

**STATE OF RHODE ISLAND
SUPREME COURT**

Joao Neves,

v.

State of Rhode Island

SU-2022-0092-MP

(PM-2022-0259)

Keith Nunes

v.

State of Rhode Island

SU-2022-0093-MP

(PM-2022-0901)

Pablo Ortega

v.

State of Rhode Island

SU-2022-0094-MP

(PM-2022-0260)

Mario Monteiro

v.

State of Rhode Island

SU-2023-0167-MP

(PM-2023-00921)

**CONSOLIDATED REVIEW ON CERTIORARI FROM THE GRANT OF
POST-CONVICTION RELIEF ENTERED IN THE SUPERIOR COURT,
PROVIDENCE COUNTY**

**BRIEF OF CENTER FOR LAW, BRAIN AND BEHAVIOR AS *AMICUS
CURIAE* IN SUPPORT OF APPELLEES-PLAINTIFFS JOAO NEVES,
KEITH NUNES, PABLO ORTEGA, AND MARIO MONTEIRO**

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INTEREST OF AMICI CURIAE

The Center for Law, Brain, and Behavior (CLBB) of the Massachusetts General Hospital, Harvard Medical School, has particular expertise in the area of neuroscience, especially with regard to the interactions of children, adolescents, and young adults with the juvenile and criminal legal systems, and the promotion of their well-being and community safety through those systems. Amici also offers a unique perspective on the interplay between the constitutional rights and neurodevelopmental and social developmental psychology of children and emerging young adults in the legal system.

QUESTION PRESENTED

Does the scientific consensus, within the fields of neuroscience and behavioral science—which establishes that the adolescent period of brain development is marked by an increased propensity toward impulsiveness, immaturity, impetuosity, susceptibility to peer pressure or the negative influence of older individuals, the failure to appreciate risks and consequences, and a remarkable capacity for change, particularly positive prosocial change, all of which flow from the particular neurology of the brain during this period of development, and reliably predicting how specific individuals will change as their brains develop through this period is not currently possible—have any bearing on the proper interpretation of Mario’s Law, R.I. Gen. Laws § 13-8-13(e)?

SUMMARY OF THE ARGUMENT

The consolidated cases before this Court in the above-captioned matters present the question of the scope and constitutionality of R.I. Gen. Laws § 13-8-13(e), better known as Mario’s Law for Mario Monteiro, one of the appellees in this matter, which was passed as an amendment to the parole statute by the Rhode Island legislature in 2021. Under well-established law, Rhode Island courts may not impose life-determinant sentences such as mandatory Life Without Parole (LWOP) on adolescents who committed any offense before the age of twenty-two (22). The law also enforces the eligibility for parole review and the issuance of a parole permit after the adolescent has served at least 20 years in prison. Neuroscientific evidence shows clearly that reliable determinations about future dangerousness cannot be made with respect to violent offenders under twenty-one (21) years of age.

Under the Eighth Amendment of the United States Constitution, States are prohibited from executing individuals based on unreliable or arbitrary determinations. *Johnson v. Mississippi*, 486 U.S. 578, 584 (1988). Since science has firmly established that it is not possible to reliably predict an eighteen (18) year old’s lifetime propensity for violence or inability to be rehabilitated, no sentence of death consistent with the Constitution may be imposed based upon an eighteen (18) year old. Any such sentence would fundamentally be predicated on an inherently unreliable prognostication and consequently cannot pass constitutional muster.

Over the last nineteen (19) years, the United States Supreme Court has issued three landmark decisions that significantly altered the treatment of young people in the criminal justice system. *Miller v. Alabama*, 567 U.S. 460 (2012); *Graham v. Florida*, 560 U.S. 48 (2010); *Roper v. Simmons*, 543 U.S. 551 (2005). In all three decisions, the Court looked to an established scientific consensus regarding adolescent development and required consideration of the unique attributes of youth when applying constitutional protections to juvenile offenders. As a result, the Court’s “decisions rested not only on common sense—on what ‘any parent knows’—but on science and social science as well.” *Miller*, 567 U.S. at 471. Over that same nineteen (19) year period, advancements in neuroscience and brain imaging research have revealed that the unique characteristics of youth the court identified in *Roper*, *Graham*, and *Miller*—immaturity and susceptibility to impulsivity, recklessness, peer influence, and emotionally driven decision-making, as well as capacities for change —persist beyond age eighteen (18). It is now well-established that a human brain continues to undergo profound changes throughout adolescence and young adulthood—a period sometimes referred to as “emerging adulthood”—in the areas and systems that are regarded as most involved in impulse control, planning, and self-regulation.¹ Brain imaging and other developments in

¹ Emerging adulthood has been loosely defined as the period between adolescence and the mid-to-late-20s. Henin & Berman, *The Promise and Peril of*

neuroscience have made visible the differences between the developing brain and the adult brain as never before, effecting a paradigm shift in the way the behavior of emerging adults is understood in the scientific community. Well-established, peer-reviewed research, as well as our collective professional experience, demonstrate that it is scientifically impossible to reliably predict the future dangerousness of an offender who commits a crime while under the age of (twenty-one) 21.

In light of the recent neuroscientific developments on late adolescent brains and the application of the Eighth Amendment in *Roper* (2005) and its progeny, the interpretation of R.I. Gen. Laws § 13-8-13(e) should be construed to reflect the legislature's intent in barring both actual and *de facto* life sentences to include the Petitioner's second life sentence. The original legislative intent of the law was to align Rhode Island's justice system with the national movement of moving away from extreme sentences for youth and emerging adults. It would be both deeply ironic and a troubling distortion of legislative intent if § 13-8-13(e) were not to include the person referred to in referring to it as "Mario's Law."

This Brief addresses the current scientific consensus regarding brain development and behavior which shows meaningful, relevant changes throughout

Emerging Adulthood: Introduction to the Special Issue, 23 *Cognitive & Behav. Prac.* 263, 263 (2016); *see also* Steinberg, *Adolescence* 4 (11th ed. 2017) (defining adolescence as beginning with puberty and ending when individuals make the transition into adult roles, roughly from ages 10 to the early 20s).

late adolescence. Because brain structure and function - as well as an individual's behavior, personality, and propensity for risk-taking and danger - are all profoundly in flux through late adolescence and early adulthood, the eligibility for parole review for a person who commits a crime before twenty-two (22) and after serving twenty (20) years reflects both legislative intent and a constitutional right.

ARGUMENT

I. SUPREME COURT PRECEDENT SHIELDS ADOLESCENTS FROM LWOP GIVEN THE MITIGATING ATTRIBUTES OF ADOLESCENCE

The U.S. Supreme Court has repeatedly recognized that the Constitution protects adolescents under eighteen (18) years of age from “the most severe punishments,” including Life Without Parole (LWOP). (*See, e.g., Roper*, 543 U.S. 551 (holding that capital punishment is unconstitutional for persons under eighteen (18)); *Graham*, 560 U.S. 48 (holding that LWOP is unconstitutional for persons under eighteen (18) for non-homicide offenses); *Miller*, 567 U.S. 460 (holding that mandatory LWOP is unconstitutional for persons under eighteen (18) for any offense]; *Montgomery v. Louisiana* 577 U.S. 190 (2016) (applying *Miller* retroactively).

In reaching these holdings, the Court relied upon, in part, the scientific findings of that time (since further confirmed and supplemented) regarding adolescent immaturity and ongoing brain development.² *Graham*, 560 U.S. at 68

² *See, e.g.,* Arnett, Reckless Behavior in Adolescence: A Developmental Perspective (1992) 12 Dev. Rev. 339 (hereafter Reckless Behavior) (cited in *Roper* 543 U.S. 551); Steinberg & Scott, Less Guilty by Reason of Adolescence: Developmental Immaturity, Diminished Responsibility, and the Juvenile Death Penalty (2003) 58 Am. Psychol. 1014 (cited in *Roper*); Erikson, Identity: Youth and Crisis (1968) (cited in *Roper*); Rosso et al., Cognitive and Emotional Components of Frontal Lobe Functioning in Childhood and Adolescence (2004) 1021 Annals. N.Y. Acad. Sci. 360-61 (submitted in *Graham*); Bunge et al., Immature Frontal Lobe

(emphasizing “fundamental differences” in the brains and behavior of adolescents); *Miller*, 567 U.S. at 472, n. 5 (“science and social science supporting *Roper’s* and *Graham’s* conclusions have become even stronger”); *People v. Franklin*, 63 Cal.4th 261, 273 (2016) (finding *Miller’s* mitigating attributes “increasingly substantiated through science”).

The *Miller* Court specifically highlighted the mitigating attributes of adolescence, with the underpinnings of social science and neuroscience, that compel these heightened constitutional guardrails. First, adolescents exhibit a “lack of maturity and an underdeveloped sense of responsibility,” which contribute to *impulsivity*, recklessness, and “heedless risk-taking.” *Miller*, 567 U.S. 471. Second, adolescents “‘are more vulnerable . . . to negative influences and outside pressures,’ including from their family and peers; they have limited ‘contro[l] over their own environment’ and lack the ability to extricate themselves from horrific, crime-producing settings.” *Id.* Third, during adolescence, personality “is not as ‘well formed’ as an adult’s; his traits are ‘less fixed’ and his actions less likely to be ‘evidence of irretrievabl[e] deprav[ity].’ ” *Id.*

Contributions to Cognitive Control in Children: Evidence from fMRI (2002) 33 *Neuron*. 301 (submitted in *Graham*); Gogtay et al., Dynamic Mapping of Human Cortical Development During Childhood Through Early Adulthood (2004) 101 *Proc. Nat’l Acad. Sci.* 8174 (submitted in *Graham*).

Furthermore, in the wake of the U.S. Supreme Court’s holdings in *Roper*, *Graham*, *Miller*, and *Montgomery*, which recognized the attributes of adolescence as constitutionally significant, pioneering neuroscientific and psychology research has continued, with a specific focus on the development of late adolescents.³ These peer-reviewed studies, some authored by amici, establish conclusively that “[a]dvances in scientific understanding have revealed that the ordinary process of neurological and cognitive development continues for several years past age 18.” *People v. Montelongo*, 274 Cal. Rptr. 3d 267, 290 (Ct. App. 2020) (Liu, J. concurring).

The scientific consensus today widely recognizes late adolescence as marked by profound brain and psychological maturation in areas governing emotional arousal and self-control.⁴ Late adolescence operates as a key phase of development

³ For clarity, we define early adolescence as 10–13, middle adolescence as 14–17, late adolescence as 18–21, and young adulthood as 22–25. For a more thorough discussion of age definitions, see Susan Sawyer et al, *The Age of Adolescence*. 2 *Lancet Child & Adolescent Health* 223, 223–228 (2018).

⁴ See, e.g., Steinberg & Icenogle, *Using Developmental Science to Distinguish Adolescents and Adults Under the Law* (2019) 1 *Ann. Rev. Dev. Psychol.* 21, 34 (hereafter Steinberg & Icenogle); National Academy of Science, Engineering, and Medicine, *The Promise of Adolescence: Realizing Opportunity for All Youth* (2019) 22 (Washington, DC: The National Academies Press) (“young adulthood” includes ages 18 to 25); Sawyer et al., *The Age of Adolescence* (2018) 2 *Lancet Child Adolesc. Health* 223–28 (hereinafter Sawyer) (characterizing 10 to 24 years as best corresponding to popular understandings of adolescence); Dosenbach et al., *Prediction of Individual Brain Maturity Using fMRI* (2010) 329 *Science* 1360

sharing the constitutionally-significant mitigating attributes of earlier periods of adolescence under the of 18, including “immaturity, impetuosity, susceptibility to peer pressure or the negative influence of older individuals, and the failure to appreciate risks and consequences.” (Assem. Com. on Public Safety, Bill Analysis, Sen. Bill No. 260 (2013–2014 Reg. Sess.), as amended June 27, 2013.)

II. OVERVIEW OF NEUROSCIENCE OF LATE ADOLESCENTS

A. Criminal Trajectories: From Juveniles to Late Adolescents

One of the most consistent findings in developmental criminology is the “age-crime curve” — the observation that criminal behavior increases in adolescence and decreases in early adulthood.⁵ In 2019, over 10 million crimes were committed in the United States. Individuals aged 18–20 were responsible for 8% of all offenses and 8.76% of all violent offenses.⁶ In a criminal trajectory study of individuals

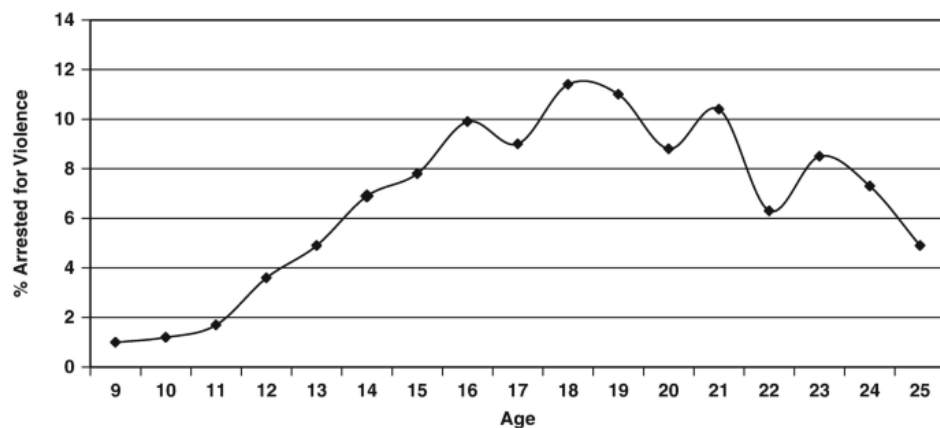
(defining “young adults” as ages 18 to 30) (hereafter Dosenbach); Arain et al., *Maturation of the Adolescent Brain* (2013) 9 *Neuropsychiatric Disease and Treatment* 450 (hereinafter Arain) (describing “adolescence” as “ages 10–24 years”).

⁵ Shulman, E.P., Steinberg, L.D. and Piquero, A.R. (2013) The age–crime curve in adolescence and early adulthood is not due to age differences in economic status - *journal of youth and adolescence*, SpringerLink. Available at: <https://link.springer.com/article/10.1007/s10964-013-9950-4>

⁶*See* Off. of Juvenile Justice and Delinquency Prevention, *Estimated number of arrests by offense and age group*, U.S. Dep’t Just. (2019), https://www.ojjdp.gov/ojstatbb/crime/ucr.asp?table_in=1 [<https://perma.cc/T6H7-3LWX>].

classified as persistent and serious delinquents, most individuals who committed serious crimes at seventeen (17) and eighteen (18), including violent crimes, following court involvement, did not continue to engage in criminal behavior into adulthood.⁷

More than 90% of young individuals engaged in criminal activities, including those participating in severe offenses, naturally discontinue such behaviors upon entering their early twenties. This phenomenon, known as the age-crime curve illustrated in Figure 1, is widely recognized to depict the correlation between advancing age and the cessation of criminal conduct across both jurisdictional and temporal boundaries.⁸



⁷ Edward Mulvey et al, Trajectories of Desistance and Continuity in Antisocial Behavior Following Court Adjudication Among Serious Adolescent Offenders, 22 *Development & Psychopathology* 453 (2010).

⁸ Steinberg, L., Cauffman, E., & Monahan, K.C. (2015). Psychological maturity and desistance from crime in a sample of serious juvenile offenders. *OJJDP Juvenile Justice Bulletin* [March 2015]. U.S. Department of Justice: Office of Juvenile Justice and Delinquency Prevention.

Figure 1 — Correlation between percentage of persons arrested for violence and advancing age. National Institute of Justice, From Youth Justice Involvement to Young Adult Offending (2014).

The peak in criminal involvement which occurs during late adolescence between ages 18 to 21, gradually decreases thereafter.⁹ This recurring pattern is consistent across demographic and socioeconomic categories and cultural/national contexts¹⁰ (Farrington, 1986), and also applies to severe forms of violence, including homicide.¹¹

The scientific evidence regarding neurodevelopment emphasizes transformative changes in late adolescent brains across diverse cognitive and emotional dimensions. Adolescence marks a pivotal stage of synaptic plasticity and neural rewiring, influenced by a combination of genetics, cognitive development, and environmental factors, including childhood trauma and chronic stress. Brain plasticity is a powerful catalyst and reshapes neural pathways, especially in the

⁹ Mulvey, E. P. (2011). Highlights from Pathways to Desistance: A longitudinal study of serious adolescent offenders. Washington, DC: U.S. Department of Justice, Office of Juvenile Justice and Delinquency Prevention; Farrington, D.P. (1986) Age and crime. *Crime and Justice: An Annual Review of Research* 7:29-90.

¹⁰ Farrington, 1986.

¹¹ Rosenfeld R., White H., Esbensen F. (2012). Special categories of serious and violent offenders: Drug dealers, gang members, homicide offenders, and sex offenders. In Loeber R., Farrington D. P. (Eds.), *From juvenile delinquency to adult crime: Criminal careers, justice policy, and prevention* (pp. 118-149). New York, NY: Oxford University Press.

prefrontal cortex functions which are crucial for judgment, decision-making, and emotional regulation. *See In re Williams*, 57 Cal. App. 5th 427 (Ct. App. 2020). As adolescents and late adolescents undergo these neurodevelopmental processes, they exhibit an expanding capacity for enhanced judgment and decision-making, contributing to a decrease in criminal involvement as they progress towards emotional and cognitive maturity, showcasing the potential for effective rehabilitation in young offenders. *In re Williams*, 57 Cal App. 5th 427; Steinberg et al., 2015). In evaluating violent crime from a developmental life-course perspective, research indicates that after mid-to-late adolescence: 1) Recidivism through the commission of violent crimes is rare; and the corollary 2) if future crimes are committed, they are generally non-violent.¹²

B. Adolescent Brain Development

1. Impulsivity and Offending Behavior

Adolescents and late adolescents exhibit increased impulsivity and risk-taking compared to adults. When faced with threats, late adolescents (ages 18–21) respond more impulsively than young adults (ages 22–25). Middle and late adolescents, as compared to both children and adults, are more likely to engage in behaviors that

¹² Tärnhäll, A., Björk, J., Wallinius, M., Gustafsson, P., & Hofvander, B. (2023). Offending Trajectories in Violent Offenders: Criminal History and Early Life Risk Factors. *International Journal of Offender Therapy and Comparative Criminology*, 67(2-3), 270–290. <https://doi.org/10.1177/0306624X221086565>.

risk their lives and well-being. For example, many health risk behaviors peak in late adolescence and young adulthood. This includes risk-taking behaviors and risk-related outcomes such as reckless driving, unprotected sex, and unintentional injuries.

This enhanced impulsivity is associated with decreased recruitment of the prefrontal cortex and reduced cognitive control of emotions. Late adolescents' brain responses look more like those of middle adolescents (ages 13–17) than those of young adults (ages 22–25). Although multifaceted, impulsivity is often defined as a tendency to act on the spur of the moment and a failure to consider the (long-term) consequences of one's action. Thus, there is a clear logical link between impulsivity and offending behavior. Given that offending behavior is often risky and offers immediate gratification, individuals with increased impulsivity are more prone to offending opportunities and taking advantage of ill-advised opportunities when they arise.¹³ Offending behavior is often viewed as a behavioral manifestation of impulsivity and research has identified a robust association between impulsivity and

¹³ James V Ray & Shayne Jones, *Aging out of crime and personality development: A review of the research examining the role of impulsiveness on offending in Middle and late adulthood* Psychology research and behavior management (2023), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10163877/>.

offending.¹⁴ Numerous empirical studies have demonstrated relationships between impulsive traits and offending among adolescent and early adulthood samples¹⁵ but virtually none extend to middle and late adulthood.¹⁶ In other words, as individuals enter into adulthood, impulsivity decreases.

2. Lack of Self-Control and Susceptibility to Social Influences

Adolescents, particularly those in their late teens (18-20), are highly influenced by social and peer interactions. Peer presence alone has a significant impact on decision-making, impulse control, and risk-taking behavior.¹⁷ The

¹⁴ Whiteside SP, Lynam DR. The five factor model and impulsivity: using a structural model of personality to understand impulsivity. *Pers Individ Dif.* 2001;30(4):669–689. Doi:10.1016/S0191-8869(00)00064-7.

¹⁵ Forrest W, Hay C, Widdowson AO, Rocque M. Development of impulsivity and risk-seeking: implications for the dimensionality and stability of self-control. *Criminology.* 2019;57(3):512–543. doi:10.1111/crim.2019.57.issue-3/issuetoc.

¹⁶ Argyriou E, Um M, Carron C, Cyders MA. Age and impulsive behavior in drug addiction: a review of past research and future directions. *Pharmacol Biochem Behav.* 2018;164:106–117. doi:10.1016/j.pbb.2017.07.013.

¹⁷ Karol Silva et al, Adolescents in Peer Groups Make More Prudent Decisions When a Slightly Older Adult is Present, *27 Psych. Sci.* 322 (2016); Raymond Bingham et al, Peer Passenger Norms and Pressure: Experimental Effects on Simulated Driving Among Teenage Males. *41 Transportation Rch. Part F, Traffic Psych & Behaviour* 124, 124–137 (2016); Albert, D., Chein, J., & Steinberg, L. (2013). Peer Influences on Adolescent Decision Making. *Current Directions in Psychological Science*, 22(2), 114–120; Smith, A. R., Steinberg, L., Strang, N., & Chein, J. (2015). Age differences in the impact of peers on adolescents' and adults' neural response to reward. *Developmental cognitive neuroscience*, 11, 75-82. *Developmental Cognitive Neurosci.* 75 (2015); Steinberg, 2017; Weigard A, Chein J, Albert D, Smith A, Steinberg L. Effects of anonymous peer observation on

adolescent brain exhibits increased sensitivity to peer influence, with notable changes in the brain's reward centers and heightened responses to social cues, making this age group particularly susceptible to external pressures which does not occur for older adults.¹⁸

These vulnerabilities persist into young adulthood, making it impossible to reliably discern and predict which few late adolescents will persist in committing crimes well into adulthood.¹⁹ As the brain continues to develop throughout late adolescence, various psychological abilities mature at different rates, impacting sentencing considerations. *Graham*, 560 U.S. 48. Late adolescents often show heightened sensitivity to rewards, threats, and peer influences, coupled with an underappreciation of risks and consequences. *Id.* This developmental pattern, intricately linked with ongoing brain maturation, results in asynchronous neurological developments defining this critical period. *Id.*

Recognizing these nuances is essential for understanding the challenges late adolescents face in resisting peer pressure and making mature decisions. Studies indicate that late adolescents exhibit increased risk-taking behavior, especially in the

adolescents' preference for immediate rewards. *Dev Sci.* 2014 Jan;17(1):71-8. doi: 10.1111/desc.12099. Epub 2013 Nov 6. PMID: 24341973; PMCID: PMC3869036.

¹⁸ *Id.*

¹⁹ Silva et al., 2016.

presence of peers, influencing real-world actions like substance misuse and risky driving.²⁰ This heightened susceptibility to peer influence underscores the need for legal evaluations that consider the distinct neurodevelopmental characteristics of late adolescents when assessing rehabilitation capacities and determining appropriate and proportional sentencing for young offenders. *Graham*, 560 U.S. 48.

Peers often play a significant role in delinquency in mid-adolescence. This relationship is reciprocal as peer delinquency increases the likelihood of delinquency, and likewise, one's own delinquency reinforces peer delinquency.²¹ Individuals with low self-control are more likely to associate with delinquent peers,²² and this association further weakens self-control in later adolescence.²³ Consistent with the previous research on peer influences and delinquency, more recent studies indicate that peer delinquency is positively related to future self-reported

²⁰ *Id.*

²¹ Huijsmans T, Nivette AE, Eisner M, Ribeaud D. Social influences, peer delinquency, and low self-control: an examination of time-varying and reciprocal effects on delinquency over adolescence. *Eur J Criminol.* 2021;18(2):192–212. doi:10.1177/1477370819838720.

²² Chapple CL (2005) Self-control, peer relations, and delinquency. *Justice Quarterly* 22(1): 89–106.

²³ Burt CH, Simons RL, Simons LG (2006) A longitudinal test of the effects of parenting and the stability of self-control: Negative evidence for the general theory of crime. *Criminology* 44(2): 353–396.

delinquency.²⁴ Despite this, most adolescents and late adolescents desist from criminal behavior.

3. Hot/Cold Cognition

Adolescents are cognitively similar to adults in certain respects and contexts. They perform comparably to adults in low-stress conditions when they are given adequate time for reasoned and thoughtful deliberation to consider consequences and make decisions. However, middle adolescents and late adolescents are more likely than adults to make risky decisions in emotional contexts. Adolescents, including late adolescents, are hypersensitive to emotional content. This occurs at the same time that they are still developing the purposeful problem-solving that comes with adulthood. Since adolescents exhibit different maturational trajectories in brain regions that are important for decision-making, self-control, and emotion regulation, adolescent behavior is very sensitive to emotional contexts.

For these reasons, this age range is susceptible to emotionally driven decisions, impulsive behavior, and poor judgment.²⁵ Research indicates that

²⁴ *Id.*

²⁵ Laurence Steinberg, *A social neuroscience perspective on adolescent risk-taking*, 28 DEVELOPMENTAL REV. 78 (2008). (“This account is consistent with a growing body of work on structural and functional changes in the prefrontal cortex, which plays a substantial role in self-regulation, and in the maturation of neural connections between the prefrontal cortex and the limbic system, which permits the better coordination of emotion and cognition. These changes permit the individual

affective control, or the ability to conduct goal-directed behavior while inhibiting responses to distracting emotional information, improves during adolescence.²⁶

Adolescents, compared to adults, generally show greater interference effects for positive or negative emotional states on their task performance but then show improved inhibition of this emotional effect as they mature into late adolescence.²⁷

Research also indicates that middle adolescents and late adolescents are more sensitive to sustained emotional arousal states than older adults. This vulnerability to emotional context has been found to persist through early adulthood.²⁸ In research studies, late adolescents had diminished cognitive abilities under sustained negative

to put the brakes on impulsive sensation-seeking behavior and to resist the influence of peers, which, together, should diminish risk-taking.”).

²⁶ Schweizer S, Gotlib IH, Blakemore SJ. The role of affective control in emotion regulation during adolescence. *Emotion*. 2020 Feb;20(1):80-86. doi: 10.1037/emo0000695. PMID: 31961183; PMCID: PMC6975522.

²⁷ Cohen, A. O., Breiner, K., Steinberg, L., Bonnie, R. J., Scott, E. S., Taylor-Thompson, K. A., Rudolph, M. D., Chein, J., Richeson, J. A., Heller, A. S., Silverman, M. R., Dellarco, D. V., Fair, D. A., Galván, A., & Casey, B. J. (2016). When Is an Adolescent an Adult? Assessing Cognitive Control in Emotional and Nonemotional Contexts. *Psychological Science*, 27(4), 549–562; Schweizer, S., Gotlib, I. H., & Blakemore, S.-J. (2020). The role of affective control in emotion regulation during adolescence. *Emotion*, 20(1), 80–86.

²⁸ Alexandra O. Cohen et al., When Is an Adolescent an Adult? Assessing Cognitive Control in Emotional and Nonemotional Contexts, 27 *Psych. Sci.* 549 (2016); Marc D. Rudolph et al., At Risk of Being Risky: The Relationship Between “Brain Age” Under Emotional States and Risk Preference, 24 *Developmental Cognitive. Neurosci.*, 93, 93–106 (2017); B. J. Casey et al, Development of the Emotional Brain, 29 *Neurosci. Letters* 693 (2019).

emotional arousal relative to adults age 22–25, but late adolescents performed similarly to 22–25 year-olds in neutral and positive emotional arousal conditions.²⁹ For example, during “threat states” in which individuals anticipated the possibility of hearing an aversive sound, late adolescents (ages 18–21) exhibited patterns of brain activity that were more similar to the adolescent group (ages 13–17) than the adult group (ages 22–25). This included reduced connectivity between distributed brain regions that are activated when exerting self-control, including the prefrontal cortex.

Adolescents and late adolescents are particularly sensitive to social inclusion and rejection and may prioritize potential social risks over health or legal risks when making decisions.³⁰ Research shows that adolescents generally take more risks when in the presence of peers, and that middle and late adolescents are more likely than adults to show increased risk preference and risky decision-making when with peers.³¹ Other studies have shown that during emotional regulation tasks, late

²⁹ *Id.* The three comparison groups included adolescents (age 13–17), late adolescents (age 18–21), and young adults (age 22–25).

³⁰ Blakemore, S.-J., & Mills, K. L. (2014). Is adolescence a sensitive period for sociocultural processing? *Annual Review of Psychology*, 65, 187–207.

³¹ Gardner, M., & Steinberg, L. (2005). Peer influence on risk-taking, risk preference, and risky decision making in adolescence and adulthood: an experimental study. *Developmental Psychology*, 41(4), 625–635; Albert, D., Chein, J., & Steinberg, L. (2013). Peer Influences on Adolescent Decision Making. *Current Directions in Psychological Science*, 22(2), 114–120.

adolescents ages 18-19 show different patterns of brain activation than adults ages 23-25 indicating that capacity for cognitive control over emotional reactivity continues to develop past age 18 and into young adulthood.³²

4. Discounting Future Consequences

Adolescents tend to discount future consequences in favor of short-term gains. Adolescents aged 12-to-20 exhibit a diminished capacity to weigh the long-term outcomes of their actions compared to older adults.³³ The neural underpinnings of temporal discounting are helpful in understanding these age differences.

Temporal discounting is strengthened through the development of structural and functional connectivity in the prefrontal cortex, a critical brain region responsible for future-oriented decision-making, and subcortical areas associated with reward processing and emotional learning.³⁴ The development of subcortical regions, like the ventral striatum and amygdala start developing at an earlier time

³² Veroude, K., Jolles, J., Croiset, G., & Krabbendam, L. (2013). Changes in neural mechanisms of cognitive control during the transition from late adolescence to young adulthood. *Developmental Cognitive Neuroscience*, 5, 63–70.

³³ Banich, M.T., De La Vega, A., Andrews-Hanna, J.R., et al. (2013). Developmental trends and individual differences in brain systems involved in intertemporal choice during adolescence. *Psychology of Addictive Behaviors*, 27, 416–430.

³⁴ Fields, S. A., Lange, K., Ramos, A., Thamotharan, S., & Rassa, F. (2014). The Relationship Between Stress and Delay Discounting: A Meta-Analytic Review. *Behavioural Pharmacology*, 25, 434–444.

frame in adolescence³⁵ than the prefrontal cortex which develops well into late adolescence.³⁶ The interactions between a more developed subcortical region and developing prefrontal systems,³⁷ manifest in difficulties with emotional regulation in the face of perceived rewards, threats, and consequences.³⁸ The maturing of prefrontal systems correlates with emotion and social development.³⁹ However, as these areas do not develop until the early-to-mid-twenties,⁴⁰ there are limited

³⁵ Braams, B.R., van Duijvenvoorde, A.C.K., Peper, J. S., & Crone, E. A. (2015). Longitudinal Changes in Adolescent Risk-Taking, Pubertal Development, and Risk-Taking Behavior, *Journal of Neuroscience*, 35, 7226-7238.

³⁶ Dreyfuss et al., *Teens Impulsively React rather than Retreat from Threat* (2014) 36 *Dev. Neurosci.* 225-26; Arain, *supra*, 9 *Neuropsychiatric Disease and Treatment* 453–55; Tyler, *Understanding the Adolescent Brain and Legal Culpability* (2015) American Bar Association. <https://www.americanbar.org/groups/public_interest/child_law/resources/child_law_practiceonline/child_law_practice/vol_34/august-2015/understanding-the-adolescent-brain-and-legal-culpability/>.

³⁷ *Id.*

³⁸ Casey et al., *Making the Sentencing Case: Psychological and Neuroscientific Evidence for Expanding the Age of Youthful Offenders* (2022) 5 *Ann. Rev. of Criminology* 7.1.

³⁹ Steinberg & Icenogle, *Ann. Rev. Dev. Psychol.* 21, 21.

⁴⁰ *Montelongo*, 274 *Cal.Rptr.3d* at 286 (Segal, J. concurring).

differences in the cognitive capacity between 17-year-olds and late adolescents aged 18-20 when it comes to evaluating short and long-term consequences.⁴¹

Stressful and threatening environments exacerbate the predisposition of late adolescents to discount future consequences. This is often observed in legal contexts, such as interrogations, where there is a higher propensity for making plea decisions without full consideration and advice of counsel and even giving false confessions. For instance, late adolescents may accept a plea deal driven by the offer of an immediate release to go home, overlooking significant future consequences for immediate rewards.⁴² These behavioral patterns highlight the importance of recognizing the unique developmental characteristics of late adolescents when evaluating their decision-making processes within the criminal justice system.

Recognizing the interplay between temporal discounting, ongoing neurodevelopment, and emotional contexts is essential in understanding adolescent and late-adolescent decision-making.

⁴¹ Pei, R. et al. (2020), Neural processes during adolescent risky decision-making are associated with conformity to peer influence. *Developmental Cognitive Neuroscience*, 44, 1-12.

⁴² Zottoli, T.M., & Daftary-Kapur, T. (2019). Guilty pleas of youths and adults: differences in legal knowledge and decision making. *Law and Human Behavior*, 43(2), 166-179.

5. Risk Appraisal/Decision-Making

The neurocognitive processes underlying mid-to-late adolescent decision-making provide valuable insights into the developing brain, as elucidated by Icenogle and Cauffman (2021).⁴³ This exploration reveals intricate changes during late adolescence, marked by synaptic pruning and myelination, influencing self-regulation and higher-order thinking.

Mid-to-late adolescents exhibit a distinct decision-making pattern, prioritizing immediate gains over long-term consequences compared to adults' more developed capacity for long-term planning. This behavior is tied to the ongoing structural and functional connectivity changes between the prefrontal cortex and the striatum, contributing to changes in self-control and reward processing. MRI studies illustrate these structural and functional changes, showcasing the neurobiological foundation for heightened sensitivity to rewards in adolescents, especially social rewards. This heightened sensitivity significantly influences risk appraisal and decision-making processes, contributing to behaviors such as reckless driving and engaging in risky sexual activities.

A longitudinal learning study, testing individuals aged 8–25, shows that increased activity in a key reward region of the brain, the striatum, supports learning

⁴³ Icenogle, Grace & Cauffman, Elizabeth. (2021). Adolescent decision making: A decade in review. *Journal of Research on Adolescence*. 31. 1006-1022. 10.1111/jora.12608.

improvements during late adolescence likely in part due to the decreasing saliency of short-term rewards, including social rewards. This heightened activity in the striatum corresponds with the neurobiological processes that make late adolescents more susceptible to immediate rewards. As evidenced by MRI studies, the intertwining of structural and functional changes provides a comprehensive understanding of the neurobiological factors contributing to the unique vulnerabilities and challenges in risk appraisal during late adolescence.

Exploring the impact of stress on decision-making in late adolescents reveals heightened vulnerability. Acute stress impairs decision-making, especially in socially stressful situations, and this effect is more pronounced in late adolescents and young adults than it is in older adults. Stress influences the prefrontal cortex and alters communication between the prefrontal cortex and subcortical regions, impacting decision-making during high-stress moments.

The interaction between structural and functional changes, the impact of stress on decision-making, and the unique vulnerabilities of adolescents all shape risk appraisal and decision-making in this age group. The extended period of plasticity during adolescence allows for changes in structural and functional connectivity between the striatum and prefrontal cortex, influencing goal-directed behavior and adaptive learning strategies. Acknowledging the intricacies of the neurobiology of

decision-making is crucial for informed legal proceedings relating to culpability and decision-making capacity in late adolescents.

6. Propensity Towards Recklessness

Adolescent brain development provides insights into recklessness and risk-taking behaviors which peak during late adolescence and gradually subside going into adulthood. Late adolescents, aged 18 to 21, frequently engage in behaviors that pose risks to their well-being, such as reckless driving, unprotected sex, and substance experimentation.⁴⁴ Impulsivity, focus on short-term incentives, and lack of self-control lead to real-world risk-taking and negative future outcomes.

Neuroscientific studies highlight the ongoing development of critical brain regions during late adolescence, which underlie this risk-taking behavior. The ventral striatum and amygdala, associated with reward processing and emotional responses, develop early in adolescence,⁴⁵ fostering reward-seeking behaviors.⁴⁶ Conversely, the prefrontal cortex, responsible for cognitive control and decision-

⁴⁴ Laurence Steinberg, *A Social Neuroscience Perspective on Adolescent Risk-Taking*, 28 *Development Rev.* 78 (2008); Teena Willoughby et al, *Examining the Link Between Adolescent Brain Development and Risk-Taking From a Social-Developmental Perspective (Reprinted)*, 89 *Brain & Cognition* 70 (2014).

⁴⁵ Heller & Casey, *The Neurodynamics of Emotion: Delineating Typical and Atypical Emotional Processes During Adolescence*, 19 *Developmental Sci. Rev.* 3, 5-6 (2016).

⁴⁶ Casey et al., *The Adolescent Brain*, 28 *Development Rev.* 62, 64 (2008).

making, continues its maturation and connectivity with subcortical regions into early adulthood, contributing to the prolonged development of self-regulation.⁴⁷ This developmental time frame denotes an enhanced sensitivity to rewards as well as heightened impulsivity and risky decision-making.

Adolescent decision-making is additionally influenced by external factors, including stress⁴⁸ and peer pressure.⁴⁹ When faced with acute threats, late adolescents exhibit heightened impulsivity and may be more vulnerable to psychological stress than young adults. Their brain responses more closely resemble those of middle adolescents (ages 13–17) than young adults (ages 22–25), emphasizing the heightened vulnerability of late adolescents to psychosocial stress.⁵⁰ Furthermore, adolescents exhibit more risk-taking behavior in the presence of similarly aged peers, compared to in the presence of adults or alone.⁵¹ The connections between the prefrontal cortex and subcortical regions are susceptible to

⁴⁷ Braams, et al (2015).

⁴⁸ Adriana Galván & Kristine McGlennen, Daily Stress Increases Risky Decision-Making in Adolescents: A Preliminary Study, 54 *Developmental Psychobiology* 433, 433–440 (2012).

⁴⁹ Icenogle, G., & Cauffman, E. (2021)1006-1022.

⁵⁰ Max Gyuill et al, Innocence and Resisting Confession During Interrogation: Effects on Physiologic Arousal. 37 *L. & Human Behavior* 366–75 (2013).

⁵¹ Silva et al, (2016).

disruption under stress, contributing to impulsive responses and increased risk-taking tendencies.⁵²

The characteristics of recklessness in late adolescence are deeply rooted in the ongoing maturation of specific brain regions, coupled with vulnerabilities to external pressures. Understanding the nuanced interplay between brain development, adversity, and peer influences is pivotal for legal considerations, recognizing that the nature of adolescent impulsivity underscores the potential for rehabilitation and positive growth.

C. Interplay Between Trauma and Brain Development

The intricate interplay between trauma and brain development during adolescence is especially relevant for a criminal justice population. Approximately 90% of justice-involved adolescents have endured one or more adverse childhood experiences (ACE), with over 20% meeting criteria for post-traumatic stress disorder (PTSD).⁵³ This reflects the disproportionate burden of childhood adversity in the

⁵² J. Van Oort et al, How the Brain Connects in Response to Acute Stress: A Review at the Human Brain Systems Level. 83 *Neurosci. & Biobehavioral Rev.* 281, 281–297 (2017).

⁵³ Carly Dierkhising et al, Trauma histories among justice-involved youth: Findings from the National Child Traumatic Stress Network, 4 *Eur. J. Psychotraumatology* 20274 (2013).; Karen Abram, et al, PTSD, Trauma, and Comorbid Psychiatric Disorders in Detained Youth. *OJDP Juv. Just. Bulletin* (U.S. Dept. Just. Off. Juv. Justice & Delinquency Prev., Washington, D.C.), June 2013.

justice system, far exceeding prevalence rates of PTSD in the general population of about 5% in adolescents and 3.6% in adults.⁵⁴ ACEs take various forms including psychological trauma, violence, poverty, neglect, and maltreatment, which contribute to the multifaceted impact on late adolescent brain structures.⁵⁵

Studies have shown that traumatic events may not only influence the brain development and behavior of the person who experiences the adversity firsthand but also future generations. This may occur because of behavioral changes in parenting styles – childhood adversity and negative parenting styles as a result of parental exposure to trauma have also been shown to be associated with offspring vulnerability to developing PTSD (Weaver et. al., 2004).⁵⁶ Additionally, parental exposure to trauma may actually lead to DNA changes that then may be inherited by future generations. Research supports this theory, showing that parental PTSD leads to inherited epigenetic changes that make offspring more vulnerable to developing

⁵⁴ Nat'l Inst. Health, Post-Traumatic Stress Disorder (PTSD) (2019), <https://www.nimh.nih.gov/health/statistics/post-traumatic-stress-disorder-ptsd> [<https://perma.cc/M53J-QDD>].

⁵⁵ Ronald Kessler et al, Childhood Adversities and Adult Psychopathology in the WHO World Mental Health Surveys, 197 *Brit. J. Psychiatry* 378 (2010); Lucy Fitton et al, Childhood Maltreatment and Violent Outcomes: A Systematic Review and MetaAnalysis of Prospective Studies. 21 *Trauma, Violence, & Abuse* 754, 754–768 (2020).

⁵⁶ Weaver, I. C., Cervoni, N., Champagne, F. A., D'Alessio, A. C., Sharma, S., Seckl, J. R., ... & Meaney, M. J. (2004). Epigenetic programming by maternal behavior. *Nature neuroscience*, 7(8), 847.

PTSD even without directly experiencing the trauma themselves (Yehuda et. al., 2014) (Lehrner and Yehuda, 2018).⁵⁷

Research has shown that interpersonal traumas, and especially chronic or complex traumas experienced in childhood or adolescence, can cause severe alterations to social, psychological, cognitive, and biological development resulting in psychosocial deficits and difficulties.

Experiencing trauma can contribute to difficulties in a number of areas. For example, it is common for people who have experienced trauma to have difficulty remembering the chronological details of the traumatic event, as well as ongoing difficulties with memory in general. They may also experience trouble with their ability to focus, may experience distortions with their sense of self, may have trouble regulating emotions, and may see negative changes in their ability to connect with and trust others. They might also exhibit symptoms of numbness, hyper-vigilance, hypersexuality, intrusive thoughts and memories, self-harm and self-destructive

⁵⁷ Yehuda, R., Daskalakis, N. P., Lehrner, A., Desarnaud, F., Bader, H. N., Makotkine, I., & Meaney, M. J. (2014). Influences of maternal and paternal PTSD on epigenetic regulation of the glucocorticoid receptor gene in Holocaust survivor offspring. *American Journal of Psychiatry*, 171(8), 872-880; Lehrner, A., & Yehuda, R. (2018). Cultural trauma and epigenetic inheritance. *Development and psychopathology*, 30(5), 1763-1777.

behaviors, substance misuse, and avoidance behaviors like truancy and running away from home or school.⁵⁸

Research with justice-involved youth and young adults has shown that disproportionately have experienced childhood trauma compared to other youth, and have symptoms and behaviors associated with histories of maltreatment and adversity that are psychologically overwhelming (trauma). Involvement with the justice system can further exacerbate trauma for these individuals through exposure to many additional adversities resulting in traumatic symptoms and trauma-derived maladaptive behaviors and ordinarily do not have ready access to the kinds of supportive and evidence-based behavioral health treatment that would assist in their recovery (SAMHSA).⁵⁹

Early life trauma profoundly affects the development of crucial brain regions, including the amygdala and striatum, responsible for emotional processing, and the prefrontal cortex, crucial for self-control. Exposure to adversity correlates with

⁵⁸ Herman, J. (2015). Trauma and recovery: The aftermath of violence—from domestic abuse to political terror. 326. <https://psycnet.apa.org/fulltext/2015-30136-000.pdf>.

⁵⁹ Trauma Training for Criminal Justice Professionals. (2015, June 22). <https://www.samhsa.gov/gains-center/trauma-training-criminal-justice-professionals>.

impaired reward processing, manifesting in structural and functional differences in the brain's connections vital for learning from rewards.⁶⁰

Adverse experiences, like childhood poverty, alter brain development in regions associated with self-regulation, contributing to deficits into adolescence and adulthood.⁶¹ Indeed, a late adolescent exposed to significant adversity may have a much lower neurocognitive age than a late adolescent who has not experienced trauma.⁶² The recognition of trauma's manifestations and its potential consequences, such as impaired reward processing and heightened risk for psychopathology is relevant to life without parole sentences. The exceptional plasticity of late adolescent brains in supportive environments where treatment is available makes rehabilitation opportunities exceptionally important for this age range.

⁶⁰ Bryan Kennedy et al, *Accumbocortical Tract Integrity is Related to Early Life Adversity and Feedback Learning*. 46 *Neuropsychopharmacology* 2288, 2288–2294 (2021).

⁶¹ Palacios-Barrios, E. E., & Hanson, J. L. (2019). Poverty and self-regulation: Connecting psychosocial processes, neurobiology, and the risk for psychopathology. *Comprehensive Psychiatry*, 90, 52–64.

⁶² *The Neurocognitive and Psychosocial Impacts of Violence and Trauma: Proceedings of a Workshop—in Brief*, National Academies of Sciences, at 2 (Apr. 2018) (“[T]hreats, abuse, and violence lead to an excessive activation of fear circuitry and stress response systems, which will then compromise normal brain development.”).

D. Risk of Substance Misuse in Adolescents

The neurodevelopment of adolescence is impactful regarding both the propensity to misuse of substances and the impact of such misuse on the brain. Adolescents engage in risk-taking behaviors, including substance misuse, more extensively than adults. The propensity for risk-taking behaviors among adolescents is developmentally normative and typically diminishes throughout young adulthood.⁶³

Risk-taking during adolescence is a double-edged sword and leads both to adaptive and maladaptive behaviors. For example, risk-taking facilitates adolescent exploration and learning, promoting identity development and preference formation as new experiences are attempted and occur. The adolescent propensity towards risk-taking may also facilitate the development of positive goal-oriented behaviors that entail a risk of failure.⁶⁴ Risk-taking can also take the form of maladaptive behaviors, notably including substance misuse, rates for which rise through adolescence and as

⁶³ Steinberg, (2008).

⁶⁴ Natasha Duell & Laurence Steinberg, *Positive Risk-Taking in Adolescence*, 13 *Child Development Perspectives* 48, 48–52 (2019).

decline during young adulthood.⁶⁵ Reckless driving and unprotected sex also peak during late adolescence before declining through young adulthood.⁶⁶

An individual's propensity to misuse substances is significantly higher in adolescence and young adulthood – while the brain's dopamine system is still developing – than after dopamine system development has concluded.⁶⁷ The brain's dopamine system is a key part of the formation of reward pathways in the brain. Dopamine concentration peaks during adolescence before stabilizing and dopamine receptor density peaks during adolescence before declining throughout young adulthood.⁶⁸

Dopamine concentrations and receptor density are therefore at a zenith during late adolescence. This drives the adolescent and late-adolescent brain to greater reward-seeking behavior than a more fully developed brain, which in turn results in

⁶⁵ Andrea Stone et al, *Review of Risk and Protective Factors of Substance Use and Problem Use in Emerging Adulthood*, 37 *Addictive Behav.* 747, 747-775 (2012).

⁶⁶Willoughby et al, (2014).

⁶⁷ Cohen et al., *When is an adolescent an adult? Assessing cognitive control in emotional and nonemotional contexts*, 27 *Psychol Sci* 549–62 (2016)

⁶⁸ Larsen, B., Olafsson, V., Calabro, F., Laymon, C., Tervo-Clemmens, B., Campbell, E., ... & Luna, B. (2020). Maturation of the human striatal dopamine system revealed by PET and quantitative MRI. *Nature Communications*, 11(1), 846.

a greater propensity to seek new experiences, misuse substances, and take risks.⁶⁹

Substances may be particularly alluring to adolescents as a means of coping with emotional or environmental stressors during this turbulent period of development.

Adolescents are also especially susceptible to peer influence and peer substance use and experience greater degrees of reward-related activity in the brain when engaging in risk-taking in the presence of peers than when alone. Notably, this peer effect is not found in adults aged 25-35 years indicating less susceptibility to peer influence as the brain continues to develop.⁷⁰

The impacts of substance misuse in adolescence are especially pronounced but, like criminal misconduct, also tends to desist throughout young adulthood. Substance misuse in adolescents can significantly impact their decision-making processes, emotional regulation and risk of criminality. By altering still-forming dopamine reward pathways, substance misuse can produce outsized effects on an adolescent's motivations and capacity for judgment. Additionally, adolescents often

⁶⁹ Hawes, S. W., Chahal, R., Hallquist, M. N., Paulsen, D. J., Geier, C. F., & Luna, B. (2017). Modulation of reward-related neural activation on sensation seeking across development. *NeuroImage*, 147, 763-771.

⁷⁰ Smith, A. R., Steinberg, L., Strang, N., & Chein, J. (2015). Age differences in the impact of peers on adolescents' and adults' neural response to reward. *Developmental cognitive neuroscience*, 11, 75-82. *Developmental Cognitive Neurosci.* 75 (2015); Beardslee, J., Datta, S., Byrd, A., Meier, M., Prins, S., Cerda, M., & Pardini, D. (2018). An examination of parental and peer influence on substance use and criminal offending during the transition from adolescence to adulthood. *Criminal justice and behavior*, 45(6), 783-798.

display rebellious or “acting-out” behavior in response to trauma, which often includes substance use. Substance use or misuse may also be an attempt to self-medicate to cope with flashbacks, anxiety, depression, or other psychological stress resulting from trauma.

E. Social Determinants of Health and Wellbeing

Social Determinants of Health (SDoH) refer to the conditions, systems, and policies in which people live and age.⁷¹ SDoH have profound impacts on adolescent development and behavior. They include socioeconomic status, race, education, access to healthy foods, transportation, housing stability, neighborhood violence, community, and environmental factors, among others.⁷² SDoH play a critical role in shaping the behaviors of adolescents.⁷³ They are not merely background factors – they are among the root causes of adolescent criminality.

Research consistently demonstrates that adolescents from underserved and marginalized backgrounds are disproportionately represented in the criminal justice

⁷¹ Hughes, N., Ungar, M., Fagan, A., Murray, J., Atilola, O., Nichols, K., ... & Kinner, S. (2020). Health determinants of adolescent criminalisation. *The Lancet Child & Adolescent Health*, 4(2), 151-162

⁷² Nation, M., Chapman, D. A., Edmonds, T., Cosey-Gay, F. N., Jackson, T., Marshall, K. J., ... & Trudeau, A. R. T. (2021). Social and structural determinants of health and youth violence: shifting the paradigm of youth violence prevention. *American journal of public health*, 111(S1), S28-S31.

⁷³ Hughes, et al, (2020).

system. Widely cited research found that 96% of American adolescents in the criminal justice system had experienced ACEs associated with SDoH.⁷⁴ This overrepresentation is not coincidental but rather a direct manifestation of the broader societal inequities these individuals face. It has been documented repeatedly that social disadvantages are significantly associated with criminal behavior among adolescents.⁷⁵

Adolescents affected by adverse SDoH, including poverty, lack of access to quality education, and neighborhood violence, are often compelled to navigate survival in environments that inherently limit their choices and opportunities. This context is crucial, especially when evaluating the conduct of adolescents, given their heightened vulnerability to social factors and systems outside their control. It is oftentimes simply not possible for an adolescent in these circumstances to change their environment, and adapting their behavior to match their environment is a more viable possibility for survival for an adolescent. The outcome is unfortunately predictable on a statistical level: increased adolescent criminality as a means of navigating a harsh environment over which they have little control.

⁷⁴ Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., & Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study. *American journal of preventive medicine*, 14(4), 245-258.

⁷⁵ Hughes, et al, (2020).

Adolescence is characterized by significant cognitive, emotional, and social growth. When this growth is stunted or diverted by adverse SDoH, the adolescent’s capacity for empathy and moral reasoning is similarly stunted and diverted. For example, exposure to chronic toxic stress – common in environments marked by violence – can affect the adolescent’s capacity for impulse control and risk assessment. This is not to suggest that adolescents are incapable of differentiating right from wrong, but rather to elucidate the significant influences of SDoH on adolescent criminality. Adolescents who live and grow under the cloud of adverse SDoH are likely to reflect these externally imposed factors in their own behavior. The determinants are referred to as “determinants” for a reason. They do not operate in isolation but are interwoven into the fabric of individual lives, influencing their behavior and choices.

1. Implications of Social Determinants of Health

Social determinants of health, including racism and poverty, have profound implications for adolescents’ health, quality of life, and involvement in the criminal justice system.⁷⁶ Studies consistently indicate that discrimination and racism have detrimental effects on the mental health of late adolescents, contributing to increased

⁷⁶ Lorch, S. A., & Enlow, E. (2016). The role of social determinants in explaining racial/ethnic disparities in perinatal outcomes. *Pediatric research*, 79(1), 141-147.

symptoms of anxiety and depression,⁷⁷ as well as implications on physical health outcomes. A study involving Black adolescents who experienced higher levels of discrimination between the ages of 16–18 found that these participants exhibited elevated stress hormone levels,⁷⁸ higher blood pressure, increased inflammation, and a higher body mass index by the age of 20.⁷⁹

Housing options tend to be limited for adolescents, whose living environments tend to be dictated by parents or guardians. However, additional stressors such as poverty, restricted access to resources and education, and unstable housing significantly reduce an adolescent's agency to “extricate” themselves from a negative home environment. This can be especially detrimental in high-conflict, neglectful, criminogenic, dangerous, or toxic home environments. These factors

⁷⁷ Miranda, R., Polanco-Roman, L., Tsypes, A., & Valderrama, J. (2013). Perceived discrimination, ruminative subtypes, and risk for depressive symptoms in emerging adulthood. *Cultural Diversity and Ethnic Minority Psychology, 19*(4), 395.

⁷⁸ Cortisol is a “stress hormone” that regulates the body’s metabolic and immune responses, and high levels enhance alertness during stress. Epinephrine is a hormone that cues up the sympathetic nervous system by increasing heart rate and respiration rate during stress. Norepinephrine is released during times of stress, and its release stimulates action, arousal, and alertness.

⁷⁹ Brody, G. H., Lei, M. K., Chae, D. H., Yu, T., Kogan, S. M., & Beach, S. R. (2014). Perceived Discrimination Among African American Adolescents and Allostatic Load: A Longitudinal Analysis With Buffering Effects. *Child development, 85*(3), 989-1002.

exert substantial influence on behavior, brain development, and future life outcomes.⁸⁰

Structural racism compounds difficulties for Black and Latino adolescents, who are more likely to face unequal access to high-quality education, employment, safe housing, credit, and healthcare.⁸¹ Perceptions of age and threat associations further perpetuate racial disparities. While Black children are more likely to be viewed as older (“adultification”) and treated and categorized as adults, White children are more frequently presumed innocent and perceived as less culpable.

Additionally, studies show that police officers strongly tend to overestimate the ages of Black and Latino children as compared to White children, which can have important impacts on how these youth interact with the criminal justice system. Similar biases persist in educational contexts, where Black children are more often incorrectly perceived as angry compared to White children and are more likely to be suspended and expelled.⁸² These findings emphasize the pervasive and lasting

⁸⁰ Despite the challenges faced by disadvantaged adolescents, most young people are resilient and largely overcome adversity as they mature into early young adulthood, particularly if they are in environments or relationships that buffer them from long-term impact of adversities and foster resilience.

⁸¹ Williams, D. R., Lawrence, J. A., & Davis, B. A. (2019). Racism and health: evidence and needed research. *Annual review of public health, 40*, 105-125.

⁸² Halberstadt, A. G., Cooke, A. N., Garner, P. W., Hughes, S. A., Oertwig, D., & Neupert, S. D. (2022). Racialized emotion recognition accuracy and anger bias of children’s faces. *Emotion, 22*(3), 403.

impact of racial biases on adolescents, influencing their interactions with the criminal justice system and shaping their overall well-being.

The experiences and challenges faced during adolescence, especially in disadvantaged circumstances, contribute to long-term changes in both brain and behavior. Stress, adversity, and racial bias can have lasting effects on an individual's cognitive capacities, emotional characteristics, and involvement in the criminal justice system.

F. Continued Capacity for Growth and Change

Late adolescents have tremendous capacity for growth and change. As indicated above, most late adolescents self-desist or “age out” of crime as they enter into adulthood. *This is true even for youth who are chronically involved in the criminal justice system or commit serious crimes.* One reason for this is brain plasticity and neural connectivity. Plasticity refers to the brain’s ability to change and adapt over time, in response to experience. The heightened plasticity during adolescence through young adulthood “wires” this age range to be neurologically primed to learn through experience. While risk-taking and impulsivity can be problematic, these brain functions also help adolescents to learn and explore.

In late adolescence, connections between the striatum and prefrontal cortex become more robust, which reduces impulsivity and increases goal-directed, purposeful behavior. This is because a developed prefrontal region is better able to

effectively regulate emotions and responses to stimuli. Late adolescents ages 18 – 21 are more likely to change and update their decision-making strategies, learning from feedback through trial and error.

Research demonstrates that late adolescents are more responsive to feedback that is positive (e.g., social praise, material reward) than punishment. This has implications for intervention and rehabilitation since late adolescents are more likely to learn from outcomes to change their behavior.

Late adolescents are also susceptible to change due to developmental changes. Their identity, family relationships, social relationships, motivation, and goals are each likely to be in flux and to evolve as their brains continue to develop and they gain life experience. The ability to regulate emotions, consider the consequences of one's actions, and plan for the future also increases markedly during this period.

Personality characteristics also change to varying degrees throughout the lifespan. Decades of research have established that personality is not solidified in childhood or adolescence. Neuroticism – a trait characterized by negative emotions and emotional instability – decreases with maturation. Agreeableness, conscientiousness, and openness to new things increase in adulthood. Even youth labeled “psychopathic” with callous-unemotional traits, tend to not have those traits persist into adulthood. For example, in a study of individuals ages 17–24 with previously identified psychopathic personality traits, those traits were found to

diminish over time until the age of twenty-four (24).⁸³ One of the reasons antisocial personality disorder cannot be diagnosed until at least the age of eighteen (18) is because so many of the antisocial traits recede in early adulthood.

Precisely because of the amount of change that occurs during late adolescence, primarily positive prosocial changes, scientists cannot reliably predict which adolescents will continue to offend into adulthood and which ones will not.

G. Neurodevelopment and Social Maturity

The import of neurodevelopment and social maturity in the context of adolescent criminality is difficult to overstate. Accepted neurodevelopmental research illuminates that the adolescent brain is in a unique state of growth and transformation, particularly in the areas responsible for decision-making and impulse control. The prefrontal cortex – which is pivotal for these functions – continues to mature into the mid-twenties. Adolescents therefore may struggle with a reduced neurobiological capacity for self-regulation of behavior as compared to adults in their late twenties.

Social maturity is commonly conceptualized as the acquisition of skills and attitudes essential to navigating and evaluating social actions and interactions – a

⁸³ Hawes, S. W., Mulvey, E. P., Schubert, C. A., & Pardini, D. A. (2014). Structural coherence and temporal stability of psychopathic personality features during emerging adulthood. *Journal of abnormal psychology*, 123(3), 623.

process that also plays a crucial role in adolescent behavior. Social maturation in adolescence involves the continued development of empathy, perspective-taking, and moral reasoning. The process of social maturation is significantly influenced by intrinsic and extrinsic factors, ranging from individual-level neurodevelopment to social modeling by family members and peers.

The interplay between an adolescent’s still-developing brain and their social environment can significantly impact behavior, including the propensity for risk-taking and criminality. Changes to the social environment subsequent to criminality have the potential to significantly alter the trajectory of social maturation.

III. A SCIENCE-BASED APPLICATION OF MARIO’S LAW ALIGNS RHODE ISLAND WITH THE NATIONAL MOVEMENT FOR IMPROVING THE JUSTICE SYSTEM

A. States’ Response to Growing Neuroscientific Research on Adolescent Brain Development

In *Miller v. Alabama*, the United States Supreme Court explicitly referenced adolescents’ tendency toward immaturity, impetuosity, and irresponsibility. *Miller*, 567 U.S. at 472. The predisposition for sensation seeking, hypersensitivity to immediate rewards, and present-focused decision-making peaks in middle to late adolescence and then declines in young adulthood. Compared to young adults above age 21, late adolescents (ages 18–21) also take more risks and engage in more

sensation-seeking behavior.⁸⁴ Due to differences in brain development, late adolescents are more likely than young adults to respond to immediate outcomes and are less likely to delay gratification.⁸⁵ The presence of peers can intensify these behaviors, and the brains of late adolescents are more responsive to peer involvement than those of young adults.⁸⁶ Late adolescents are also more easily swayed by adult influence and coercion than their adult counterparts.⁸⁷

Neuroscience findings show that brain development continues in young people until the age of twenty-five (25), with these “emerging adults” exhibiting the same immaturity, vulnerability, and rehabilitative potential that the Court found

⁸⁴ Laurence Steinberg, Adolescent Brain Science and Juvenile Justice Policymaking, 23 *Psych., Pub. Pol’y, & L.* 410 (2017).

⁸⁵ Michelle Achterberg et al, Frontostriatal White Matter Integrity Predicts Development of Delay of Gratification: A Longitudinal Study, 36 *J. Neurosci.* 1954 (2016); Samuel Hawes et al, Modulation of Reward-Related Neural Activation on Sensation Seeking Across Development, 147 *Neuroimage* 763 (2017).

⁸⁶ Dustin Albert, Jason Chein & Laurence Steinberg, The Teenage Brain: Peer Influences on Adolescent Decision-Making, 22 *Current Directions Psych. Sci.* 114 (2013); Ashley Smith et al, Age Differences in the Impact of Peers on Adolescents’ and Adults’ Neural Response to Reward, 11 *Developmental Cognitive Neurosci.* 75 (2015).

⁸⁷ Hayley Cleary, Applying the Lessons of Developmental Psychology to the Study of Juvenile Interrogations: New Directions for Research, Policy, and Practice, 23 *Psych., Pub. Pol’y, & L.*, 118, 118–130 (2017).

significant in *Miller* and *Montgomery*.⁸⁸ In light of the Court’s repeated rationale that children are less culpable than adults,⁸⁹ coupled with this additional data, an increasing number of states have altered their criminal sentencing.

Washington

The Supreme Court of Washington concluded that mandatory LWOP sentences when imposed on individuals under twenty-one (21) violated the Washington Constitution. *In re Monschke*, 197 Wash. 2d 305, 325-26 (2021). In *Monschke*, the Washington Supreme Court explained that “[m]odern social science, our precedent, and a long history of arbitrary line drawing have all shown that no clear line exists between childhood and adulthood.” *Id.* at 306. The court concluded that “youthful defendants older than 18 share the same developing brains and

⁸⁸ Insel & Tabashneck, Ctr. For Law, Brain & Behavior at Mass General Hospital, White Paper on the Science of Law Adolescence: A Guide for Judges, Attorneys and Policy Makers 22 (2022), <https://clbb.mgh.harvard.edu/wp-content/upload/CLBB-White-Paper-on-the-SCience-of-Late-Adolescence-pdf> (CLBB).

⁸⁹ See Stephen St. Vincent, *Kids Are Different*, 109 Mich. L. Rev. First Impressions 9 (2010); Jody Kent Lavy, Notion that “Kids Are Different” Takes Hold in Youth Justice Policy Reform, JUV. JUST. INFO. EXCH. (Dec. 31, 2012), <https://perma.cc/LGP5-7W4K>; *J.D.B. v. North Carolina*, 564 U.S. 261 (2011) (holding that youth is relevant for the purposes of whether someone is in custody such that Miranda warnings are constitutionally required); *Montgomery*, 577 U.S. 190 (2016) (holding that *Miller* should be applied retroactively).

impulsive behavioral attributes as those under 18” and thus must qualify for similar constitutional protections. *Id* at 313.

California

California passed a statute that retroactively eliminates LWOP sentences for children. Cal. Penal Code § 3051. The statute provides that a person sentenced to life without parole for an offense committed before age eighteen (18) is eligible for parole at a youth offender parole hearing during his or her 25th year of incarceration.⁹⁰ *Id.* This statute amended an earlier statute providing new parole eligibility rules for individuals who committed crimes under the age of twenty-third (23) and directing the parole board to use special criteria and procedures in these cases.⁹¹

Massachusetts

Massachusetts initially eliminated life without parole for juveniles through a court decision. In December 2013, the Massachusetts Supreme Judicial Court held that life without parole for juveniles violates the Massachusetts Constitution. *Diatchenko v. Dist. Att’y for Suffolk Dist.*, 466 Mass. 655, 656, (2013). Under the decision, juvenile offenders convicted of first-degree murder and previously

⁹⁰ See <https://juvenilesentencingproject.org/california/>.

⁹¹ See <https://pdo.santaclaracounty.gov/cases-we-take/juvenile/youthful-offender-parole>.

sentenced to mandatory life without parole are eligible for a parole hearing after serving 15 years. A month ago, in January 2024, the Court relied upon the scientific consensus outlined above to bar – prospectively and retroactively - the imposition of life without parole for any offense committed between 18 – 20, inclusive. *Commonwealth v. Mattis*, 493 Mass. 216, 222, (2024).

Michigan

The Michigan Supreme Court held that imposing mandatory LWOP for 18-year-olds violates its state constitutional ban on cruel or unusual punishment. *People v. Parks*, 510 Mich. 225 (2022). In so holding, the Michigan Supreme Court reasoned that because “the Eighth Amendment dictates that youth matters in sentencing,” and because science has shown that eighteen-year-olds possess the same attributes of youth as do juveniles, mandatorily sentencing an eighteen-year-old to LWOP is an “unusually excessive imprisonment and thus a disproportionate sentence that constitutes ‘cruel or unusual punishment’” under the Michigan Constitution. *Id.* at 226.

District of Columbia

The District of Columbia enacted the Incarceration Reduction Amendment Act (ICRA) in 2016, which permitted anyone who committed a crime as a juvenile to petition for a resentencing after having served twenty (20) years of their

sentence.⁹² D.C. Code 24-403.03. When none of the individuals released pursuant to ICRA reoffended, proponents sought to extend the reform to all individuals who committed crimes before they were twenty-five (25).⁹³ Despite vigorous protest,⁹⁴ the D.C. Council passed an amendment to its initial reform, extending the resentencing opportunity to individuals whose crime occurred before they turned twenty-five (25) and who had served a minimum of fifteen (15) years of incarceration. D.C. Code 24-403.03. This “Second Look Amendment Act” applies to all sentences.

The District of Columbia thus recognizes the science and psychology of emerging adults, providing a chance at sentence reduction for all individuals who were under twenty-five (25) years old when they committed a crime. *Id.*

B. Adoption of Retroactive Parole Eligibility by Many States

The Supreme Court’s decision in *Montgomery* has enabled and prompted states across the country to take action to adopt procedures allowing for the

⁹² Madison Howard, *Second Chances: A Look at D.C.’s Second Look Act*, Am. Univ. Wash. Coll. L.: The Crim. L. Practice (May 8, 2021).

⁹³ Michael Serota, *Taking a Second Look at (In)justice*, Univ. Chic. Law Rev. Online (Jan. 23, 2020), <https://lawreviewblog.uchicago.edu/2020/01/23/taking-a-second-look-at-injustice-by-michael-serota/>.

⁹⁴ Professor Kathryn Miller details the fierce criticism to extending this bill. *See A Second Look for Children Sentenced to Die in Prison*, Oklahoma Law Rev. (2022).

resentencing and release of individuals formerly sentenced to LWOP and other lengthy sentences for serious crimes as late adolescents and emerging adults. Thirty-one states (31) have released incarcerated juveniles, formerly serving life without parole, back into their communities – most of which have been through the altering of sentence and parole eligibility.

With the decision in *Miller*, the Supreme Court recognized that children have both decreased levels of culpability and increased prospects for rehabilitation compared to adults. Data demonstrates that the Court’s intuition that the vast majority of youth “age out” of crime is true.⁹⁵ In California, a recent study of people released from LWOP sentences (including those under 18 and young adults) found a 3% rate of new convictions within 3 years, with only one new felony-qualifying conviction.⁹⁶ Data from other states also supports that recidivism in “juvenile-lifers” is low. These research findings are directly aligned with other data studies that demonstrate low rates of reoffending after release for those convicted of violent crimes.

⁹⁵ David P. Farrington, Rolf Loeber, and James C. Howell, “Young Adult Offenders: The Need for More Effective Legislative Options and Justice Processing,” *Criminology & Public Policy*, vol. 11 (2012): pp. 729-50, accessed May 1, 2023, doi:10.1111/j.1745-9133.2012.00842.x; David P. Farrington, “Age and Crime,” *Crime and Justice*, vol. 7 (1986): pp. 189-250, accessed May 1, 2023, doi:10.1086/449114.

⁹⁶ https://www.hrw.org/report/2023/06/28/i-just-want-to-give-back/reintegration-of-people-sentenced-to-life-without-parole#_ftn41.

Furthermore, the rehabilitative capacity of late adolescents and emerging adults is more than that of an adult. Because their developing brains are more malleable than those of adults, young people are also more capable of change and rehabilitation. In addition, most youth naturally age out of delinquent behavior. Accordingly, the juvenile justice field's decision-making must be informed by science and research to ensure young people are adjudicated fairly and given opportunities to learn and recover from youthful mistakes. While the grant of parole eligibility does not promise the grant of release, it is increasingly important to provide opportunities to the youth to establish that their crimes were the product of transient immaturity and ensure that there is a “meaningful opportunity for release.” *Williams v. United States*, 205 A.3d 837 (D.C. 2019).

Hence, the broad interpretation and adequate application of laws such as R.I. § 13-8-13(e) is critical to reflect the restorative capacity of emerging adults, their distance from crime due to psychosocial maturation, and to provide the youth with an opportunity to integrate back into their communities.

IV. THE INTERPRETATION OF MARIO’S LAW TO INCLUDE CONSECUTIVE SERVING OF MULTIPLE SENTENCES IS UNTETHERED TO SCIENCE ACKNOWLEDGED BY MULTIPLE COURTS AND WOULD RESULT IN OUTCOMES IN VIOLATION OF THE INTENT OF *ROPER* AND ITS PROGENY.

The interpretation of Mario’s Law to require parole to consecutive sentences runs the risk of fully circumventing the intent of the statute to provide meaningful

opportunities for release while maintaining significant risks of disproportionate sentencing. The passage of the legislation was heavily influenced by the recent discoveries about late-adolescent brain development and findings that recidivism rates are significantly lower in youth as compared to adults.

According to the Office of Juvenile Justice and Delinquency Prevention, most juvenile offending is, in fact, limited to adolescence (i.e., these offenders do not persist into adulthood).⁹⁷ The original legislative intent behind Mario’s Law was to provide a benefit for the consideration of youth and to modify sentencing due to mitigating factors based on age, immaturity, and an underdeveloped sense of responsibility that leads to recklessness and impulsiveness.

However, the original intent for the passage of Mario’s Law would be undermined if the benefit of the legislation was not extended to those with more than a single offense. In striking down a mandatory minimum of 30 years for youth, the New Jersey Supreme Court found a twofold constitutional concern: “the court’s lack of discretion to assess a juvenile’s individual circumstances and the details of the offense before imposing a decades-long sentence with no possibility of parole; and the court’s inability to review the original sentence later, when relevant information

⁹⁷ Steinberg, L., Cauffman, E., & Monahan, K.C. (2015). Psychological maturity and desistance from crime in a sample of serious juvenile offenders. *OJJDP Juvenile Justice Bulletin* [March 2015]. U.S. Department of Justice: Office of Juvenile Justice and Delinquency Prevention.

that could not be foreseen might be presented.” *State v. Comer*, 266 A.3d 374, 401 (N.J. 2022).

Other states have gone even further to address this issue, barring the imposition of mandatory minimums and requiring individualized consideration of youth at sentencing. *State v. Lyle*, 854 N.W. 2d 378 (Iowa 2014); *State v. Houston-Sconiers*, 391 P.3d 409 (Wash. 2017). In striking down a mandatory ten (10) year sentence imposed on a seventeen (17) year-old, the Iowa Supreme Court concluded that mandatory sentences not only for the most severe lifetime terms, but also for lesser sentences, raised constitutional concerns because they serve to deprive sentencers of the ability to “craft a punishment that serves the best interests of the child and society.” *Lyle*, 854 N.W. 2d at 402.

The retroactive parole relief provided by Mario’s Law will serve as an important tool to provide relief from now-unconstitutional mandatory sentences, while avoiding the constitutional pitfall of imposing multiple sentences to be consecutively served that may rise to being *de facto* life sentences, or at least profoundly compromise the *Miller* guarantee of a “meaningful opportunity” to demonstrate successful rehabilitation as an adult.

CONCLUSION

Based on the information presented in this amicus, *Amici Curiae* presenting the within Brief to this Court respectfully requests that the Superior Court's decision

be upheld, and that Appellees-Plaintiffs be released consistent with the previous parole decisions.

Date: February 19, 2024

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/s/ Richard A. Sinapi
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