarcerated, and which groups are predisposed to the worst outcomes if they do. Young offenders fall into both categories. For all inmates, longer sentences mean greater exposure to toxic stress and an increased likelihood of trauma, both of which are associated with worse post-release outcomes.

1. Establishing a Separate Category for Young Adult Offenders

The understanding that individuals are still undergoing significant development well into their twenties is not new. Research as early as the 1960s began to provide empirical evidence that the brain areas associated with impulse control and reasoning are among the last to mature.[174] Since the 1990s, "scientific research has provided consistent evidence" that brain maturation continues into the mid-20s.[175] Because young adult offenders are still undergoing cognitive development, it is especially important to minimize the neurological harm they are exposed to in the name of punishment. Treating young adults as a unique age group makes sense because young adult offenders *are* unique.[176] They commit a disproportionate number of crimes, are significantly more likely to desist from crime naturally, and have the worst outcomes from incarceration. Accordingly, a separate sentencing category should be established for offenders between the ages of eighteen and twenty-four.

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171. Sjors Ligthart et al., *Prison and the Brain: Neuropsychological Research in the Light of the European Convention on Human Rights*, 10 NEW J. EUR. CRIM. L. 287, 293 (2019).

172. *Id.*

173. *See* Haney, *supra* note 4, at 17–19.

174. *See, e.g.*, PAUL L. YAKOVLEV & ANDRE-ROCH LECOURS, *The Myelogenetic Cycles of Regional Maturation of the Brain*, *in* REGIONAL DEVELOPMENT OF THE BRAIN IN EARLY LIFE 3 (Alexandre Minkowski ed., 1967).

175. Kathryn Monahan et al., *Juvenile Justice Policy and Practice: A Developmental Perspective*, 44 CRIME & JUST. 577, 578 (2015).

176. *Cf.* Graham, *supra* note 108, at 624 (observing that "emerging adults, in addition to their differences from mature adults, are also a distinct population from juveniles").

Even before there was scientific support, the need to treat this age as a separate legal category was understood and accepted; between 1950 and 1984, the Federal Youth Corrections Act explicitly allowed "defendants aged eighteen through twenty-five to be sentenced to probation services instead of prison, serve lower sentences than older adults, and have aspects of their criminal history sealed."[177] The Act was repealed by a 1984 "crime control bill," which also established the federal sentencing commission and abolished parole in the federal system.[178] Though the criminal reforms of the 1980s departed from the idea, there is a growing acceptance that "[o]n average, the group is less culpable and has significant capacity for rehabilitation."[179]

Offenders in their late teens and early twenties are sentenced the same as—or even more harshly than—older adults.[180] Though sentencing guidelines instruct judges to consider an individual's likelihood of rehabilitation when exercising discretion, "they sometimes treat youthfulness as an aggravating rather than a mitigating factor."[181] They do so based on either of two assumptions. The first is the belief that an offender's young age at the time of the offense indicates innate criminality—that a younger offender is less likely to desist from crime. But that assumption contradicts the age-crime curve and the Supreme Court's stated conclusion that young offenders have a great capacity for rehabilitation.[182] The second assumption is that, based on the age-crime curve, a longer sentence is an effective way to incapacitate a young offender during their peak crime years.[183] Considering the high rates of victimization for young offenders in prison, and the developing brain's vulnerability to trauma, this is far from true. Youthful offenders are the most harmed by long sentences, and prison has the potential to disrupt their natural desistence from crime.

Not only are individuals most likely to commit crimes during adolescence and emerging adulthood, but they are also most likely to desist from crime during this period.[184] This desistence occurs without intervention for the

177. *Id.* at 619

178. *Id.*

179. *Id.* at 620.

180. *See* Shawn D. Bushway & Anne Morrison Piehl, *The Inextricable Link Between Age and Criminal History in Sentencing*, 53 CRIME & DELINQ. 156, 157 (2007) ("Empirical studies of sentencing outcomes generally find that, on average, younger defendants receive longer sentences, controlling for other attributes of the crimes and the defendants' criminal histories."). Some sentencing guidelines explicitly direct judges to impose harsher sentences on young adults: "[m]ost notably, the Virginia sentencing guidelines include a penalty for youth in the calculation used to determine sentence enhancements." *Id.* at 160.

181. Barry C. Feld, *Punishing Kids in Juvenile and Criminal Courts*, 47 CRIME AND JUST. 417, 454 (2018).

182. *See* Graham, *supra* note 108, at 620.

183. *See* Gupta-Kagan, *supra* note 15, at 714.

184. *See* David P. Farrington et al., *Young Adult Offenders: The Need for More Effective Legislative Options and Justice Processing*, 11 CRIMINOLOGY & PUB. POL'Y 729, 734 (2012) (noting that "the highest concentration of desistance takes place during early adulthood irrespective of age of onset").

majority of young offenders. In the Cambridge Study in Delinquent Development, a "prospective longitudinal survey" of young adult offenders, decreases in self-reported offending led to the conclusion that "most offenders desisted naturally in their early 20s."[185] The desistance was not due to incarceration; on the contrary, "convictions were followed by an increase in self-reported offending in this sample."[186] A graded sentencing scheme would take into account the age-crime curve, giving less harsh sentences to those at the peak of the curve (who are least likely to be deterred by prison and most likely to be victimized while incarcerated), while increasing sentence severity with increasing offender age. This approach would mitigate the negative effects of prison for the group most likely to desist from crime naturally. Though chronic stress can have a negative effect at any age, the harm is much more likely to persist if experienced while young. For older offenders, the severity of the sentence would correlate with their increased deviation from the curve. This type of gradual sentencing change comports with our understanding of criminal behavior and its relationship with brain development.[187]

It is easy to ignore the benefits of a graded sentencing approach. The fact that older inmates are less likely to recidivate than younger inmates leads many to believe that longer sentences are more effective. But the age-crime curve tells us that the likelihood of arrest and conviction peak at a young age; time spent in prison is time on the downslope of the curve. By the time that individual is released, they are already less likely to commit another crime, irrespective of correctional intervention. Rearrests and further periods of confinement add additional years of maturity. Arguments for decreased sentence length are stymied by the fact that a longer sentence *does* reduce the criminal behavior of inmates upon release, if only because it increases their *age*. But young offenders are at an especially high risk of experiencing trauma and stress in prison. The criminogenic effects of prison are especially difficult to measure in young adults because of their high rate of natural desistance from crime. However, this tendency to desist naturally, combined with their neurological vulnerability, demands a different approach in sentencing young adults.

2. Sentencing Guidelines and Prison Alternatives

Sentencing guidelines rest on the basic assumptions that characteristics of individual offenders—such as age, criminal history, or acceptance of responsibility—necessitate a more or less severe punishment, and that this variation in punishment accomplishes a goal.[188] Many guidelines center around

185. *Id.* at 735.

186. *Id.*

187. *See* Gupta-Kagan, *supra* note 15, at 674–75 ("The gradual development that continues past teenagers' 18th birthdays suggest better policy is to provide gradual sentencing change after turning 18 rather than the bright line at 18 that currently exists—and this idea has begun to get traction in both academic and policy circles.").

188. *See* Sonja B. Starr, *Evidence-Based Sentencing and the Scientific Rationalization of Discrimination*, 66 STAN. L. REV. 803, 805 (2014).

a calculation of recidivism risk.[189] Characteristics associated with a high likelihood of reoffending are tied to a harsher sentence; in theory, an offender's recidivism risk will decrease as the length of their sentence increases. But this logic "oversimplifies the relationship between incarceration and recidivism" because there "is no particular reason to believe that groups that recidivate at higher rates are also more responsive to incarceration."[190] The foundational assumptions of sentencing guidelines fall apart if higher-risk defendants are either less responsive to specific deterrence or are "more vulnerable to the possible criminogenic effects of incarceration."[191] Both may be true.

State sentencing guidelines provide an illustration. In Indiana, judges are presented with a pre-sentence investigation report detailing "the convicted person's history of delinquency or criminality, social history, employment history, family situation, economic status, education, and personal habits."[192] The Indiana Supreme Court denied that the guidelines were discriminatory, holding that socioeconomic information is "effective in predicting the risk of recidivism and the amenability to rehabilitative treatment."[193] But under these guidelines, a higher-risk defendant is one with a prior criminal history (and thus shown to be less responsive to specific deterrence); impoverished, unemployed, and undereducated (and thus statistically more likely to have prior trauma or a substance abuse disorder); and without family and support systems (and thus susceptible to the negative psychological effects of incarceration). An offender with all these characteristics—one less responsive to deterrence and more vulnerable to incarceration's criminogenic effects—will receive the highest possible sentence. The recidivism risk model assigns harsher punishments to precisely those populations most damaged by them.

A longer sentence carries a greater potential for harm. The length of stay for federal prisoners doubled between 1988 and 2012.[194] For inmates in state prisons, the length of stay for violent crimes increased 137%.[195] This, despite a growing understanding that the perceived severity of a potential punishment has significantly less impact than the likelihood of that punishment.[196] Threats of long sentences do little to deter potential criminals. Considering specific

189. *See id.* (noting that courts in more than twenty states use some form of recidivism risk assessment and the approach has been included in a new draft of the Model Penal Code).

190. *Id.* at 857.

191. *Id.*

192. IND. CODE § 35-38-1-9(b)(2) (2017).

193. Malenchik v. State, 928 N.E.2d 564, 574 (Ind. 2010).

194. Marc Mauer, *Long-Term Sentences: Time to Reconsider the Scale of Punishment*, 87 UMKC L. REV. 113, 122 (2018).

195. PEW CTR. ON THE STATES, TIME SERVED: THE HIGH COST, LOW RETURN OF LONGER PRISON TERMS 3 (June 2012), https://www.pewtrusts.org/-/media/assets/2012/06/06/time_served_report.pdf (noting that Florida "led the way among states with a 137 percent increase in length of stay" for violent crimes).

196. Daniel S. Nagin, *Deterrence in the Twenty-First Century*, 42 CRIME & JUST. 199, 199 (2013) ("The evidence in support of the deterrent effect of the certainty of punishment is far more consistent than that for the severity of punishment.").

deterrence—the effects of punishment "on those who have suffered it"[197]—longer sentences are not an effective deterrent, and do not correlate with lower recidivism rates.[198] As discussed above, one possible explanation for this is the increased likelihood of experiencing trauma and victimization during a long prison sentence. Since "PTSD and victimization experiences have been associated with increased rates of violent behavior and drug use,"[199] a longer sentence may indirectly lead to criminal behavior. Especially for high-risk populations, the potential criminogenic effect of a longer sentence should be a consideration in sentencing guidelines.

Guidelines can also specify alternatives to incarceration for certain crimes. In Colorado, for example, there is a separate sentencing scheme for drug offenders that allows judges to order treatment or diversion programs while reducing penalties.[200] One study compared the recidivism rates of people sentenced to prison with those given probation, and found that for all offense types, prisoners had significantly higher recidivism rates than probationers.[201] Controlling for offense severity, age, and prior criminal history, drug offenders were twice as likely to be rearrested if they were sentenced to prison rather than probation.[202] In the case of non-violent and first-time offenders, incarceration produces worse outcomes than the available alternatives.

CONCLUSION

Discussions of prison reform often frame the issue as a trade-off: if we reduce the prison population or improve the conditions of incarceration, crime will increase. This dichotomy is premised on the idea that prison has a net negative effect on criminal behavior, and the assumption that psychological harm is a necessary, or even beneficial, element of carceral punishment.[203] On a neurological level, that assumption is false. Most young offenders will desist from crime naturally, and the people most likely to be incarcerated are those with histories of trauma, substance abuse, and mental illness—the people most vulnerable to the psychological damage of prison. Even absent such risk factors, prison sentences as brief as three months can cause severe psychological

197. Mark C. Stafford & Mark Warr, *A Reconceptualization of General and Specific Deterrence*, 30 J. RSCH. CRIME & DELINQ. 123, 123 (1993).

198. *See* Mauer, *supra* note 194, at 125–26 (citing studies of state and federal prisoners who received reduced sentences due to retroactively applied legislation and showed identical recidivism rates as the comparison group who served longer sentences).

199. Sadeh & McNiel, *supra* note 129, at 574.

200. *See* Michael Tonry, *Sentencing in America, 1975–2025*, 42 CRIME & JUST. 141 (2013).

201. *See* Cassia Spohn & David Holleran, *The Effect of Imprisonment on Recidivism Rates of Felony Offenders: A Focus on Drug Offenders*, 40 CRIMINOLOGY 329, 350 (2002).

202. The four-year recidivism rate was 82% for prisoners and 43% for probationers. *Id.* at 348.

203. *See* GRANT DUWE, AM. ENTER. INST., RETHINKING PRISON: A STRATEGY FOR EVIDENCE-BASED REFORM 3 (2017) (noting that many still believe "[p]rison is supposed to be a tough and uncomfortable experience"). Indeed, legislators seem to operate on the principle that harsh punishments will surely "jolt inmates into reforming their criminal ways." *Id.* at 2.

damage.[204] That damage in turn leads to behavioral and cognitive changes, making a successful transition from prison difficult and rearrest more likely. Longer sentences entail greater harm, and thus have greater criminogenic potential.

By allowing us to appreciate the nuances of a particular problem, brain science can be a powerful tool for devising solutions. It has long been understood that prison takes a psychological toll, and neuroscientific research has since illuminated the mechanisms by which that harm is caused, as well as the ways it can be prevented or reduced. Young offenders and those with mental disorders are more likely to experience the negative effects of prison, and sentencing policy should reflect this understanding. Within prison, funding must be directed toward programs and resources that build resilience, such as substance abuse counseling, vocational training, and educational opportunities. Finally, former inmates should be supported through community resources that will give them the greatest chance of success. There is increasing support for prison reform, but large-scale changes happen slowly. In the meantime, policymakers should employ our modern understanding of brain science to reduce the negative effects of incarceration and improve post-release outcomes.

204. *See* Meijers et al., *supra* note , at 4 (finding a "significant deterioration in self-control and attention after 3 months of imprisonment").