

# JUSTICE FOR EMERGING ADULTS AFTER *JONES*: THE RAPIDLY DEVELOPING USE OF NEUROSCIENCE TO EXTEND EIGHTH AMENDMENT *MILLER* PROTECTIONS TO DEFENDANTS AGES 18 AND OLDER

FRANCIS X. SHEN, FENELLA MCLUSKIE, ERIN SHORTELL, MARIAH BELLAMOROSO, ELIZABETH ESCALANTE, BRENNAN EVANS, IAN HAYES, CLARISSA KIMMEY, SARAH LAGAN, MADELEINE MULLER, JENNIFER NEAR, KAILEY NICHOLSON, JOB OKERI, IFEOMA OKOLI, EMILY REHMET, NANCY GERTNER & ROBERT KINSCHERFF\*

*Federal and state court decisions over the past year are reshaping the contours of juvenile justice litigation. At the federal level, the Supreme Court's recent decision in Jones v. Mississippi left intact the Court's current commitment to treating age 18 as the dividing line between youth and adult criminal sentencing. If a youth commits a crime at age 17 years, 364 days, 23 hours, 59 minutes, and 59 seconds old, that youth cannot be put to death or receive mandatory life without parole (LWOP). One second later, these constitutional protections disappear. Calling into question this line drawing, litigants across the country are actively leveraging neuroscientific research to argue that emerging adults ages 18 through early 20s should receive the same constitutional protections as those under 18. While federal courts have not been receptive to this argument, some state courts are. Groundbreaking recent cases in Washington, Illinois, and Massachusetts state courts may signal a potential path forward. In light of these many recent developments, this Essay provides the first empirical analysis of how courts*

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\* Francis X. Shen, Professor of Law & McKnight Presidential Fellow, University of Minnesota; Instructor in Psychology, Harvard Medical School MGH Department of Psychiatry; Director, Shen Neurolaw Lab; Faculty Member, Center for Law, Brain & Behavior at Massachusetts General Hospital; Executive Director of Education & Outreach, MacArthur Foundation Research Network on Law and Neuroscience. Fenella McLuskie and Mariah Bellamoroso, J.D. Candidates, Harvard Law School. Erin Shortell, J.D./M.P.H., Harvard Law School & Harvard T.H. Chan School of Public Health. Elizabeth Escalante, B.S. Cognitive Science, Tufts University. Brenna Evans, J.D. Candidate, University of Minnesota Law School. Ian Hayes, B.A. Candidate, Sociology, Harvard College. Clarissa Kimmey, J.D. Candidate, Yale Law School. Sarah Lagan, B.A. Neuroscience, Harvard College. Madeleine Muller, B.A. Psychology, Northwestern University. Jennifer Near and Kailey Nicholson, B.A. Candidates, Neuroscience, Harvard College. Job Okeri, J.D. Candidate, University of Minnesota Law School. Ifeoma Okoli, B.A. Psychology, Harvard College. Emily Rehmert, B.A. Cognitive Neuroscience and Public Policy, Brown University; Project Manager, Center for Law, Brain & Behavior at Massachusetts General Hospital. Nancy Gertner, Senior Lecturer on Law, Harvard Law School; Judge (Ret.), United States District Court for the District of Massachusetts; Managing Director, Center for Law, Brain & Behavior at Massachusetts General Hospital. Robert Kinscherff, Professor, Doctoral Clinical Psychology Program, William James College; Executive Director, Center for Law, Brain & Behavior at Massachusetts General Hospital. Preparation of this article was supported in part by the Dana Foundation and the Harvard Mind Brain Behavior Interfaculty Initiative. Thank you to all members of the Shen Neurolaw Lab and research assistants at the Massachusetts General Hospital Center for Law, Brain & Behavior. Copyright © 2022 by Francis X. Shen et al.

are receiving the argument to raise the age for constitutional protections and introduces a publicly accessible, searchable database containing 494 such cases. The data suggest that at present, Eighth Amendment arguments to categorically extend federal Miller protections to those 18 and above are unlikely to win. At the same time, however, state constitutions and state-level policy advocacy provide a path to expand constitutional protections for emerging adults. We discuss the implications of these trends for the future use of neuroscientific evidence in litigation concerning the constitutionality of the death penalty and LWOP for emerging adults. As this litigation moves forward, we recommend further strengthening connections between litigants and the scientific and forensic communities. Whether at the state or federal level, and whether in courts or legislatures, the record should contain the most accurate and applicable neuroscience.

|   |     |
|---|-----|
| INTRODUCTION .....  | 102 |
| I. LINE DRAWING AT AGE 18: CONSENSUS AND CONFLICT .....           | 106 |
| II. ANALYZING NEUROSCIENCE-INFORMED <i>MILLER</i> CHALLENGES..... | 107 |
| A. Distribution of Cases Across Time and Geography .....          | 108 |
| 1. Time Distribution .....  | 108 |
| 2. Geographical Distribution .....                                | 109 |
| B. Age of Defendant at Time of Offense.....                       | 110 |
| C. How Litigants Use Neuroscience.....                            | 111 |
| D. Court Responses to Neuroscientific Evidence .....              | 112 |
| III. DISCUSSION: THE PATH FORWARD.....                            | 114 |
| CONCLUSION.....   | 121 |
| APPENDIX.....   | 122 |

## INTRODUCTION

**emerging.** *Adj.* starting to exist, grow, or become known<sup>1</sup>

In 1999, five youths—ranging from ages 15 to 19—participated in the carjacking, kidnapping, and murder of two youth pastors in Texas.<sup>2</sup> All five were convicted of homicide,<sup>3</sup> but at sentencing, their paths diverged.<sup>4</sup>

Brandon Bernard (age 18 at the time of the offense) and Christopher Vialva (age 19 at the time of the offense) were both sentenced to death.<sup>5</sup> Vialva was executed on September 24, 2020,<sup>6</sup> and despite a high-profile

<sup>1</sup> *Emerging*, OXFORD ADVANCED AMERICAN DICTIONARY (2021).

<sup>2</sup> *United States v. Bernard*, 299 F.3d 467, 471 (5th Cir. 2002).

<sup>3</sup> *Id.*

<sup>4</sup> See Yasmin Tinwala, *Brandon Bernard's Bagley Murders Accomplice Who Got Out in Jan Wept with Mother as 40-year-old Was Executed*, MEAWW (Dec. 13, 2020), <https://meaww.com/terry-brown-brandon-bernard-friend-accomplice-freed-wept-with-mother-during-execution-bagley-murders> [<https://perma.cc/3MFJ-TA94>].

<sup>5</sup> *Bernard*, 299 F.3d at 471, 485.

<sup>6</sup> Michael Tarm, *Feds Put First Black Inmate to Death Since Execution Restart*, AP NEWS (Sept. 23, 2020), <https://apnews.com/article/race-and-ethnicity-racial-injustice-terre-haute-executions-archive-d54440254ddea7685bcab5417612f0de> [<https://perma.cc/7WUQ-VAXB>].

clemency campaign, Bernard was executed on December 10, 2020.<sup>7</sup> Tony Sparks (age 16 at the time of the offense) was initially sentenced to life without the possibility of parole (LWOP), but in the wake of the Supreme Court's 2012 ruling in *Miller v. Alabama*,<sup>8</sup> his sentence was reduced to thirty-five years.<sup>9</sup> Christopher Lewis (age 15 at the time of the offense) and Terry Brown (age 17 at the time of the offense) were both sentenced to twenty years and four months' imprisonment.<sup>10</sup> Brown was released in January 2020, mere months before Bernard, his childhood best friend, was executed.<sup>11</sup> On the day Bernard was executed, Brown hugged his mother, prayed for the murder victims, and cried.<sup>12</sup>

The differing paths of these five youth illustrate a bright line currently drawn by the United States criminal legal system: youths who commit a crime when they are 17 years, 364 days, 23 hours, 59 minutes, and 59 seconds old cannot be put to death or receive mandatory life without parole.<sup>13</sup> One second later, these constitutional protections disappear.

This line was drawn in part based on scientific research on the behaviors and brains of adolescents, which was included in various briefs and cited by the United States Supreme Court in a series of cases in which the Court ruled that the Eighth Amendment prohibits the death penalty for those under age 18 at the time of their capital offense;<sup>14</sup> prohibits life without the possibility of parole for non-homicide offenders under age 18 at the time of the offense;<sup>15</sup> and prohibits *mandatory* LWOP for those under age 18 at the time of their offense, even for homicide offenses.<sup>16</sup> These cases "establish that

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<sup>7</sup> Christina Carrega, *Brandon Bernard Executed After Supreme Court Denies Request for Delay*, CNN (Dec. 11, 2020), <https://www.cnn.com/2020/12/10/politics/brandon-bernard-executed/index.html> [<https://perma.cc/NN9P-V3EW>].

<sup>8</sup> See 567 U.S. 460, 470 (2012) (holding that mandatory life without parole sentences for those under the age of 18 at the time of their crimes violate the Eighth Amendment's prohibition on cruel and unusual punishments).

<sup>9</sup> Sparks v. United States, No. W-11-CV-123, 2018 WL 1415775, at \*13 (W.D. Tex. Mar. 19, 2018), *aff'd*, 941 F.3d 748 (5th Cir. 2019).

<sup>10</sup> *Id.* at \*3.

<sup>11</sup> Tinwala, *supra* note 4.

<sup>12</sup> *Id.*

<sup>13</sup> See *Roper v. Simmons*, 543 U.S. 551, 578 (2005) (holding that the Eighth and Fourteenth Amendments prohibit imposition of the death penalty on those who were under the age of 18 when their crimes were committed); *Miller*, 567 U.S. at 465.

<sup>14</sup> *Roper*, 543 U.S. at 578.

<sup>15</sup> *Graham v. Florida*, 560 U.S. 48, 75 (2010) (holding that states must provide a "meaningful opportunity to obtain release based on demonstrated maturity and rehabilitation").

<sup>16</sup> *Miller*, 567 U.S. at 465. *Miller* concerned the sentencing of two 14-year-old defendants who were convicted of murder and automatically sentenced under Alabama state law to serve life without the possibility of parole. *Id.* The Court held "that mandatory life without parole for those under the age of 18 at the time of their crimes violates the Eighth Amendment's prohibition on 'cruel and unusual punishments.'" *Id.* Rather than automatically sentence similarly placed defendants to life, the Court held that there must be individualized sentencing (so-called "*Miller* hearings"). *Id.* at 489. The Court declined to consider the "alternative argument that the Eighth

children are constitutionally different from adults,”<sup>17</sup> specifically for mandatory LWOP sentences. The Court’s recent decision in *Jones v. Mississippi*<sup>18</sup> retained the Court’s previous determination that “children are constitutionally different from adults for sentencing purposes,”<sup>19</sup> but held that, in a sentencing proceeding to determine whether the defendant should get life with parole, *Miller* and *Montgomery v. Louisiana*<sup>20</sup> do not specifically require a “separate factual finding of permanent incorrigibility.”<sup>21</sup>

The question now arises: In light of a recent growing evidence base in developmental neuroscience about the still-maturing brains of emerging adults, should youth ages 18 to early 20s receive the same constitutional protections as those under the age of 18? While the law retains a bright line at age 18, before which mandatory LWOP may not be imposed, recent developments in neuroscience increasingly show that brain circuitry relevant to decisionmaking and culpability continues to develop in significant ways through an individual’s early 20s.<sup>22</sup> This science has been persuasive to some legal actors. For example, in the Brandon Bernard case discussed above, one of the prosecutors on his case later publicly supported Bernard’s appeals for a stay of execution, noting recent advancements in developmental science suggesting that there are no meaningful distinctions between the brains of 17- and 18-year-olds.<sup>23</sup>

In this Essay, we provide the first examination of cases in which neuroscience is being deployed to argue that the death penalty and mandatory LWOP should be constitutionally prohibited for emerging adults. We focus here on the use of neuroscience to argue for the categorical application of *Miller* to cases involving emerging adults, not necessarily the use of neuroscience for mitigation or other purposes in individual cases. As we discuss later, using brain evidence for extending the adolescent category in juvenile courts, LWOP, and prison conditions is not the same as using brain evidence in an individual case.

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Amendment requires a categorical bar on life without parole for juveniles, or at least for those 14 and younger.” *Id.* at 479.

<sup>17</sup> *Id.* at 471.

<sup>18</sup> 141 S. Ct. 1307 (2021) (holding that a separate factual finding of permanent incorrigibility is not required before a juvenile can be sentenced to life without parole).

<sup>19</sup> *Miller*, 567 U.S. at 471.

<sup>20</sup> 136 S. Ct. 718, 732 (2016) (holding that the Court’s decision in *Miller* retroactively applied the prohibition of mandatory life sentences to all juvenile cases).

<sup>21</sup> *Jones*, 141 S. Ct. at 1313.

<sup>22</sup> See BJ Casey, Kim Taylor-Thompson, Estée Rubien-Thomas, Maria Robbins & Arielle Baskin-Sommers, *Healthy Development as a Human Right: Insights from Developmental Neuroscience for Youth Justice*, 16 ANN. REV. L. & SOC. SCI. 203, 212–15 (2020).

<sup>23</sup> Angela Moore, *Op-Ed: I Helped Put Brandon Bernard on Federal Death Row. I Now Think He Should Live*, INDYSTAR (Nov. 18, 2020), <https://www.indystar.com/story/opinion/2020/11/18/op-ed-brandon-bernard-execution-prosecutor-says-he-should-live/6329685002> [<https://perma.cc/DAD7-MWVP>].

Our analysis finds that litigants regularly argue that drawing the line at age 18 is inconsistent with current neuroscientific consensus.<sup>24</sup> It is clear, however, that courts are presently unreceptive to raising the age for *Miller* protections. In our database, the record for Eighth Amendment challenges is 0 wins and 494 losses.<sup>25</sup> One temporary win, in federal district court, was subsequently vacated and remanded at the appellate level.<sup>26</sup> A second win, in the Illinois Supreme Court, was made on the basis of a *state* constitutional provision rather than the Eighth Amendment.<sup>27</sup>

Courts are rejecting attempts to extend *Miller* both on the basis of *stare decisis* and because of a perceived lack of legal relevance of advances in neuroscientific knowledge about the emerging adult brain.<sup>28</sup> Courts consistently point out that because the Supreme Court's constitutional line drawing at age 18 was based in large part on societal norms reflected in legislative determinations defining juvenile and adult criminal jurisdiction, rather than exclusively on the neuroscientific understanding of the developing brain, new arguments premised on neuroscience are unpersuasive.<sup>29</sup> While the Supreme Court's recent verdict in *Jones* would seem to signal that it is unlikely the Court would expand protections for youths 18 and older, developments at the state level suggest that challenges based on state constitutional provisions may be more successful.<sup>30</sup> We discuss the implications of these trends for the future use of neuroscientific evidence in litigation concerning the constitutionality of the death penalty and LWOP for emerging adults.

The Essay proceeds as follows. Part I briefly reviews scholarly literature scrutinizing age 18 as the boundary line for constitutional protections. Part II introduces the methods we used to identify and analyze cases that utilize neuroscience evidence to try to extend *Miller* and illustrates

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<sup>24</sup> For the database that contains a full list of the cases studied, see Appendix.

<sup>25</sup> *Id.*

<sup>26</sup> *See Cruz v. United States*, No. 11-CV-787, 2018 WL 1541898 (D. Conn. Mar. 29, 2018), *vacated*, 826 F. App'x 49, 52 (2d Cir. 2020) (concluding "that the district court erred when it held that the Eighth Amendment forbids a mandatory life sentence for a defendant who was eighteen at the time of his offense").

<sup>27</sup> *People v. House*, 142 N.E.3d 756, 774 (Ill. App. Ct. 2019) (relying on the Proportionate Penalties Clause of the Illinois Constitution).

<sup>28</sup> *See, e.g., In re Jones*, 42 Cal. App. 5th 477 (2019) (holding that adult criminal offenders serving sentences of LWOP were not similarly situated to juvenile offenders serving LWOP sentences), *aff'd*, No. A161270, 2021 WL 3260322 (Cal. Ct. App. July 30, 2021); *supra* note 24.

<sup>29</sup> *See, e.g., In re Jones*, 42 Cal. App. 5th at 481 ("The United States Supreme Court has repeatedly found that 'children are constitutionally different from adults for purposes of sentencing.'" (citing *Miller v. Alabama*, 567 U.S. 460 (2012)); *id.* at 481–83 (rejecting *Jones*'s statutory interpretation that would allow recall or resentencing for "young adults who are between 18 and 25 when they commit their LWOP offenses" because they are "similarly situated to juvenile LWOP offenders because they also have developing brains, lack maturity, and have increased potential for rehabilitation" and finding that *Jones* "cites no authority for the purpose he ascribes to [the statute], and . . . his formulation fails fully to capture it").

<sup>30</sup> *See Jones v. Mississippi*, 141 S. Ct. 1307 (2021).

general trends and notable exceptions in courts' responses to this evidence. Part III discusses the implications of these results for the future use of neuroscience evidence in law and policy concerning the sentencing of emerging adults.

## I.

### LINE DRAWING AT AGE 18: CONSENSUS AND CONFLICT

Current neuroscientific consensus is that age 18 is not a magic number in the development of legally-relevant brain circuitry.<sup>31</sup> Cross-national behavioral evidence suggests sensation-seeking behavior peaks around age 19, with self-regulation developing through the mid-20s.<sup>32</sup> However, the concept of brain maturity remains “fuzzy,” and “there is little agreement among scientists on what properties of a brain should be evaluated when judging whether a brain is mature.”<sup>33</sup>

In *Roper v. Simmons*, Justice Kennedy recognized this fundamental tension: “[t]he qualities that distinguish juveniles from adults do not disappear when an individual turns 18.”<sup>34</sup> Just as “any parent knows” that 16-year-olds are not as mature as adults, parents also know that their child’s 18th birthday does not mark the end of development.<sup>35</sup> This understanding is

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<sup>31</sup> See generally CTR. FOR L., BRAIN & BEHAVIOR, WHITE PAPER ON THE SCIENCE OF LATE ADOLESCENCE: A GUIDE FOR JUDGES, ATTORNEYS, AND POLICY MAKERS (2022), <https://clbb.mgh.harvard.edu/white-paper-on-the-science-of-late-adolescence> [<https://perma.cc/7MEZ-WVLS>] [hereinafter CLBB (2022)]; see also Leah H. Somerville, *Searching for Signatures of Brain Maturity: What Are We Searching For?*, 92 NEURON 1164 (2016) (discussing evidence of continued neurobiological maturation throughout adolescence); see, e.g., *id.* at 1165 (“These findings provide convergent evidence for continued neurodevelopment during the 18- to 21-year-old window.”); Alexandra O. Cohen, Kaitlyn Breiner, Laurence Steinberg, Richard J. Bonnie, Elizabeth S. Scott, Kim A. Taylor-Thompson, Marc D. Rudolph, Jason Chein, Jennifer A. Richeson, Aaron S. Heller, Melanie R. Silverman, Danielle V. Dellarco, Damien A. Fair, Adriana Galván & BJ Casey, *When Is an Adolescent an Adult? Assessing Cognitive Control in Emotional and Nonemotional Contexts*, 27 PSYCH. SCI. 549, 559 (2016) (“[T]hese findings suggest that young adulthood is a time when cognitive control is still vulnerable to negative emotional influences, in part as a result of continued development of lateral and medial prefrontal circuitry.”).

<sup>32</sup> Laurence Steinberg, Grace Icenogle, Elizabeth P. Shulman, Kaitlyn Breiner, Jason Chein, Dario Baccini, Lei Chang, Nandita Chaudhary, Laura Di Giunta, Kenneth A. Dodge, Kostas A. Fanti, Jennifer E. Lansford, Patrick S. Malone, Paul Oburu, Concetta Pastorelli, Ann T. Skinner, Emma Sorbring, Sombat Tapanya, Liliana Maria Uribe Tirado, Liane Peña Alampay, Suha M. Al-Hassan & Hanan M.S. Takash, *Around the World, Adolescence Is a Time of Heightened Sensation Seeking and Immature Self-Regulation*, 21 DEV. SCI. 1, 1–2 (2017) (“Consistent with the dual systems model, sensation seeking increased between preadolescence and late adolescence, peaked at age 19, and declined thereafter, whereas self-regulation increased steadily from preadolescence into young adulthood, reaching a plateau between ages 23 and 26.”).

<sup>33</sup> Somerville, *supra* note 31, at 1164.

<sup>34</sup> 543 U.S. 551, 574 (2005).

<sup>35</sup> Parents in the United States may be especially aware of this currently, as 52% of young adults are still living with their parents (the highest rate since the Great Depression) due to the economic impact of COVID-19. Richard Fry, Jeffrey S. Passel & D’Vera Cohn, *A Majority of*

not limited to parents. Car rental companies and insurers, for instance, charge significantly higher rental prices for rental drivers under age 25.<sup>36</sup> As one scholar observed, “[p]arents, neuroscientists, and car rental companies appear to be on the same track here; it is the criminal justice system that is out of sync.”<sup>37</sup>

While there is a general agreement that drawing a bright line at age 18 needs to be reexamined, it is less clear what a viable path forward looks like in the context of criminal sentencing. The primary, and not necessarily mutually exclusive, recommendations are: (1) to extend constitutional protections already afforded to juveniles (application of LWOP) to encompass young adults at least to age 21 and perhaps to age 25; (2) to raise the age limit for juvenile courts; (3) to create specialized young adult courts and diversion programs; and (4) to treat young adults differently within existing systems.<sup>38</sup>

In this Essay, we focus on the first possibility: extending constitutional protections for LWOP and the death penalty to those older than age 18.

## II.

### ANALYZING NEUROSCIENCE-INFORMED *MILLER* CHALLENGES

The Supreme Court decided *Miller* on June 25, 2012.<sup>39</sup> As of this

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*Young Adults in the U.S. Live with Their Parents for the First Time Since the Great Depression*, PEW RSCH. CTR. (Sept. 4, 2020), <https://www.pewresearch.org/fact-tank/2020/09/04/a-majority-of-young-adults-in-the-u-s-live-with-their-parents-for-the-first-time-since-the-great-depression> [<https://perma.cc/852B-KZ6E>].

<sup>36</sup> David P. Farrington, Rolf Loeber & James C. Howell, *Young Adult Offenders: The Need for More Effective Legislative Options and Justice Processing*, 11 CRIMINOLOGY & PUB. POL’Y 729, 733 (2012) (“[P]remiums for car insurance for young drivers (especially males) up to approximately age 25 are dramatically higher than for older drivers. . . . [C]ar rental companies . . . either do not rent cars to people younger than age 25 or levy a surcharge for drivers younger than that age.”).

<sup>37</sup> David Pimentel, *The Widening Maturity Gap: Trying and Punishing Juveniles As Adults in an Era of Extended Adolescence*, 46 TEX. TECH L. REV. 71, 100 (2013).

<sup>38</sup> Kevin Lapp, *Young Adults & Criminal Jurisdiction*, 56 AM. CRIM. L. REV. 357, 359–60 (2019) (analyzing “three potential responses: (1) accommodating the distinguishing characteristics and developmental needs of young adult offenders within general jurisdiction criminal courts, (2) extending juvenile court jurisdiction beyond age eighteen, and (3) creating distinct Young Adult Courts”); see also Elizabeth S. Scott, Richard J. Bonnie & Laurence Steinberg, *Young Adulthood as a Transitional Legal Category: Science, Social Change, and Justice Policy*, 85 FORDHAM L. REV. 641, 644 (2016) (“Young adults should be treated as a distinct, transitional category subject to reduced sanctions for less serious crimes, special expedited parole policies, and correctional programs and settings designed to serve their development needs.”); Vincent Schiraldi, *Can We Eliminate the Youth Prison? (And What Should We Replace It With?)*, SQUARE ONE PROJECT (June 2020), <https://squareonejustice.org/paper/can-we-eliminate-the-youth-prison-and-what-should-we-replace-it-with-by-vincent-schiraldi-june-2020> [<https://perma.cc/L59A-TA2Y>] (arguing for the elimination of youth incarceration).

<sup>39</sup> *Miller v. Alabama*, 567 U.S. 460, 460 (2012).

writing, over 5,000 court decisions have cited *Miller*.<sup>40</sup> This Essay examines a subset of these cases in which litigants use neuroscientific evidence to argue that *Miller*'s holding should be extended to those age 18 and older.<sup>41</sup> From an initial finding of 5,384 cases, we established a database of 494 cases that substantively discuss neuroscience and involve defendants aged 18 or older at the time of their offense.<sup>42</sup> Using a sixteen-case convenience sub-sample from this database, we then more deeply investigated how the most recent litigants are employing neuroscience.<sup>43</sup>

Our analysis indicates that federal courts have refused to extend *Miller* to defendants age 18 and above. Despite litigants' regular use of neuroscientific arguments, none of the 494 petitions identified in our database were ultimately successful.<sup>44</sup> In this Part, we analyze (A) trends over time and across geography, (B) differences in the age of the defendant at the time of the offense, (C) the specific neuroscientific evidence proffered by litigants, and (D) our core concern: how courts respond to these arguments that include an introduction of neuroscientific evidence.

### *A. Distribution of Cases Across Time and Geography*

#### 1. Time Distribution

Between 2013 and 2016, courts considered in each year an average of thirty cases attempting to extend *Miller* to defendants age 18 and older.<sup>45</sup> In January 2016, the Supreme Court ruled that *Miller* applied retroactively, which opened the doors for additional litigants.<sup>46</sup> The number of annual cases in our database tripled after 2016, and although our database ends in 2020, it appears that cases continued to be plentiful in 2021.<sup>47</sup>

The appellate process may delay this timeline. In many states, lower-level court cases are not published on Westlaw, the source of our data. Lower court cases in these states would not appear in our database unless and until they were appealed. For example, a petition filed in a Pennsylvania county

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<sup>40</sup> Cases Citing *Miller v. Alabama*, WESTLAW EDGE, <https://westlaw.com> [hereinafter Cases Citing *Miller v. Alabama*] (last visited Nov. 9, 2021) (search in search bar for "567 U.S. 460"; then follow "*Miller v. Alabama*" hyperlink; then follow "Cases" under "Citing References").

<sup>41</sup> We focused exclusively on cases citing brain science; our data do not indicate how many of these challenges were made without such reference to brain science.

<sup>42</sup> For a detailed description of methodology, see Appendix.

<sup>43</sup> To develop this sub-sample, we selected cases from the past three years that included both a reference to "neuro!" and a reference to "adolesc!" and had filing documents available for download through the Westlaw system. Because most cases in Westlaw do not contain accompanying filing documents, we also supplemented this sample of cases with additional briefs obtained through requests to attorneys. This produced a sub-sample of sixteen cases.

<sup>44</sup> See *supra* note 24.

<sup>45</sup> See *infra* Figure 1.

<sup>46</sup> See *Montgomery v. Louisiana*, 136 S. Ct. 718, 732 (2016) ("*Miller* announced a substantive rule that is retroactive in cases on collateral review.>").

<sup>47</sup> Cases Citing *Miller v. Alabama*, *supra* note 40.



court in March 2016 did not appear in our database until a verdict was reached on appeal in October 2017. More broadly, increases in the number of petitions may not be reflected in our data until several months or even years later.

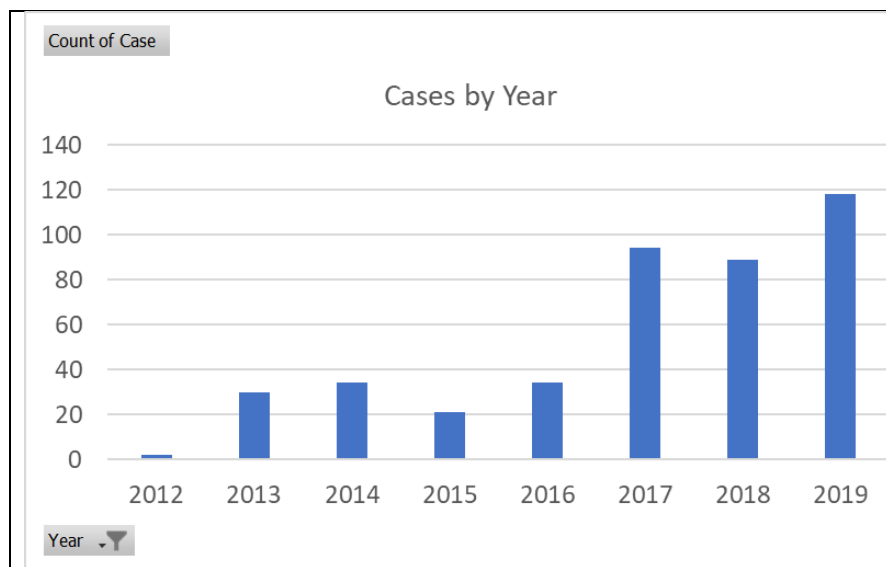


Figure 1: Cases considering extending *Miller* to ages 18 and above, by year of decision

## 2. Geographical Distribution

Nearly half (47%) of the cases considered are from Pennsylvania. The principal reason for this trend is that, as noted in oral argument in *Miller*, Pennsylvania historically had been one of the states with the largest numbers “of juveniles serving life without parole by a huge margin.”<sup>48</sup> The higher number of cases from Pennsylvania may also be a result of the state’s sentencing procedures. Pennsylvania requires defendants to file a Post-Conviction Relief Act (PCRA) petition.<sup>49</sup> Allowing defendants to act on their own initiative provides a standard procedure for defendants aged 18 and older to argue that *Miller* should apply in their circumstance, likely increasing the number of petitions filed.

The substantial number of cases from Pennsylvania may also be related to a growing movement towards youth criminal justice reform within the state.<sup>50</sup> After *Montgomery*, the Philadelphia District Attorney’s Office

<sup>48</sup> Transcript of Oral Argument at 57, *Miller v. Alabama*, 567 U.S. 460 (2012) (No. 10-9646).

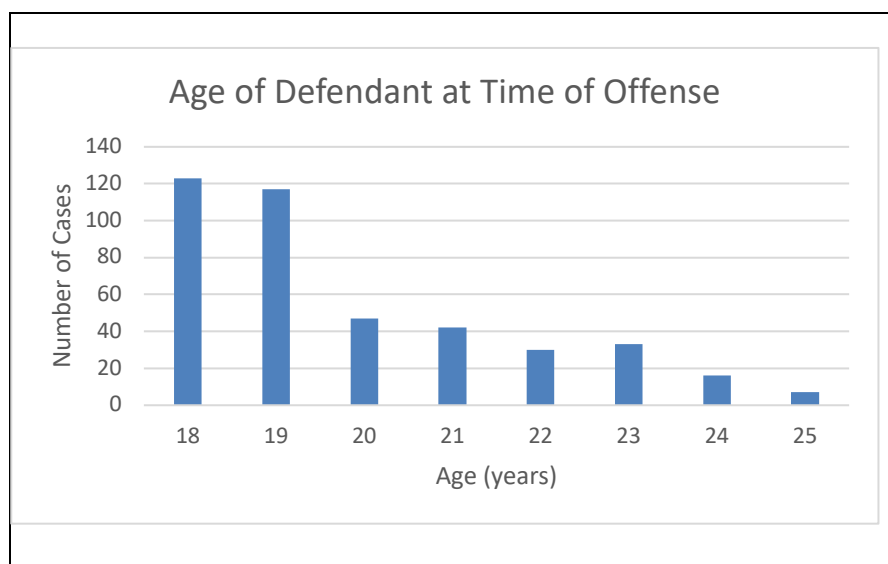
<sup>49</sup> 42 PA. CONS. STAT. § 9545(b)(iii) (2018).

<sup>50</sup> Email from Marsha Levick, Chief Legal Officer, Juv. L. Ctr., to Francis X. Shen (Feb. 16, 2021, 2:15 PM EST) (on file with authors) [hereinafter Levick Email] (citing the state’s large and well-organized population of juvenile LWOPs and its reform-minded public defender community).

established a specialized “Lifer Committee,” to make concerted resentencing efforts in the state.<sup>51</sup> As of December 2019, Pennsylvania had resentenced more juvenile LWOPs than any other state.<sup>52</sup> A growing coalition of engaged legal actors—including the Juvenile Law Center, Pennsylvania Innocence Project, federal defenders’ offices in Philadelphia and Pittsburgh, advocates in the Philadelphia defender’s office, an array of anti-death penalty advocates, and the recently founded abolitionist Amistad Law Project—have further produced, as described by attorney Marsha Levick, an “energy point[ing] to a robust interest in reducing incarceration and extreme sentencing” in Pennsylvania.<sup>53</sup> The Pennsylvania outlier cases are an important reminder that although we discuss national trends in this Essay, state-specific developments will vary.

### B. Age of Defendant at Time of Offense

The majority of cases in our database involve defendants who were ages 18 or 19 at the time of their offenses. The number of cases drops off approaching age 25, with some outliers (Figure 2).<sup>54</sup>



<sup>51</sup> Tarika Daftary-Kapur & Tina M. Zottoli, *Resentencing of Juvenile Lifers: The Philadelphia Experience*, DEP’T JUST. STUD. FAC. SCHOLARSHIP & CREATIVE WORKS 1 (2020), <https://digitalcommons.montclair.edu/cgi/viewcontent.cgi?article=1084&context=justice-studies-facpubs> [<https://perma.cc/6P6B-CZ6F>].

<sup>52</sup> *Id.* at 2.

<sup>53</sup> Levick Email, *supra* note 50.

<sup>54</sup> Not included in Figure 2 are a small number of cases in which the defendant was over the age of 25 at the time of the offense (20 cases) with ages ranging from 26 to 73. Also not included in Figure 2 are remaining cases for defendants with offenses committed at multiple ages (2) and cases in which age data was not available (4).

**Figure 2: Cases considering extending *Miller* to ages 18 and above, by age of defendant at time of the offense**

### *C. How Litigants Use Neuroscience*

In general, petitioners used neuroscientific evidence to bolster the assertion that *Miller* should be extended to cover petitioners aged 18 to mid-20s because the brain continues to develop in critical ways through the mid-20s.<sup>55</sup> However, the specific neuroscience evidence cited in these cases varied widely. In the sixteen-case subset for which we examined case briefs, we identified 108 unique scientific citations. These citations all generally concerned the developing brain, but some were publications in law, others in science, and still others were commentaries. Only 6 of these 108 publications were cited in 4 or more cases.<sup>56</sup> The most commonly cited source of neuroscientific evidence was a *Fordham Law Review* article<sup>57</sup> that analyzes neuroscientific and psychological research on young adults and concludes that the period between adolescence and adulthood “can be understood as a transitional stage” different from both adolescence and adulthood.<sup>58</sup> Petitioners cited evidence from the article suggesting that the brain continues developing from age 18 through the mid-20s and that the brains of individuals in this age group typically share important similarities with the adolescent brain.

For example, one petitioner submitted an amicus brief that cited the *Fordham Law Review* article to argue that “eighteen year olds [sic] ‘are not fully mature adults’ but rather are more like adolescents under the age of eighteen in three essential ways”: their propensity for risk-taking, their susceptibility to peer pressure, and their prospects for rehabilitation.<sup>59</sup> Other petitioners cited a variety of sources, from scientific journal articles to news articles, to form roughly the same general argument: The young adult brain

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<sup>55</sup> See, e.g., *Zebroski v. State*, 179 A.3d 855, 860 (Del. 2018) (“[The defendant] acknowledges that . . . *Miller v. Alabama* . . . was limited to ‘those under the age of 18 . . .,’ but he contends that ‘major advances in neuroscience have demonstrated that the brain of a teenager, even at the age of 18, is profoundly different from that of a mature adult.’”). A few petitioners also raised slightly different arguments based on neuroscience. For example, a petitioner who was 46 years old at the time of his offense claimed his mental disability placed him in a similar developmental stage to that of a juvenile. *People v. Coty*, No. 123972, 2020 IL 123972, at \*10 (Ill. June 4, 2020). Another petitioner argued that *Miller*’s reasoning prohibits mandatory LWOP for all individuals who possess the “mitigating attributes of youth” or who “suffer[] from severe hardship and abuse.” *Commonwealth v. Pfender*, No. 839 WDA 2016, 2017 WL 1736683, at \*4 (Pa. Super. Ct. May 3, 2017). An additional petitioner similarly argued *Miller* should apply to him because of his history of chronic traumatic abuse throughout childhood and adolescence, which he asserted delayed his brain’s physical development. *Commonwealth v. Cruz*, No. 1224 MDA 2016, 2017 WL 825477, at \*1 (Pa. Super. Ct. Mar. 2, 2017). The courts rejected all of these arguments.

<sup>56</sup> For a complete list of citations and their frequency, see Appendix.

<sup>57</sup> See Scott et al., *supra* note 38.

<sup>58</sup> *Id.* at 644.

<sup>59</sup> Brief for Gary Johnson & Tyshawn Sanders as Amici Curiae at 21–27, *Commonwealth v. Watt*, 146 N.E.3d 414 (Mass. 2020) (No. SJC-11693).

shares similarities with the adolescent brain that require the extension of *Miller* protections to those above 18 years old.<sup>60</sup>

Follow-up interviews with attorneys and legal clinical supervisors who have regularly utilized neuroscientific evidence in this type of litigation suggest that there is currently no centralized resource through which to access a consolidated list of relevant and up-to-date scientific citations.<sup>61</sup> Moreover, the sources referenced vary in terms of comprehensiveness, timeliness, and scientific rigor.

#### D. Court Responses to Neuroscientific Evidence

We relied on the full database of 494 cases to analyze court responses to claims that *Miller* should be expanded to include young adults.<sup>62</sup> In all of these cases, the courts rejected the petitioners' arguments that *Miller* should be extended on the merits. Most courts simply stated that *Miller* only applied to LWOP for those below 18 years old, so the case did not govern the sentencing of anyone 18 or older.<sup>63</sup>

A few courts offered additional justification for their refusal to extend *Miller*. For example, in *Zebroski v. State*,<sup>64</sup> the court refused to extend *Miller* despite the petitioner's neuroscientific evidence for two reasons. First, the Supreme Court in *Roper* decided to draw a line at 18 despite acknowledging that the brain does not finish developing at exactly 18 years of age.<sup>65</sup> Second, the Supreme Court did not base its decisions in *Roper*, *Graham*, and *Miller* purely on "the most advanced" neuroscience available: "The choice of age 18 was not . . . an attempt to identify . . . the developmental boundary between childhood and adulthood. It was based on societal markers of adulthood—the age at which the states allow individuals to 'vot[e], serv[e] on juries, [and] marry[] without parental consent.'"<sup>66</sup> Because the Supreme Court's line drawing at age 18 had been grounded at least partially on societal norms, courts found new arguments premised exclusively on

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<sup>60</sup> See, e.g., *Commonwealth v. Brown*, No. 1491 EDA 2016, 2017 WL 2379871, at \*2 (Pa. Super. Ct. June 1, 2017) (stating that the petitioner cited a medical journal article that stated that "[t]he frontal lobes [of the brain], home to key components of the neural circuitry underlying executive functions such as planning, working memory, and impulse control, . . . are the last areas of the brain to mature; they may not be fully developed until halfway through the third decade of life").

<sup>61</sup> Eight anonymous background interviews were conducted by co-author Shen between September 2020 and May 2021. Interviewees were selected via convenience sampling methods.

<sup>62</sup> For a complete description of methodology, see Appendix.

<sup>63</sup> See, e.g., *In re Jones*, 255 Cal. Rptr. 3d 571 (Ct. App. 2019); see *infra* Appendix.

<sup>64</sup> 179 A.3d 855 (Del. 2018) (holding that *Miller* did not extend to 18-year-olds); see also *People v. Banner*, 2020 IL App (1st) 172016-U ¶¶ 52–53 (denying the protections of *Miller* to a 20-year-old offender).

<sup>65</sup> *Zebroski*, 179 A.3d at 861 ("[T]he Court was aware when it decided *Roper* that children do not transform into psychologically-and neurologically-mature adults on their eighteenth birthdays . . . , 'however, a line must be drawn.'" (quoting *Roper v. Simmons*, 543 U.S. 551, 574 (2005))).

<sup>66</sup> *Id.* at 862 (citation omitted).

neuroscience largely unpersuasive.

Courts sometimes ruled against petitioners for reasons not directly related to the strength of their arguments to extend *Miller*, such as lack of timeliness.<sup>67</sup> Other judges made institutional competence arguments, concluding that while courts were bound by precedent, legislatures should consider whether to reform the law based on neuroscientific evidence about the young adult brain.<sup>68</sup>

A few courts left open the possibility that *Miller* might apply beyond the defendant's 18th birthday, but still refused to grant such relief. One court agreed with a petitioner that "the legal definition of 'youth' is expanding," and therefore it would seem a "short step" to extend *Miller*'s protections to 18-year-olds.<sup>69</sup> It nevertheless declined to take the "greater leap" of applying *Miller*'s protections to a defendant who was 23 years old at the time of his offense and whom the court did not believe actually exhibited the youthful qualities identified in *Miller*.<sup>70</sup>

The most notable exception to the general trend occurred in *Cruz v. United States*,<sup>71</sup> a Connecticut district court case concerning the application of *Miller* to 18-year-olds.<sup>72</sup> The court noted the consistency of the Supreme Court's restriction of *Miller* to those under 18, but asserted that no precedent barred it from extending *Miller* to those 18 and older.<sup>73</sup> The court then accepted the petitioner's argument that both national and neuroscientific consensus supported *Miller*'s extension to defendants 18 years old at the time of their crimes.<sup>74</sup>

As for evidence of national consensus, the district court weighed legislative enactments regarding the sentencing of young adults,<sup>75</sup> actual sentencing practices,<sup>76</sup> and general trends of where society draws the line between child and adult.<sup>77</sup> With respect to scientific consensus, the district court based its decision heavily on the expert testimony of Dr. Laurence Steinberg, though it also considered various scientific articles submitted by

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<sup>67</sup> See, e.g., *Commonwealth v. Frazier*, No. 3489 EDA 2016, 2017 WL 4512279, at \*3 (Pa. Super. Ct. Oct. 10, 2017) (holding primarily that there was lack of timeliness, but noting also that the petitioner's *Miller* argument lacked merit).

<sup>68</sup> See, e.g., *People v. Sanchez*, 98 N.Y.S.3d 719, 725 (N.Y. Sup. Ct. 2019) ("In this Court's view, the Legislature should consider allowing a discretionary motion for resentencing in cases where an offender sentenced to LWOP was under an age higher than 18 (for example, under age 21), to a life sentence with the possibility of parole.")

<sup>69</sup> *People v. Suggs*, 2020 IL App (2d) 170632, ¶¶ 33, 35, *appeal denied*, 154 N.E.3d 801 (Ill. 2020).

<sup>70</sup> *Id.* ¶¶ 35–36.

<sup>71</sup> No. 11-CV-787, 2018 WL 1541898 (D. Conn. Mar. 29, 2018).

<sup>72</sup> *Id.*

<sup>73</sup> *Id.* at \*15.

<sup>74</sup> *Id.* at \*25.

<sup>75</sup> *Id.* at \*18–19.

<sup>76</sup> *Id.* at \*20–21.

<sup>77</sup> *Id.* at \*21–22.

the petitioner and his expert witness.<sup>78</sup> Ultimately, “relying on both the scientific evidence and the societal evidence of national consensus,” the district court concluded “that the hallmark characteristics of juveniles that make them less culpable also apply to 18-year-olds. . . . The court therefore holds that *Miller* applies to 18-year-olds . . . .”<sup>79</sup> In a telling, and not unexpected, development, *Cruz* was subsequently overturned on appeal.<sup>80</sup>

The Illinois state constitution’s proportionate penalties clause also provided an alternative path for petitioners to succeed in raising a *Miller* challenge. In the companion cases of *People v. Johnson*<sup>81</sup> and *People v. Ruiz*,<sup>82</sup> which concerned group crimes committed by defendants of varying ages, an Illinois state court allowed the defendants (aged 18 and 19 at the times of the crimes) to file successive post-conviction petitions on these grounds (petitions which would otherwise be barred):

[Petitioners] have made *prima facie* showings in their pleadings that evolving understandings of the brain psychology of adolescents require *Miller* to apply to them. Their petitions and their counsel on appeal urge that we account for the emerging consensus that the development of the young brain continues well beyond 18 years, the arbitrarily demarcated admittance to adulthood for those arrested and entering our criminal law system.<sup>83</sup>

Aside from these state court cases that dealt with procedural issues and the ultimately overturned temporary win in Connecticut federal district court, none of the petitions we evaluated were successful in convincing courts to extend *Miller* protections to young adults 18 and above.

### III.

#### DISCUSSION: THE PATH FORWARD

Despite litigants’ regular use of neuroscientific evidence about the emerging adult brain, federal courts are not yet persuaded that *Miller* should be extended to defendants age 18 to early 20s. We do not conclude, however, that ongoing litigation efforts are in vain.

First, we are focused in this Essay exclusively on the use of neuroscientific evidence to support Eighth Amendment (and state constitutional) arguments concerning emerging adults ages 18 through early 20s *as a class*. But neuroscience also has a role to play in the arguments that *individual* young adults make in challenging their lengthy sentences. Translating group-averaged scientific data to individualized adjudication is

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<sup>78</sup> *Id.* at \*22–25.

<sup>79</sup> *Id.* at \*25.

<sup>80</sup> *Cruz v. United States*, 826 F. App’x 49, 52 (2d Cir. 2020).

<sup>81</sup> 170 N.E.3d 1027 (Ill. App. Ct. 1st Dist. 2020).

<sup>82</sup> 165 N.E.3d 36 (Ill. App. Ct. 1st Dist. 2020).

<sup>83</sup> *Johnson*, 170 N.E.3d at 1030.

a well-known challenge in the law.<sup>84</sup> In the context of juvenile sentencing since *Miller*, forensic experts Thomas Grisso and Antoinette Kavanaugh have proposed an individualized approach,<sup>85</sup> but courts have offered little “guidance regarding application of the *Miller* factors or other developmental evidence to examine mitigation in individual cases.”<sup>86</sup> Emerging adult cases suggest that further work is needed to develop evidentiary records that are sufficiently individualized.

For instance, in October 2021, the Illinois Supreme Court considered the case of Antonio House, who was sentenced to life as a 19-year-old for his involvement as a lookout in a 1993 double homicide.<sup>87</sup> House argued that he was entitled to a resentencing hearing because his mandatory life sentence violated the proportionate penalties clause of the Illinois Constitution as applied to him.<sup>88</sup> In remanding the case back to the circuit court to further develop the record, the Illinois Supreme Court found that House failed to:

[P]rovide or cite any evidence relating to how the evolving science on juvenile maturity and brain development applies to *his specific facts and circumstances*. As a result, no evidentiary hearing was held, and the trial court made no factual findings critical to determining whether the science concerning juvenile maturity and brain development applies equally to young adults, or to *petitioner specifically*, as he argued in the appellate court.<sup>89</sup>

Similar as-applied challenges will require individualized evidence and this will in turn require collaboration between the forensic and scientific research communities. At the Center for Law, Brain & Behavior (CLBB), we foster such collaboration through programs such as the Federal Judicial Center-CLBB Workshop on Science-Informed Decision Making.<sup>90</sup>

Second, and returning to class-based bright line challenges, it should be recognized that high impact litigation often requires many years of challenges to succeed and that even unsuccessful lawsuits can shift perception over time.<sup>91</sup> Instead, our data indicate the need for more accessible

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<sup>84</sup> See generally David L. Faigman, John Monahan & Christopher Slobogin, *Group to Individual (G2i) Inference in Scientific Expert Testimony*, 81 U. CHI. L. REV. 417 (2014).

<sup>85</sup> See generally THOMAS GRISSO & ANTOINETTE KAVANAUGH, EVALUATIONS FOR SENTENCING OF JUVENILES IN CRIMINAL COURT (2020).

<sup>86</sup> Thomas Grisso & Antoinette Kavanaugh, *Prospects for Developmental Evidence in Juvenile Sentencing Based on Miller v. Alabama*, 22 PSYCH., PUB. POL’Y AND L. 235, 236 (2016).

<sup>87</sup> *People v. House*, 2021 IL 125124 (Ill. 2021).

<sup>88</sup> *Id.* at \*2.

<sup>89</sup> *Id.* at \*5 (emphasis added).

<sup>90</sup> Nancy Gertner, Judith Edersheim, Robert Kinscherff & Cassandra Snyder, *Supporting Responsive Federal Drug Sentencing Through Education in the Workshop on Science-Informed Decision Making*, 34 FED. SENT’G REP. 12, 12 (2021) (“The Workshop on Science-Informed Decision Making . . . has provided education in neuroscience and the behavioral sciences, along with skills training in using insights from those sciences to individualize court responses . . .”).

<sup>91</sup> For example, *Brown v. Board of Education*, 347 U.S. 483 (1954), which famously held

neuroscientific evidence and an increased emphasis on state court litigation and complementary policy and legislative reform.

As impact litigation efforts continue, it is clear that there is a need for a more focused, thorough, and sophisticated application of neuroscientific evidence. As suggested by our review of briefs in select cases, litigators do not have access to a “go-to” set of scientific resources. Scientific discussion in the cases analyzed often failed to tackle nuances such as the challenge of drawing individual inferences about a particular petitioner from group-averaged neuroscientific data.<sup>92</sup> In addition, much of the scientific literature cited in these briefs was published *before* 2012, which dampens the case that “new” science (unavailable to the *Miller* court) justifies raising the age. A comprehensive review of the relevant scientific literature, summarized in an accessible manner for lawyers and judges, would be highly useful for the field. One step in this direction is a recent CLBB Guide,<sup>93</sup> but more applied tools—such as model briefs—are also needed.

Of course, even with stronger scientific evidence and more precise arguments, future federal litigation faces steep odds. This is particularly true after *Jones*, which signaled the Supreme Court’s current reluctance to reduce punishment for juveniles despite leaving much of the existing precedent nominally intact. Given our review of emerging adult *Miller* cases to date and the current federal court climate, arguments predicated at least partially on state constitutional grounds may provide litigants with a more productive way forward. Groundbreaking recent cases in Washington, Illinois, and Massachusetts state courts together open up a potential path to navigate the future landscape of emerging adult justice. These cases may be highly influential in turning the tide of public perception.

In 2021 the Washington Supreme Court extended *Miller* to ban automatic life without parole sentences for 18- to 20-year-olds under the state constitution’s bar of “cruel punishment.”<sup>94</sup> In a 5-4 decision, the court granted two petitioners, aged 19 and 20 at the time of their offenses, a new sentencing hearing, concluding:

Modern social science, our precedent, and a long history of arbitrary line drawing have all shown that no clear line exists between childhood and adulthood . . . . [W]hen it comes to mandatory LWOP sentences, *Miller*’s constitutional guarantee of an individualized

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racial segregation in public schools unconstitutional, came on the heels of years of unsuccessful challenges to Jim-Crow-Era legislation. And in environmental law, unsuccessful lawsuits have played a key strategic role in “articulating climate change as a legal and financial risk” and helping to “guide . . . responsive adjudication in the longer term.” Geetanjali Ganguly, Joana Setzer & Veerle Heyvaert, *If at First You Don’t Succeed: Suing Corporations for Climate Change*, 38 OXFORD J.L. STUDS. 841, 841 (2018).

<sup>92</sup> See generally Faigman, *supra* note 84.

<sup>93</sup> See generally CLBB (2022), *supra* note 31.

<sup>94</sup> *In re Monschke & Bartholomew*, 482 P.3d 276, 279 (Wash. 2021).



sentence—one that considers the mitigating qualities of youth—must apply to defendants at least as old as these defendants were at the time of their crimes. . . .

. . . .

. . . Just as courts must exercise discretion before sentencing a 17-year-old to die in prison, so must they exercise the same discretion when sentencing an 18-, 19-, or 20-year-old.<sup>95</sup>

Arguments such as these founded on state constitutions may be particularly effective in situations involving relative culpability for group offenses. Proportionality in sentencing may mean something different when two similarly situated defendants receive drastically different sentences for the same crime exclusively on the basis of their age. States such as Illinois, as discussed above, have already extended *Miller* in cases involving multiple defendants of different ages at the time of a group crime.<sup>96</sup>

Similarly, in 2020, the Massachusetts Supreme Judicial Court acknowledged that neuroscientific advancements necessitated reevaluation of the policy of sentencing young adults to LWOP,<sup>97</sup> and remanded the case to the lower court for examination of neuroscientific evidence specific to the defendant.<sup>98</sup> As of this writing, Massachusetts is again considering whether to ban LWOP sentences for defendants aged 18 at the time of their offense.<sup>99</sup> In the case at hand, two youths were convicted of homicide. One of them was ten days younger than 18 at the time of the offense and will become eligible for parole after serving a fifteen-year sentence. The other was only eight months older, but received life without the possibility of parole.<sup>100</sup> Their case may have profound ramifications—both for the upwards of two hundred people serving LWOP sentences for crimes committed as young adults in Massachusetts and for litigants and courts across the country following these developments.

In addition to litigation in state courts, state legislatures and local courts are considering (and in some cases implementing) reforms aimed at young adults. For example, commentators in some states have suggested that young

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<sup>95</sup> *Id.* at 277, 288.

<sup>96</sup> *See, e.g.*, *People v. Ruiz*, 165 N.E.3d 36, 41 (Ill. App. Ct. 1st Dist. 2020) (holding that Ruiz, who had acted in concert with Mejia, made a prima facie showing in his pleadings that *Miller* should apply to him); *People v. Johnson*, 170 N.E.3d 1027, 1030 (Ill. App. Ct. 1st Dist. 2020) (holding that Johnson, who also committed crimes of murder and kidnapping alongside an accomplice, had also made a prima facie showing in his pleadings that *Miller* should apply to him).

<sup>97</sup> *Commonwealth v. Watt*, 146 N.E.3d 414, 428 (Mass. 2020).

<sup>98</sup> *Id.*

<sup>99</sup> *Order to Remand*, *Commonwealth v. Watt*, No. SJC-11693 (Mass. Dec. 24, 2021) (remanding consolidated cases to the trial court to “consider and address whether the imposition of a mandatory sentence of life without the possibility of parole for Mattis and those convicted of murder in the first degree who were eighteen to twenty-one at the time of the crime, violates article 26 of the Massachusetts Declaration of Rights”).

<sup>100</sup> *Id.* at 420.

adults should be spared permanent criminal records to “facilitate their access to education, employment, and housing” after release.<sup>101</sup> Legislative reforms are also underway, such as expanded parole eligibility for those incarcerated for crimes they committed as young adults. California, for instance, grants special parole hearings for those who are serving long prison sentences for qualifying crimes they committed before the age of 26. At these hearings, the parole board must consider “the diminished culpability of youth” and provide a meaningful opportunity for the individual to obtain release.<sup>102</sup> The hearings are set at a fixed date during the individual’s incarceration, based on both the length of the underlying sentence and the defendant’s age at the time of the offense, and thus may allow for earlier parole eligibility.

How state and local policies should optimally respond to the unique needs of emerging adults remains contested, even amongst experts.<sup>103</sup> At the core of the policy challenge is that emerging adults are neither young children nor fully formed adults.<sup>104</sup> It is beyond the scope of this Essay to lay out a policy prescription for justice-involved emerging adults, and there is a concern that leaving reform to the states could result in even worse treatment for emerging adults depending on a legislature’s priorities. In thinking about potential paths forward, we recommend to readers the policy analyses conducted by the Emerging Adult Justice Project at Columbia University.<sup>105</sup> In particular, the collaborative Emerging Adult Justice Learning Community provides a promising model for researchers, practitioners, and youth themselves to co-develop innovative solutions.<sup>106</sup>

Some states have modified the structure of their criminal court systems

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<sup>101</sup> BJ CASEY, RICHARD J. BONNIE, ANDRE DAVIS, DAVID L. FAIGMAN & MORRIS B. HOFFMAN, HOW SHOULD JUSTICE POLICY TREAT YOUNG OFFENDERS?: A KNOWLEDGE BRIEF OF THE MACARTHUR FOUNDATION RESEARCH NETWORK ON LAW AND NEUROSCIENCE 4 (2017).

<sup>102</sup> See CAL. PENAL CODE § 3051(f)(1) (West 2020).

<sup>103</sup> For example, law professor Kevin Lapp concludes young adults need to be given more independence and held more accountable than juveniles. Lapp, *supra* note 38, at 378. Legal scholars Elizabeth S. Scott and Richard J. Bonnie, along with psychologist Laurence Steinberg, similarly point out that emerging adults are similar to adults in some ways but similar to juveniles in others, such as “behavior, psychological functioning, and brain development.” Scott et al., *supra* note 38, at 645; *cf.* Miller v. Alabama, 567 U.S. 460, 470–71 (2012) (identifying the ways in which “children are constitutionally different from adults for purposes of sentencing” to support the conclusion that “mandatory life-without-parole sentences for juveniles violate the Eighth Amendment”).

<sup>104</sup> See, e.g., Clare Ryan, *The Law of Emerging Adults*, 97 WASH. U. L. REV. 1131, 1146 (2020) (“The notion that adolescents are different both from younger children and from adults has shaped the contours of legal regulation. Law gives special attention to teenagers with respect to . . . criminal law . . .”); see also Lapp, *supra* note 38, at 388 (distinguishing juveniles from those 18 years and older based on differing liberty interests and state interests in intervention).

<sup>105</sup> *Emerging Adult Justice*, COLUM. JUST. LAB, <https://justicelab.columbia.edu/EAJ> [<https://perma.cc/P6XZ-W778>].

<sup>106</sup> As an example of the Project’s policy recommendations from utilization of these methods, see SELEN SIRINGIL PERKER, LAEL E.H. CHESTER & VINCENT SCHIRALDI, COLUM. JUST. LAB, EMERGING ADULT JUSTICE IN ILLINOIS: TOWARDS AN AGE-APPROPRIATE APPROACH (2019), [https://justicelab.columbia.edu/sites/default/files/content/EAJ%20in%20Illinois%20Report%20Final\\_1.pdf](https://justicelab.columbia.edu/sites/default/files/content/EAJ%20in%20Illinois%20Report%20Final_1.pdf) [<https://perma.cc/QQ7C-9CX3>].

to better respond to emerging adults. In 2018, Vermont passed legislation that would extend juvenile courts' jurisdiction for qualifying crimes through age 19 by 2022.<sup>107</sup> Lawmakers in Connecticut, Massachusetts, New York, Illinois, and California pushed to do the same.<sup>108</sup> Such efforts have successfully raised juvenile jurisdiction through age 18 in New York, as well as in Michigan.<sup>109</sup> A Department of Justice research committee has recommended raising the minimum age of criminal court jurisdiction to age 21 or age 24.<sup>110</sup> Relatedly, some have proposed specialized young adult courts, which would focus on rehabilitation in light of evidence of young adults' ability to change,<sup>111</sup> and could in theory apply less harsh sentences than adult courts.<sup>112</sup>

Whether these are effective reforms remains to be seen. But what does seem clear is that reforms within the criminal legal system alone will not be sufficient. A recent review of the literature on emerging adults suggests the importance of community-based resources to help at-risk and justice-involved emerging adults achieve employment, education, housing stability, and healthy relationships.<sup>113</sup> The Juvenile Law Center similarly emphasizes the need for other systems of support beyond the criminal legal system.<sup>114</sup> The Justice Policy Institute also looks beyond the traditional criminal legal system, and finds that an "improved approach to young adults should be community-based, collaborative, and draw on the strengths of young adults,

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<sup>107</sup> VT. STAT. ANN. tit. 33, § 5201 (West 2020).

<sup>108</sup> Aidan Ryan, *Crime Bill Would Redefine Juveniles as up to Age 21*, BOS. GLOBE (July 9, 2019), <https://www.bostonglobe.com/metro/2019/07/09/crime-bill-would-redefine-juveniles-age/maHshbBT6QaaX9ooVDVidN/story.html> [<https://perma.cc/87B2-SSUC>]; Anita Chabria, *Offenders Under 21 Would Be Automatically Tried as Juveniles Under New California Bill*, L.A. TIMES (Jan. 28, 2020), <https://www.latimes.com/california/story/2020-01-28/california-considers-charging-all-teens-as-juveniles> [<https://perma.cc/5WNJ-U7C6>].

<sup>109</sup> NAT'L GOVERNORS ASS'N, AGE BOUNDARIES IN JUVENILE JUSTICE SYSTEMS 2 (2021), [https://www.nga.org/wp-content/uploads/2021/08/Raise-the-Age-Brief\\_5Aug2021.pdf](https://www.nga.org/wp-content/uploads/2021/08/Raise-the-Age-Brief_5Aug2021.pdf) [<https://perma.cc/4NPK-U7Y9>].

<sup>110</sup> Lapp, *supra* note 38, at 382 (citing U.S. DEP'T OF JUST., OFF. OF JUV. JUST. & DELINQ. PREVENTION, YOUNG OFFENDERS: WHAT HAPPENS AND WHAT SHOULD HAPPEN 2 (2014), <https://www.ncjrs.gov/pdffiles1/nij/242653.pdf> [<https://perma.cc/E2MW-LKM6>]).

<sup>111</sup> See M. Eve Hanan, *Incapacitating Errors: Sentencing and the Science of Change*, 97 DENV. L. REV. 151, 186–201 (2019) (arguing that character can change throughout adulthood, so all courts should focus on rehabilitation).

<sup>112</sup> CASEY ET AL., *supra* note 101, at 4.

<sup>113</sup> LEAH SAKALA, LEIGH COURTNEY, ANDREEA MATEI & SAMANTHA HARVELL, URB. INST., A GUIDE TO COMMUNITY STRATEGIES FOR IMPROVING EMERGING ADULTS' SAFETY AND WELL-BEING (2020), [https://www.urban.org/sites/default/files/Publication/101838/a20guide20to20community20strategies20for20improving20emerging20adults2720safety20an\\_0.pdf](https://www.urban.org/sites/default/files/Publication/101838/a20guide20to20community20strategies20for20improving20emerging20adults2720safety20an_0.pdf) [<https://perma.cc/N9QN-2JED>].

<sup>114</sup> KAREN U. LINDELL & KATRINA L. GOODJOINT, JUV. L. CTR., RETHINKING JUSTICE FOR EMERGING ADULTS, 18–25 (2020), <https://jlc.org/sites/default/files/attachments/2020-09/JLC-Emerging-Adults-9-2.pdf> [<https://perma.cc/6CTT-USDK>].

their families, and their communities.”<sup>115</sup>

For example, San Francisco’s Young Adult Court (YAC) provides employment, housing, and educational support to emerging adults charged with crimes, and it was established after then-district attorney George Gascón attended a lecture on brain development.<sup>116</sup> The YAC emphasizes the still-developing brains of the young adults accused of violating the law, and provides court staff with training on recent neuroscience.<sup>117</sup> Upon successful completion of the program, which usually lasts ten to eighteen months, many young adults’ felonies are dismissed or reduced to misdemeanors.<sup>118</sup> In 2020, a Massachusetts county created a similar program modeled after the YAC,<sup>119</sup> and similar young adult courts have been established in Orange County, California,<sup>120</sup> Cook County, Illinois,<sup>121</sup>

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<sup>115</sup> JUST. POL’Y INST., IMPROVING APPROACHES TO SERVING YOUNG ADULTS IN THE JUSTICE SYSTEM 2 (2016), [https://justicepolicy.org/wp-content/uploads/justicepolicy/documents/jpi\\_young\\_adults\\_final.pdf](https://justicepolicy.org/wp-content/uploads/justicepolicy/documents/jpi_young_adults_final.pdf) [<https://perma.cc/63J8-89U5>].

<sup>116</sup> Tim Requarth, *A California Court for Young Adults Calls on Science*, N.Y. TIMES (Apr. 17, 2017), <https://www.nytimes.com/2017/04/17/health/young-adult-court-san-francisco-california-neuroscience.html> [<https://perma.cc/KC9J-K8C2>].

<sup>117</sup> The YAC prioritizes those who have committed violent and nonviolent felonies as opposed to misdemeanors. Requarth, *supra* note 116 (“The court does not accept cases involving serious bodily harm, deadly weapons or gang activity.”). Young adults must be referred to the program and undergo screening before being placed in a four-step program as an alternative to incarceration. SUPER. CT. CAL. CNTY. S.F., YOUNG ADULT COURT, POLICIES AND PROCEDURES MANUAL 5, 12 (2019), <https://www.sfsuperiorcourt.org/sites/Default/files/images/YACPoliciesProceduresAug2019AppendicesFINAL.pdf?1593739714204> [<https://perma.cc/C24S-ZCLF>]; *id.* at 3 (“YAC offers eligible participants intensive clinical case management, individual and group counseling, supportive family services, dialectical and cognitive behavioral therapy, and connections to substance use treatment, housing, parenting, and academic and vocational support through linkages to the community.”).

<sup>118</sup> JENNIFER HENDERSON-FRAKES, SENGSOUVANH (SUKEY) LESHNICK & HANNAH DIAZ, SOC. POL’Y RSCH. ASSOCS., AN EVALUATION OF SAN FRANCISCO’S YOUNG ADULT COURT (YAC) 5, B-3 (May 2017), [http://www.bscc.ca.gov/wp-content/uploads/San-Francisco-YAC-Interim-Report\\_05252017.pdf](http://www.bscc.ca.gov/wp-content/uploads/San-Francisco-YAC-Interim-Report_05252017.pdf) [<https://perma.cc/P7CL-U6N4>].

<sup>119</sup> GEN. CT. OF THE COMMONWEALTH OF MASS., REPORT OF THE TASK FORCE ON EMERGING ADULTS IN THE CRIMINAL JUSTICE SYSTEM, SD.2840, at 20 (2020), <https://malegislature.gov/Bills/191/SD2840> [<https://perma.cc/H7C3-JVTK>] (noting that the Hampden County (which encompasses the city of Springfield, Massachusetts) program involves “job training, education, and different types of programming and counseling that have proven effects on recidivism, like cognitive behavioral therapy and transitional employment”).

<sup>120</sup> *Young Adult Court*, UNIV. CAL. IRVINE, CAL. IRVINE, DEV., DISORDER, & DELINQ. LAB’Y (2018), <https://3dlab.psychology.uci.edu/young-adult-court> [<https://perma.cc/YU7R-A7UU>].

<sup>121</sup> *Restorative Justice Community Court - Cook County Circuit Court (North Lawndale)*, RESOL. SYS. INST. (2017), <https://www.aboutrsi.org/court-adr-across-illinois/programs/restorative-justice-community-court-cook-county-north-lawndale> [<https://perma.cc/DEC2-U9RV>].

Omaha, Nebraska,<sup>122</sup> Brooklyn, New York,<sup>123</sup> and Niagara County, New York.<sup>124</sup> On a national scale, the U.S. Department of Education and U.S. Department of Justice have jointly funded the Young Adult Diversion Project since 2017. The program aids sixteen state and local partners in providing young adults ages 16 to 24 with alternatives to prosecution and incarceration.<sup>125</sup>

State-level litigation and policy developments, such as the ones we review here, indicate a growing willingness to consider the emerging adult category as one that deserves special consideration in the criminal legal system.

#### CONCLUSION

To quote the Supreme Court, “any parent knows” that kids are different from adults.<sup>126</sup> But for those in the middle—emerging adults—a growing body of behavioral and neuroscientific research suggests an important new insight on developmental trajectories. Even though we may label those 18 and above as “adults” in some contexts, the decisionmaking of emerging adults, ages 18 to 25, remains distinct from those who are older. Evidence of this new scientific insight is now being used in litigation and policy debates at both the state and federal levels. Our analysis in this Essay shows that, at present, state-level routes are more successful. Further, both state and federal litigation would benefit from strengthening connections between litigants, the scientific community, and the applied forensic behavioral health community of practitioners who conduct forensic evaluations in individual cases. Efforts should be made to further engage in science-informed policy at the state and local levels, to ensure that appellate records reflect the most accurate and applicable neuroscience available, and to connect group-averaged scientific evidence with individualized assessments.

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<sup>122</sup> *Young Adult Court*, DOUGLAS CNTY. DIST. CT. (2020), <https://www.dc4dc.com/young-adult-court> [<https://perma.cc/KW9S-KLCC>].

<sup>123</sup> *Young Adult Bureau*, BROOKLYN DIST. ATT’Y OFF. (2016), <http://www.brooklynda.org/young-adult-bureau/> [<https://perma.cc/LZH8-VT84>].

<sup>124</sup> *Lockport Treatment Court*, N.Y. CTS., NIAGARA CNTY., <http://ww2.nycourts.gov/COURTS/8jd/Niagara/lcctreatment.shtml> [<https://perma.cc/EC9Q-WA8M>].

<sup>125</sup> *Young Adult Diversion Project*, PERKINS COLLABORATIVE RES. NETWORK, <https://cte.ed.gov/initiatives/young-adult-diversion-project> [<https://perma.cc/WDN8-CMA6>] (noting that this includes “special education, career and technical education, and other workforce development opportunities”).

<sup>126</sup> *Roper v. Simmons*, 543 U.S. 551, 569 (2005).

## APPENDIX

This Appendix provides additional methodological detail for the results reported in the main text. The data described below is made publicly available on a Google Sheet database at:

[https://docs.google.com/spreadsheets/d/1jjiRoVPjMDotDA9u5ja8r5nE9bdcM6XHtOu\\_Bah4qe0/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1jjiRoVPjMDotDA9u5ja8r5nE9bdcM6XHtOu_Bah4qe0/edit?usp=sharing) [https://perma.cc/Y5EP-U96S].

As described in the Essay text, the Database contains information on 494 case opinions in which neuroscience-informed arguments were made to extend *Miller v. Alabama* to defendants age 18 and older.

The Supreme Court issued its opinion in *Miller* on June 25, 2012.<sup>127</sup> As of this writing, *Miller* has been cited in over 5,000 cases.<sup>128</sup> The main text of the Essay examines the subset of cases citing *Miller* that have utilized neuroscientific evidence in order to argue that the protections of *Miller* should be extended to those age 18 and over.<sup>129</sup>

Here we describe the methods we used to build a new database of these cases.<sup>130</sup> We started with the universe of all cases citing to *Miller*, as of September 26, 2020 (Table A1). This initial search produced 5,384 results. These cases were then narrowed to those that mentioned “neuro!”<sup>131</sup> or “brain”, which left 1,019 results (Table A1). For each of these 1,019 cases, we then read the case text carefully to select only the cases that substantially discussed neuroscience, and in which the petitioner was age 18 or older at the time of the crime.<sup>132</sup> This produced a final database for analysis of 494 cases (Table A1).

For each of the 494 cases in our database, we examined the age of the party, the use of neuroscientific evidence, and the court’s holding. Notably, more than half (58%) of cases in the database considered pro se petitions; defendants were represented in their attempts to expand *Miller* in the other

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<sup>127</sup> *Miller v. Alabama*, 567 U.S. 460 (2012).

<sup>128</sup> See Cases Citing *Miller v. Alabama*, *supra* note 40.

<sup>129</sup> We focused here exclusively on those cases citing brain science. Thus, our search and coding strategy does not allow us to say how many of these challenges were made without such reference to brain science.

<sup>130</sup> All searches were conducted in the Westlaw Edge legal research database.

<sup>131</sup> On Westlaw, the “!” symbol is a root expander that retrieves variations on a word’s ending. For example, “neuro!” would retrieve results containing neuroscientific, neuroscience, neurological, etc.

<sup>132</sup> As a preliminary step at this stage, two different research assistants each read the same ten cases and then compared notes to ensure inter-coder reliability. Two examples of cases that failed to pass this step are *State v. Watkins*, 423 P.3d 830, 830 (Wash. 2018) and *Kinkel v. Perrson*, 417 P.3d 401, 403 (Or. 2018). Although both cases mentioned “neuro!” and “adolesc!,” they were both eliminated on the basis that the defendants were under age 18 at the time of the crime (and thus did not need to argue for an extension of *Miller* to age 18 and above). Most of the cases that were filtered out between steps 2 and 3 were filtered out due to the offender being under age 18 at the time of the offense.

42% of cases.<sup>133</sup>

**Table A1. Identification of Cases to Include in Analysis**

| Step   | Number of Cases |
|--|-----------------|
| <i>Step #1: Identify cases, state and federal, citing Miller v. Alabama, as of September 26, 2020.</i>   | 5,384           |
| <i>Step #2: Of those cases included in step 1, restrict database to cases that mention “neuro!” or “brain”.<sup>134</sup> This step required a word search of the case text.</i>                           | 1,019           |
| <i>Step #3: Of those cases included in step 2, identify cases that substantially mention or discuss neuroscience and involve defendants age 18 or older. This step involved close reading of the case.</i> | 494             |

The database likely undercounts the actual number of cases in this category—cases leveraging neuroscientific evidence to try to extend *Miller*—for multiple reasons. First, our search terms may have not captured all relevant cases. For instance, it is possible that in the text of the case decision itself no reference was made to “neuroscience” or “brain”, even though the petitioner might have mentioned it in his or her petition. In addition, if the court used different terminology, such as developmental science, without referencing “neuroscience” or “brain”, we did not identify that case for analysis in our database. We went through several iterations to refine search terms to collect the broadest sampling of cases, but it is still possible that cases were omitted during this process. Second, Westlaw does not publish the decisions of many lower-level state courts that are responsible for considering these challenges in the first instance. These lower-level state court decisions are thus absent from our dataset.

The database can be downloaded to a local hard drive or viewed online. The data columns are organized as follows:

Column 1 contains the full citation<sup>135</sup> of the most recent opinion; previous appeals were consolidated into a single entry as noted in column 8.

Column 2 contains the year of the most recent opinion.

<sup>133</sup> This data does not include thirty-seven cases for which there was no data on whether the defendant was represented in their challenge or whether they proceeded pro se.

<sup>134</sup> The Westlaw search includes cases that appear multiple times due to appeal proceedings.

<sup>135</sup> Westlaw citations are used for unpublished opinions.

Column 3 contains the state of the case.

Column 4 contains the presumed sex of the defendant(s).

Column 5 contains information on intellectual disability arguments; “yes” indicates a defendant raised claims pertaining to a mental or intellectual disability that placed the defendant in the same category as those between the ages of 18 and 25.

Column 6 contains age(s) of the defendant(s) at the time of offense, where available.

Column 7 indicates whether the defendant was a pro se petitioner; “yes” indicates a pro se petitioner.

Column 8 lists the full citations of earlier appeals in the same matter.

Having established a database of cases that mentioned neuroscience, we wanted to dive deeper to investigate *how* neuroscience was being proffered. To do this, we developed a convenience sub-sample of sixteen cases from the previous three years (2017–2020).<sup>136</sup> For each of these cases, which totaled 576 pages of text, we also downloaded all available briefs on Westlaw. This step produced 1,225 pages of supporting documentation. For each of these sixteen cases, we examined the content of the scientific research being cited (see discussion in main text). Table A2 presents the most frequently cited scientific references.

**Table A2. Citations Used in Database Cases**

| Citation   | Count | Pct |
|--|-------|-----|
| Elizabeth S. Scott, Richard J. Bonnie & Laurence Steinberg, <i>Young Adulthood as a Transitional Legal Category: Science, Social Change, and Justice Policy</i> , 85 FORDHAM L. REV. 641 (2016).   | 9     | 56% |
| Andrew Michaels, <i>A Decent Proposal: Exempting Eighteen-to-Twenty-Year-Olds from the Death Penalty</i> , 40 N.Y.U. REV. L. & SOC. CHANGE 139 (2016).   | 5     | 31% |
| Alexandra O. Cohen, Richard J. Bonnie, Kim Taylor-Thompson & BJ Casey, <i>When Does a Juvenile Become an Adult? Implications for Law and Policy</i> , 88 TEMPLE L. REV. 769 (2016).  | 4     | 25% |
| Linda Van Leijenhorst, Bregtje Gunther Moor, Zdeňka A. Op de Macks, Serge A.R.B. Rombouts, P. Michiel Westenberg & Eveline A. Crone, <i>Adolescent Risky Decision-Making: Neurocognitive Development of Reward and Control Regions</i> , 51 NEUROIMAGE 345 (2010). | 4     | 25% |

<sup>136</sup> See *supra* note 43 and accompanying text.



| Citation  | Count | Pct |
|---|-------|-----|
| Alexandra O. Cohen, Kaitlyn Breiner, Laurence Steinberg, Richard J. Bonnie, Elizabeth S. Scott, Kim A. Taylor-Thompson, Marc D. Rudolph, Jason Chein, Jennifer A. Richeson, Aaron S. Heller, Melanie R. Silverman, Danielle V. Dellarco, Damien A. Fair, Adriana Galván & BJ Casey, <i>When Is an Adolescent an Adult? Assessing Cognitive Control in Emotional and Nonemotional Contexts</i> , 27 PSYCH. SCI. 549 (2016).  | 4     | 25% |
| Margot Gardner & Laurence Steinberg, <i>Peer Influence on Risk Taking, Risk Preference, and Risky Decision Making in Adolescence and Adulthood: An Experimental Study</i> , 41 DEVELOPMENTAL PSYCH. 625 (2005).   | 4     | 25% |
| Sara B. Johnson, Robert W. Blum & Jay N. Giedd, <i>Adolescent Maturity and the Brain: The Promise and Pitfalls of Neuroscience Research in Adolescent Health Policy</i> , 45 J. ADOLESCENT HEALTH 216 (2009).   | 3     | 19% |
| NAT'L INST. OF MENTAL HEALTH, THE TEEN BRAIN: STILL UNDER CONSTRUCTION (2011),<br><a href="http://www.ncdsv.org/images/NIMH_TeenBrainStillUnderConstruction_2011.pdf">http://www.ncdsv.org/images/NIMH_TeenBrainStillUnderConstruction_2011.pdf</a><br>[ <a href="https://perma.cc/J2VG-3CEP">https://perma.cc/J2VG-3CEP</a> ].   | 3     | 19% |
| Kathryn Monahan, Laurence Steinberg & Alex R. Piquero, <i>Juvenile Justice Policy and Practice: A Developmental Perspective</i> , 44 CRIME & JUST. 577 (2015).  | 3     | 19% |
| Vincent Schiraldi & Bruce Western, <i>Why 21 Year-Old Offenders Should Be Tried in Family Court</i> , WASH. POST (Oct. 2, 2015),<br><a href="https://www.washingtonpost.com/opinions/time-to-raise-the-juvenile-age-limit/2015/10/02/948e317c-6862-11e5-9ef3-fde182507eac_story.html">https://www.washingtonpost.com/opinions/time-to-raise-the-juvenile-age-limit/2015/10/02/948e317c-6862-11e5-9ef3-fde182507eac_story.html</a><br>[ <a href="https://perma.cc/CS48-XCWR">https://perma.cc/CS48-XCWR</a> ].                                 | 3     | 19% |
| MACARTHUR FOUND. RSCH. NETWORK ON ADOLESCENT DEV. & JUV. JUST., ISSUE BRIEF 3: LESS GUILTY BY REASON OF ADOLESCENCE (2006),<br><a href="https://ccoso.org/sites/default/files/import/Less-guilty-by-reason-of-adolescence.pdf">https://ccoso.org/sites/default/files/import/Less-guilty-by-reason-of-adolescence.pdf</a><br>[ <a href="https://perma.cc/5JTE-JKH4">https://perma.cc/5JTE-JKH4</a> ].  | 3     | 19% |
| Barry Feld, <i>The Transformation of the Juvenile Court—Part II: Race and the “Crack Down” on Youth Crime</i> , 84 MINN. L. REV. 327 (1999).  | 3     | 19% |
| Laurence Steinberg, Grace Icenogle, Elizabeth P. Shulman, Kaitlyn Breiner, Jason Chein, Dario Bacchini, Lei Chang, Nandita Chaudhary, Laura Di Giunta, Kenneth A. Dodge, Kostas A. Fanti, Jennifer E. Lansford, Patrick S. Malone, Paul Oburu, Concetta Pastorelli, Ann T. Skinner, Emma Sorbring, Sombat Tapanya, Liliana Maria Uribe Tirado, Liane Peña Alampay, Suha M. Al-Hassan & Hanan M.S. Takash, <i>Around the World, Adolescence Is a Time of Heightened Sensation Seeking and Immature Self-Regulation</i> , DEV. SCI., Mar. 2018. | 3     | 19% |
| Nico U.F. Dosenbach, Binyam Nardos, Alexander L. Cohen, Damien A. Fair, Jonathan D. Power, Jessica A. Church, Steven M. Nelson, Gagan S. Wig, Alecia C. Vogel, Christina N. Lessov-Schlaggar, Kelly Anne Barnes, Joseph W. Dubis, Eric Feczko, Rebecca S. Coalson, John R. Pruett, Jr., Deanna M. Barch, Steven E. Petersen & Bradley L. Schlaggar, <i>Prediction of Individual Brain Maturity Using fMRI</i> , 329 SCIENCE 1358 (2009).  | 3     | 19% |

| Citation   | Count | Pct |
|--|-------|-----|
| Adolf Pfefferbaum, Torsten Rohlfing, Margaret J. Rosenbloom, Weiwei Chu, Ian M. Colrain & Edith V. Sullivan, <i>Variation in Longitudinal Trajectories of Regional Brain Volumes of Healthy Men and Women (Ages 10 to 85 Years) Measured with Atlas-Based Parcellation of MRI</i> , 65 <i>NEUROIMAGE</i> 176 (2013).   | 3     | 19% |
| Christian Beaulieu & Catherine Lebel, <i>Longitudinal Development of Human Brain Wiring Continues from Childhood into Adulthood</i> , 31 <i>J. NEUROSCIENCE</i> 10937 (2011).  | 3     | 19% |
| Marc D. Rudolph, Oscar Miranda-Domínguez, Alexandra O. Cohen, Kaitlyn Breiner, Laurence Steinberg, Richard J. Bonnie, Elizabeth S. Scott, Kim Taylor-Thompson, Jason Chein, Karla C. Fettich, Jennifer A. Richeson, Danielle V. Dellarco, Adriana Galván, BJ Casey & Damien A. Fair, <i>At Risk of Being Risky: The Relationship Between “Brain Age” Under Emotional States and Risk Preference</i> , 24 <i>DEV. COGNITIVE NEUROSCIENCE</i> 93 (2017). | 3     | 19% |