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Legal Osmosis: The Role of Brain Science in Protecting Adolescents

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LEGAL OSMOSIS: THE ROLE OF BRAIN SCIENCE IN PROTECTING ADOLESCENTS

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I. INTRODUCTION

Kids!
I don't know what's wrong with these kids today!
Kids!
Who can understand anything they say?
Kids!
They are disobedient, disrespectful oafs!
Noisy, crazy, sloppy, lazy loafers!
And while we're on the subject . . . .[1]

Current discussions on "kids today" frequently echo Paul Lynde's voice on stage and screen in *Bye Bye Birdie*, lamenting the flaws of the new generation.[2] More than ever, we hear that youth, be it Millennials, Netizens, or Generation Z, are spoiled,[3] lazy,[4] property destroyers,[5]

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** Preston & Scott, Salt Lake City, Utah, J.D., 2012, J. Reuben Clark Law School, Brigham Young University.

1. CHARLES STROUSE & LEE ADAMS, *Kids*, *on* BYE BYE BIRDIE [ORIGINAL BROADWAY CAST RECORDING] (Columbia Masterworks Records 1960).

2. *See id.*

3. STEVE FARKAS ET AL., PUB. AGENDA, KIDS THESE DAYS: WHAT AMERICANS REALLY THINK ABOUT THE NEXT GENERATION 38 (Chris Perry ed., 1997) [hereinafter KIDS THESE DAYS] (reporting results from a national survey of adults, wherein forty-eight percent said that children over the age of five, but not yet teenagers, are commonly "spoiled"); Susanne Goldstein, *Here's How to Deal with Millennials Who Aren't Ready to Face Real Challenges*, BUS. INSIDER (Aug. 17, 2012, 1:01 PM), http://www.businessinsider.com/3-reasons-millennials-arent-ready-for-real-

violent,[6] disorderly,[7] and sexually threatening to adults[8]—based on limited or no concrete supporting evidence. Unfortunately, while there are notable exceptions,[9] an increasing number of scholars and courts are acting on this sense of a change in youth to advocate for reducing minors' rights and the historical legal protections afforded to minors,[10]

careers-2012-8 (arguing that because of helicopter parenting and awards for non-achievements, young people have a difficult time being responsible in the real world).

4. KIDS THESE DAYS, *supra* note 3, at 37-38 (reporting that thirty percent of respondents thought that lazy children were common, while forty-one percent thought that teenagers with "poor work habits" were very common, and fifty percent thought that teenagers who "have too much free time" were very common); Julianne Micoleta, *Generation Z Teens Stereotyped as 'Lazy and Unaware,'* HUFFINGTON POST (Mar. 6, 2012, 10:19 AM), http://www.huffingtonpost.com/2012/03/06/apathetic-teens-generatio_n_1323577.html (stating that older generations consider youth to be "lazy, unaware and apathetic").

5. KIDS THESE DAYS, *supra* note 3, at 8 (reporting that many adults think of teenagers as "wild," and quoting an opinion that "kids are more destructive now").

6. Tracy Barnhart, *Violent Youth of Today – The THUG Life*, CORRECTIONSONE (May 2, 2008), http://www.correctionsone.com/juvenile-offenders/articles/1842711-Violent-youth-of-today-The-THUG-Life ("But you have to wonder, why are they so violent toward authority? Why are the youth of today so resistant to authority and what makes my job so hard and violent working with these youth?"); Doug Walker, *Are Teens Becoming More Violent?*, WLOX (Nov. 2, 2009, 2:58 PM), http://www.wlox.com/story/11428053/are-teens-becoming-more-violent (discussing some studies that suggest youth violence is increasing).

7. KIDS THESE DAYS, *supra* note 3, at 37-38 (thirty percent of respondents thought that teenagers who were "wild and disorderly in public" were very common, and thirty-one percent thought that children who were "out of control in public areas" were very common).

8. Some recent judicial language suggests how a perception of many teenagers might lie beneath the treatment of an individual teenager. For example, in a 2013 case, the judge said that a fourteen-year-old victim was "as much in control of the situation" as her thirty-five-year-old teacher who engaged her in sexual conduct. Debra Cassens Weiss, *Ex-Teacher Gets 30 Days for Rape of Girl, 14; Judge Says She Was 'Older than Her Chronological Age,'* ABA J. (Aug. 28, 2013, 2:27 PM), http://www.abajournal.com/mobile/article/ex-teacher_gets_30_days_for_sex_with_student_14_judge_says_she_was_older_th. Unquestionably, teenagers are more sexually active than in prior generations, but this comment suggests that they are also more "responsible" about their activity, even when measured against the culpability of an adult. The science disagrees. *See* Ashcroft v. Free Speech Coal., 535 U.S. 234, 246-47 (2002) ("[T]eenagers engaging in sexual activity – that is a fact of modern society . . . ."); KIDS THESE DAYS, *supra* note 3, at 8 ("This study shows . . . that Americans are intensely concerned about young people, but their concerns center directly on youngsters' moral well-being."). Fortunately, on appeal, the Montana Supreme Court reversed the decision and reassigned the case to a new judge, stating:

> The idea that [the minor] could have "control" of the situation is directly at odds with the law, which holds that a youth is incapable of consent and, therefore, lacks any control over the situation whatsoever. . . . [T]here is no basis in the law for the court's distinction between the victim's "chronological age" and the court's perception of her maturity.

State v. Rambold, 325 P.3d 686, 690-91 (Mont. 2014).

9. For instance, the federal Credit Card Accountability Responsibility and Disclosure (CARD) Act of 2009 moved the age at which individuals may have a credit card in their own names from eighteen to twenty-one. 15 U.S.C. § 1637(c)(8)(A) (2012). The juvenile punishment cases discussed below are another example of increasing protections. *See infra* Part III.

10. *See, e.g.*, Josie Foehrenbach Brown, *Developmental Due Process: Waging a Constitutional Campaign to Align School Discipline with Developmental Knowledge*, 82 TEMP. L.

some of which have been in place for centuries. What is missing from most policy discussions is information available from behavioral and neuroscience.

Some critics of various protections built into adolescence law articulate the viewpoint that teenagers no longer need or deserve legal protections; others leave the assumption unspoken. The following language typifies these viewpoints: "[T]he rules regarding majority today are a mélange of legal anachronism and contemporary expediency which reflect only minimally our current understanding about the intellectual and emotional capacities and interests of young persons."[11] Moreover, "the advances in child development research . . . suggests that children, particularly older adolescents, are not the naïve infants that the common law decisions suggest."[12]

REV. 929, 960 & n.200, 961 (2009) (citing, *inter alia*, examples from the FLA. STATE CONFERENCE NAACP ET AL., ARRESTING DEVELOPMENT: ADDRESSING THE SCHOOL DISCIPLINE CRISIS IN FLORIDA 7-8, 16, 21 (2006)), *available at* http://b.3cdn.net/advancement/e36d17097615e7c612_bbm6vub0w.pdf (reporting on the rush to school "zero tolerance" policies in the last two decades that go far beyond what was required for gun safety under the Gun-Free Schools Act, 20 U.S.C. § 7151(b)(1) (2012), and now include sins such as "insubordination, tardiness, absenteeism, . . . disrupting class," and minor student fights (internal quotation marks omitted)); Julia Halloran McLaughlin, *Exploring the First Amendment Rights of Teens in Relationship to Sexting and Censorship*, 45 U. MICH. J.L. REFORM 315, 324-25, 327 (2012) (arguing that the recent anti-sexting statutes and convictions are based on the unwarranted concept that minors must be protected from themselves, and that "[t]he threat of such prosecution chills the internet speech of teens' online communities formed to explore sexual identity in the comparative safety of cyber chat rooms . . . ."); Toni L. Conner, Student Work, *Juvenile Curfews: Political Pandering at the Expense of a Fundamental Right*, 109 W. VA. L. REV. 459, 460, 463 (2007) (discussing the "resurgence" in the enactment and enforcement of teen curfew laws in response to citizens' concerns about crime). In addition, some lower courts are only sparingly applying the pro-juvenile rulings in the juvenile justice cases. *See, e.g.*, Goins v. Smith, 556 F. App'x 434, 440 (6th Cir. 2014) ("[The language in the juvenile justice cases] certainly counsels in favor of considering juveniles' diminished culpability in imposing consecutive term-of-years sentences, [but] *Miller* does not clearly require such an approach where a juvenile faces an aggregate term-of-years sentence. Thus, . . . the sentencing court [need not] factor Goins's juvenile status into his sentence."); *see also infra* Part III. California courts are disputing whether a California state law permitting the Board of Parole Hearings to consider the defendant's youth is sufficient to meet the constitutional requirements, even if the sentencing court does not take the defendant's age into account. *Compare In re* Alatriste, 163 Cal. Rptr. 3d 748, 753 (Ct. App. 2013), *reh'g granted* 317 P.3d 1183 (Cal. 2014), *with In re* Heard, 166 Cal. Rptr. 3d 824, 834-36 (Ct. App. 2014), *reh'g granted* 323 P.3d 1 (Cal. 2014).

11. Walter J. Wadlington, *Consent to Medical Care for Minors*, *in* CHILDREN'S COMPETENCE TO CONSENT 57, 57 (Gary B. Melton et al. eds., 1983).

12. Larry Cunningham, *A Question of Capacity: Towards a Comprehensive and Consistent Vision of Children and Their Status Under the Law*, 10 U.C. DAVIS J. JUV. L. & POL'Y 275, 292 (2006); *see also* Larry A. DiMatteo, *A Theory of Interpretation in the Realm of Idealism*, 5 DEPAUL BUS. & COM. L.J. 17, 58 (2006) ("The ancient lineage of this paternalistic doctrine has lost touch with the socioeconomic condition of minors in the modern world. The law's response has produced a patchwork of sub-doctrines that continue to pay homage to the pristine version. The attempt to bridge the gap between the social reality of minority and legal doctrine through the use of

For some, the perception of no-longer-deserving minors is linked to their identification as the wired generation.

> [T]he premise that minors require protection from their own lack of judgment and experience . . . is an *archaic notion* in a time where adolescents spend, on average, more than nine hours a day using electronic devices and accessing media, including watching television, surfing the internet on computers and mobile phones, listening to digital media players, and talking and texting on their mobile phones.[13]

Others tie their critique of legal protections for minors to the dramatic change in minors' buying power. One example of a fairly dramatic shift in legal analysis is the 2011 publication of the Restatement (Third) of Restitution and Unjust Enrichment,[14] which adopted a narrow minority view significantly burdening the right of minors to disaffirm contracts.[15] In commenting on the radical restriction of contract law protections for minors in the revised Restatement, senior contracts scholar, Joseph Perrillo, observed: "[I]n the modern world where minors purchase goods freely, they should be held to their bargains, other than their entry into credit transactions."[16]

Indeed, the day-to-day lives of older children and teenagers are different now than when legal protections for minors were developed. "[T]he law is caught in a bind between competing interests: the desire to protect children from others, from harmful situations, and from their own improvidence, and the desire to give children as much autonomy as they can bear, as soon as they can bear it."[17] The critical question for judges, legislators, scholars, and other policymakers is the extent to

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exceptions has produced a chaotic jurisprudence.").

13. Karen A. Shiffman, Comment, *Replacing the Infancy Doctrine Within the Context of Online Adhesion Contracts*, 34 WHITTIER L. REV. 141, 146-47 (2012) (emphasis added).

14. *See* RESTATEMENT (THIRD) OF RESTITUTION AND UNJUST ENRICHMENT § 33 (2011).

15. *See* Cheryl B. Preston & Brandon T. Crowther, *Minor Restrictions: Adolescence Across Legal Disciplines, the Infancy Doctrine, and the Restatement (Third) of Restitution and Unjust Enrichment*, 61 U. KAN. L. REV. 343, 348-53 (2012) [hereinafter Preston & Crowther, *Minor Restrictions*]. For a discussion of the majority approach to restitution for minors' voided contracts, see Cheryl B. Preston & Brandon T. Crowther, *Infancy Doctrine Inquiries*, 52 SANTA CLARA L. REV. 47, 62-63 (2012) [hereinafter Preston & Crowther, *Infancy Doctrine Inquiries*].

16. Joseph M. Perillo, *Restitution in a Contractual Context and the Restatement (Third) of Restitution and Unjust Enrichment*, 68 WASH. & LEE L. REV. 1007, 1017 (2011); *see also, e.g.*, Larry A. DiMatteo, *Deconstructing the Myth of the "Infancy Law Doctrine": From Incapacity to Accountability*, 21 OHIO N.U. L. REV. 481, 525 (1994) ("The time has long been ripe for the elimination of the law of infant incapacity. The sophistication of today's youth and the increase of their buying power has made the hindrance caused by the 'protection' of the infancy law doctrine even more severe."). Furthermore, "[g]iven the advanced maturity of many minors and their tremendous purchasing power, the right of disaffirmance as a means of protecting them seems somewhat draconian." DiMatteo, *supra*, at 504-05 (footnotes omitted).

17. SAMUEL M. DAVIS, CHILDREN'S RIGHTS UNDER THE LAW 6 (2011) (footnote omitted).

which the evolution of, and even radical changes in, the lives of minors and their roles in society warrant changes in legal doctrines. We argue in this Article that the science of the brain confirms the continued reality of the most potent markers of vulnerability and immaturity, notwithstanding minors' much changing and broader experience and expertise in some matters. Although adolescents have high levels of cognitive abilities,[18] scientists now can see, with the recent advent of neurotechnology[19]—including magnetic resonance imaging ("MRI") technology—adolescents' brains' structures and watch them function. Simply put, teenagers may have the *ability* to reason like adults, but do so with "vexing inconsistency."[20]

The law has historically provided legal protections for minors in the areas of torts, juvenile justice, medical consent, family law, and contracts.[21] In addition, numerous other age-based restrictions exist, such as limits on drinking,[22] gambling,[23] employment,[24] obtaining tattoos and piercings,[25] as well as prohibitions on carrying or possessing firearms,

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18. *See, e.g.*, BÄRBEL INHELDER & JEAN PIAGET, THE GROWTH OF LOGICAL THINKING: FROM CHILDHOOD TO ADOLESCENCE 251-65 (1958); Cunningham, *supra* note 12, at 282 & n.23, 324-35 (citing Gary B. Melton, *Taking* Gault *Seriously: Toward a New Juvenile Court*, 68 NEB. L. REV. 146, 153 (1989); Rhonda Gay Hartman, *Adolescent Autonomy: Clarifying an Ageless Conundrum*, 51 HASTINGS L.J. 1265, 1285-86 (2000); Wallace J. Mlyniec, *A Judge's Ethical Dilemma: Assessing a Child's Capacity to Choose*, 64 FORDHAM L. REV. 1873, 1878 (1996)); Shawn L. Ward & Willis F. Overton, *Semantic Familiarity, Relevance, and the Development of Deductive Reasoning*, 26 DEVELOPMENTAL PSYCHOL. 488, 492 (1990).

19. In addition to MRI technology, other neurotechnology, such as positron emission tomography, electroencephalography, and magnetoencephalography, has greatly expanded the window into the human mind and is continuing to offer greater potential applications in legal fields. *See generally* Laurence R. Tancredi & Jonathan D. Brodie, *The Brain and Behavior: Limitations in the Legal Use of Functional Magnetic Resonance Imaging*, 33 AM. J.L. & MED. 271 (2007).

20. ELIZABETH S. SCOTT & LAURENCE STEINBERG, RETHINKING JUVENILE JUSTICE 37 (2008) ("Even when adolescent cognitive capacities approximate those of adults, youthful decision-making may still differ from that of adults due to psychosocial immaturity."); David Dobbs, *Beautiful Teenage Brains*, NAT'L GEOGRAPHIC, Oct. 2011, at 36, 48 ("[T]hey're still learning to use their brain's new networks. Stress, fatigue, or challenges can cause a misfire. Abigail Baird, a Vassar psychologist who studies teens, calls this neural gawkiness—an equivalent to the physical awkwardness teens sometimes display while mastering their growing bodies."); *see also* Victoria Slade, Note, *The Infancy Defense in the Modern Contract Age: A Useful Vestige*, 34 SEATTLE U. L. REV. 613, 629 (2011) ("Even if children's brains are fully developed before they reach age eighteen, they are still immature about decision making, which matters most for the purposes of the infancy defense: They are impulsive risk takers.").

21. For a discussion of age protections in these and other categories of laws, see Preston & Crowther, *Minor Restrictions*, *supra* note 15, at 353-55, 359-60. For a discussion of the contours of the infancy doctrine protections in contract law, see Preston & Crowther, *Infancy Doctrine Inquiries*, *supra* note 15, at 50.

22. Preston & Crowther, *Minor Restrictions*, *supra* note 15, at 368.

23. *Id.* at 367.

24. *Id.* at 368.

25. *Id.*; *see also* Alicia Ouellette, *Body Modification and Adolescent Decision Making:*

stun guns, and irritant sprays,[26] access to tanning beds,[27] and the right to pawn property or sell precious metals to dealers.[28] Other age-based legal rules cover legal proceedings, such as the obligation to restrict leading questions and harassment of under-age witnesses[29] and freedom from jury duty.[30] Many of these age-based legal rules are ancient. The judges and legislatures who have considered and shaped these legal protections have either lacked access to sophisticated scientific research, or failed to consider it thoroughly, reaching these conclusions solely through precedent and common sense. Now we have access to scientific findings that reinforce the protections they put in place.

In a series of cases defining the contours of minors' criminal culpability, the Supreme Court demonstrated that it is open to scientific arguments, effectively employing neuroscience in defining legal distinctions between adolescents and adults.[31] However, the Court's wholehearted acceptance of scientific research for juvenile justice cases offers a contrast to the Court's more recent decision in which it dismissed scientific evidence in a First Amendment challenge to a statute based on a finding that minors are adversely impacted by violent video games.[32] While these cases seem to indicate either an inconsistency in the Supreme Court's approach to scientific findings on adolescence or the Court's unwillingness to extend the use of brain science outside of the criminal law context, we find, upon closer examination, these cases are reconcilable and consistent with greater use of scientific findings.

Because policymakers often rely on general perceptions, which are frequently based on media, it is not difficult to see how a change in the culture surrounding children, rather than measurable scientific findings, can lead to unfortunate changes to the relevant law, sometimes dramatic

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Proceed with Caution, 15 J. HEALTH CARE L. & POL'Y 129, 134-35 (2012).

26. *See generally* Eugene Volokh, *Older Minors, the Right to Keep and Bear (Almost Entirely) Nonlethal Arms, and the Right to Defend Life*, 43 ARIZ. ST. L.J. 447 (2011).

27. *Indoor Tanning Restrictions for Minors - A State-by-State Comparison*, NAT'L CONF. ST. LEGISLATURES, http://www.ncsl.org/research/health/indoor-tanning-restrictions.aspx (last updated Aug. 2014).

28. Layla Summers, Comment, *The Future of the Abortion Right:* Ayotte v. Planned Parenthood *& the Roberts' [sic] Court*, 5 WHITTIER J. CHILD & FAM. ADVOC. 669, 722-23 app. J (2006).

29. *See Leading Questions and Child Witnesses*, NAT'L DISTRICT ATT'YS ASS'N, http://www.ndaa.org/pdf/Leading%20Questions%20and%20Child%20Witnesses6-2011.pdf (last updated June 2011).

30. Summers, *supra* note 28, at 703-04 app. B.

31. *See* Miller v. Alabama, 132 S. Ct. 2455, 2464-65 (2012); Graham v. Florida, 560 U.S. 48, 68-69 (2010); Roper v. Simmons, 543 U.S. 551, 569-70 (2005).

32. Brown v. Entm't Merchs. Ass'n, 131 S. Ct. 2729, 2739 (2011); *see also infra* Part III.

and sometimes subtle.[33] But the science supporting the legal distinctions between minors and adults has great potential to reshape and strengthen legal protections in all aspects of the law. If the law were to more fully incorporate scientific research on minors, it would be better able to justify current legal policies and would be far better informed to tailor laws to meet minors' specific needs. However, when doing so, legal policymakers must be aware of the significant challenges of incorporating this research, as with all scientific principles, into the law. When approached carefully and consistently, scientific research can be successfully integrated into our legal structure, infusing it with greater understanding and ability to meet the needs and realities of adolescents rather than the panic of older generations or the self-interested demands of corporate and governmental pressure.

Part II of this Article examines the presently available developmental research regarding the nature of adolescence, together with the neuroscience evidence, which strengthens and corroborates it.[34] This research shows a neurological basis for the law, recognizing that minors are more prone to risk-taking and are less able to regulate their emotions and deflect the pressure of peers.[35] Part III discusses the seeming divergence in the Supreme Court's approaches to utilizing scientific research to craft law relating to minors within the juvenile justice and First Amendment arenas.[36] We explain how these approaches can be reconciled considering the nature of the cases and the type of science put forward in the briefs.[37] Part IV addresses the challenges inherent in using science to develop legal policy and how those challenges can be minimized.[38] When used with caution, our understanding of adolescence can be expanded and sharpened by applicable scientific research. Finally, Part V offers an example from contract law of how evidence from neuroscience could, and should, have a material impact on the development of law governing adolescence.[39] Scientific principles can bolster and reinforce crucial protections afforded by law to minors.

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33. A more detailed discussion of attitudes, media reports, and reasons for changing views about minors, can be seen in our upcoming article, entitled *The Legal Length of Adolescence* (on file with the *Hofstra Law Review*).

34. *See infra* Part II.

35. *See infra* Part II.

36. *See infra* Part III.

37. *See infra* Part III.C.

38. *See infra* Part IV.

39. *See infra* Part V.

II. SCIENTIFIC FINDINGS REGARDING ADOLESCENCE

Scientists have long studied adolescent behavior and made conclusions about how adolescents think and what motivates them. Notwithstanding growing research on the capabilities of teenagers and their need for respect and autonomy, the developmental science shows that, alongside these positive qualities, minors are nonetheless still impulsive, take more risks than adults, and are less capable of controlling their emotions.[40] These behavioral immaturities suggest that minors are not in the same position as adults when making long-term decisions, especially when surrounded by their peers. And, in the Internet age, they are always surrounded by their peers, using social media to bounce every decision off a host of other teenagers.[41]

Developmental research has long provided a basis for establishing legal protections for minors, even if it has been largely ignored by legal policymakers.[42] However, in the past decade, scientists have been able to rely on modern medical technology to explore the neurological bases for how adolescents think and what differentiates them from adults. Through this research, scientists have discovered structural and functional immaturities in the adolescent brain.[43]

Advocates for adolescent autonomy in the second half of the twentieth century relied on the work of Jean Piaget and his progeny to argue that adolescents "possess cognitive abilities equivalent to those of adults."[44] Piaget concluded that "children . . . have adult-like reasoning

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40. *See* Brief for the Am. Med. Ass'n and the Am. Acad. of Child and Adolescent Psychiatry as Amici Curiae in Support of Neither Party at 7, 9-10, Graham v. Florida, 560 U.S. 48 (2010) (Nos. 08-7412, 08-7621) [hereinafter Graham AMA Brief]; Curtis Campogni, *A Psychological Approach to Autonomy and Independence*, EXAMINER (June 29, 2011, 11:26 AM), http://www.examiner.com/article/a-psychological-approach-to-autonomy-and-independence. For a discussion of our use of briefs filed by various medical associations in Supreme Court cases, see *infra* note 113.

41. Goldstein, *supra* note 3 ("High school kids today spend their evenings texting, Facebooking and in group chats on Skype. They share typical kid stuff, but also ask each other for help deciding what to do about almost any topic. . . . Millennials [need mentoring because they] are used to being a member of a tribe, not independent thinkers.").

42. *See, e.g.*, Hartman, *supra* note 18, at 1348 (recognizing that judges have ignored developmental research, but also arguing that the developmental research contradicts the prevailing view of minors' decisional incapacity); Terry A. Maroney, *Adolescent Brain Science After* Graham v. Florida, 86 NOTRE DAME L. REV. 765, 781-82 (2011) (recognizing that advocacy involved with developmental research did not produce results prior to *Graham*).

43. Graham AMA Brief, *supra* note 40, at 4, 13.

44. Hartman, *supra* note 8, at 1285; *see, e.g.*, INHELDER & PIAGET, *supra* note 18, at 251-65; Cunningham, *supra* note 12, at 282, 303; Ward & Overton, *supra* note 18, at 492. Piaget's research is frequently cited in support of the proposition that adolescents have cognitive abilities equal to adults. *See* Hartman, *supra* note 18, at 1285-86.

abilities by age 15,"[45] meaning they have the "cognitive capability to reason, understand, appreciate, and articulate decisions."[46] Thus armed, they argued for reducing the age of minority and the protections for adolescents. While Piaget's conclusions have not been proven wrong as far as they go, they fail to account for the complete picture of adolescent abilities, including the changes that happen in the adolescent brain.[47] Significantly, recent neurobiological findings support the assertion that incomplete brain development may contribute to adolescents' behavioral immaturities, providing a neurological basis to support long-existing views about the need to protect them from themselves and others.

A. Adolescent Behavioral Immaturities

Adolescents, as a class, are generally immature in three separate, but related, ways: first, adolescents are more likely to engage in risky behavior than adults; second, adolescents are less able to control their impulses than adults; and finally, adolescents are less capable of regulating their emotional responses than adults. Each of these behavioral patterns is discussed in this Subpart. They reinforce many policies currently in place to protect adolescents.

Adolescents tend to engage in far more risky behavior than do adults,[48] and emerging research is beginning to explain in more detail why this occurs.[49] "[A]dolescents tend to experience heightened levels of sensitivity to rewards, especially to immediate rewards," which results in "a higher likelihood of engaging in the risky behavior."[50] This new research clarifies prior beliefs that adolescent risk-taking behavior stems

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45. Cunningham, *supra* note 12, at 282 (citing Melton, *supra* note 18, at 153; Mlyniec, *supra* note 18, at 1878); *see also* Hartman, *supra* note 18, at 1285.

46. Hartman, *supra* note 18, at 1286.

47. SCOTT & STEINBERG, *supra* note 20, at 37; *see also* Slade, *supra* note 20, at 629.

48. Terry A. Maroney, *The False Promise of Adolescent Brain Science in Juvenile Justice*, 85 NOTRE DAME L. REV. 89, 97 (2009); *see also* Jennifer Mayer Cox et al., *The Impact of Juveniles' Ages and Levels of Psychological Maturity of Judges' Opinions About Adjudicative Competence*, 36 LAW & HUM. BEHAV. 21, 21 (2012) ("Adolescents also tend to be less risk averse and engage in more risky behavior than do adults.").

49. Graham AMA Brief, *supra* note 40, at 7-8; *see also* Dobbs, *supra* note 20, at 49, 59 (discussing new scientific research and "adaptive-adolescence," which explains how natural selection, genetics, and individual development leads to risk-reward discrepancies between teenagers and adults).

50. Graham AMA Brief, *supra* note 40, at 7 (citing Laurence Steinberg, *Adolescent Development and Juvenile Justice*, 5 ANN. REV. CLINICAL PSYCHOL. 459, 469-70 (2009)); *see also* Cox et al., *supra* note 48, at 21 ("Adolescents are less likely to identify the potential risks in a given situation, more likely to underestimate 'the likelihood that possible negative consequences might occur,' and less likely to appreciate how serious the negative consequences would be if they did occur.") (citing J.L. Woolard et al., Judgment in Legal Contexts Instrument Manual 10 (2003) (unpublished manuscript) (on file with the *Hofstra Law Review*)).

from "youthful ignorance, irrationality, delusions of invulnerability, or misperceptions of risk."[51] More likely, risk taking comes from a psychological misperception of potential rewards of risky behavior.[52] Adolescents have less ability than adults to "regulate their emotional responses to stimuli."[53] This can "result in actions taken without full consideration or appreciation of the consequences."[54] Further, "adolescents are more likely to take risks when they are in the presence of peers."[55] This is "associated with greater neural activity in the areas of the brain associated with reward processing" because "adolescents appear to place unique reward value on the presence of peers."[56]

Additionally, adolescents are limited in their ability to control their impulses,[57] and consequently, are "less able than adults to consistently reflect before they act."[58] Development studies have shown that capacity for self-direction increases gradually throughout adolescence,[59] while impulsivity gradually declines.[60] The ability to control one's impulsive

51. Elizabeth Cauffman et al., *Age Differences in Affective Decision Making as Indexed by Performance on the Iowa Gambling Task*, 46 DEVELOPMENTAL PSYCHOL. 193, 194 (2010); *see also* Dobbs, *supra* note 20, at 54 (explaining a study showing teenagers taking more chances "because they gave more weight to the payoff," not because "they suddenly downgraded the risk").

52. Graham AMA Brief, *supra* note 40, at 8 (citing Susan L. Andersen, *Trajectories of Brain Development: Point of Vulnerability or Window of Opportunity?*, 27 NEUROSCIENCE & BIOBEHAVIORAL REVS. 3, 3-13 (2003)); *see also* Dobbs, *supra* note 20, at 54 (discussing a study by Professor Laurence Steinberg showing that "risk-taking rises not from puny thinking but from a higher regard for reward"); Laurence Steinberg & Elizabeth S. Scott, *Less Guilty by Reason of Adolescence: Developmental Immaturity, Diminished Responsibility, and the Juvenile Death Penalty*, 58 AM. PSYCHOLOGIST 1009, 1012 (2003).

53. Graham AMA Brief, *supra* note 40, at 10 (citing Isabelle M. Rosso et al., *Cognitive and Emotional Components of Frontal Lobe Functioning in Childhood and Adolescence*, 1021 ANNALS N.Y. ACAD. SCI. 355, 360-61 (2004)).

54. *Id.* at 10-11 (citing Laurence Steinberg & Kathryn C. Monahan, *Age Differences in Resistance to Peer Influence*, 43 DEVELOPMENTAL PSYCHOL. 1531, 1538 (2007) (explaining how resistance to peer pressure increases linearly between ages fourteen and eighteen)); *see also* Maroney, *supra* note 48, at 110 (citing SCOTT & STEINBERG, *supra* note 20, at 40) (attributing minors' lack of ability to perceive long-term consequences to the structural maturity of the adolescent brain).

55. Brief for the Am. Med. Ass'n and the Am. Acad. of Child and Adolescent Psychiatry as Amici Curiae in Support of Neither Party at 9, Miller v. Alabama, 132 S. Ct. 2455 (2012) (Nos. 10-9646, 10-9647) [hereinafter Miller AMA Brief].

56. *Id.*

57. Steinberg & Scott, *supra* note 52, at 1013.

58. Graham AMA Brief, *supra* note 40, at 9.

59. *Id.* (citing B.J. Casey et al., *The Adolescent Brain*, 28 DEVELOPMENTAL REV. 62, 64 (2008); Laurence Steinberg et al., *Age Differences in Future Orientation and Delay Discounting*, 80 CHILD DEV. 28, 29, 38-40 (2009)).

60. *Id.* (citing Laurence Steinberg et al., *Age Differences in Sensation Seeking and Impulsivity as Indexed by Behavior and Self-Report: Evidence of a Dual Systems Model*, 44 DEVELOPMENTAL PSYCHOL. 1764, 1766 (2008)).

reactions "is necessary to achieve adult levels of problem solving ability, logical reasoning, and the consistent exercise of good judgment."[61] Without these controls fully developed, adolescents lack a "cornerstone of cognitive development."[62] Even if adolescents had the cognitive skills to correctly assess the costs and benefits of their actions, their impulsivity could propel them into unwise decisions.[63] Based on this research, the American Psychiatric Association ("APA") concluded in its amicus brief filed in *Miller v. Alabama*[64] that "'adults tend to make more adaptive decisions than adolescents,' in part because 'they have a more mature capacity to resist the pull of social and emotional influences and remain focused on long-term goals.'"[65]

With respect to emotional regulation, stress can affect adolescents' "ability to effectively regulate behavior as well as . . . to weigh costs and benefits and override impulses with rational thought."[66] A cost-benefit analysis is thus further skewed by adolescents' increased susceptibility to stress from daily events.[67] Altogether, adolescents' inability to fully regulate their emotional responses leads them "to experience emotional states that are more extreme and more variable than those experienced by adults."[68] Where social science has explored the developmental patterns that mark adolescence, neuroscience is now beginning to provide an explanation for adolescent behavior.

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61. *Id.* at 8-9 (citing Beatrice Luna, *The Maturation of Cognitive Control and the Adolescent Brain*, *in* FROM ATTENTION TO GOAL-DIRECTED BEHAVIOR: NEURODYNAMICAL, METHODOLOGICAL AND CLINICAL TRENDS 249, 251 (Francisco Aboitiz & Diego Cosmelli eds., 2009)). Minors are not incapable of exercising good judgment. Rather, their limited ability to control their impulsive reactions makes it difficult for them to *consistently* exercise good judgment.

62. *Id.* at 8-9 (quoting Casey et al., *supra* note 59, at 64).

63. Cunningham, *supra* note 12, at 283-84 (quoting Laurence Steinberg & Elizabeth Cauffman, *Maturity of Judgment in Adolescence: Psychosocial Factors in Adolescent Decision Making*, 20 LAW & HUM. BEHAV. 249, 251 (1996)).

64. 132 S. Ct. 2455 (2012).

65. Brief for the Am. Psychological Ass'n et al. as Amici Curiae in Support of Petitioners at 9, Miller v. Alabama, 132 S. Ct. 2455 (2012) (Nos. 10-9646, 10-9647) [hereinafter Miller APA Brief] (quoting Dustin Albert & Laurence Steinberg, *Judgment and Decision Making in Adolescence*, 21 J. RES. ON ADOLESCENCE 211, 220 (2011)).

66. Graham AMA Brief, *supra* note 40, at 11 (citing Lita Furby & Ruth Beyth-Marom, *Risk Taking in Adolescence: A Decision-Making Perspective*, 12 DEVELOPMENTAL REV. 1, 22 (1992); Linda Patia Spear, *The Adolescent Brain and Age-Related Behavioral Manifestations*, 24 NEUROSCIENCE & BIOBEHAVIORAL REVS. 417, 422-23 (2000)).

67. *Id.* at 11-12 (citing Furby & Beyth-Maron, *supra* note 66, at 22; Spear, *supra* note 66, at 423).

68. *Id.* at 12 (citing Elizabeth Cauffman & Laurence Steinberg, *(Im)maturity of Judgment in Adolescence: Why Adolescents May Be Less Culpable than Adults*, 18 BEHAV. SCI. & L. 741, 743-45, 756-57, 759 (2000); Spear, *supra* note 66, at 429.

B. Adolescent Brain Structure and Function Immaturity

In contrast to developmental studies on adolescence, which have existed for decades, the most illuminating insights into the adolescent brain have only emerged since the late 1990s, with the use of MRI technology.[69] These developments have revealed "that both the structure of the adolescent brain, and the way it functions, are immature compared to the adult brain."[70] Structurally, the adolescent brain has not fully laid down the fatty myelin insulation, the brain's white matter, which is necessary for the proper transmission of signals within the brain and to the body.[71] Moreover, "[t]his delayed completion [compared to adults] . . . heightens flexibility just as [teenagers] confront and enter the world that [they] will face as adults."[72] In fact, what many see as immaturity is merely "neural gawkiness" as the brain forms needed neural connections that are difficult or impossible to form until the myelin coating is finished.[73] A National Geographic article emphatically declared that teenagers "act that way because their brains aren't done! You can see it right there in the [MRI] scans!"[74]

One of the most noteworthy recent structural discoveries is that the prefrontal cortex, responsible for the brain's decision-making functions, continues to develop through adolescence,[75] making it "one of the last brain regions to mature."[76] The prefrontal cortex is associated with

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69. *Id.* at 13 (citing MICHAEL S. GAZZANIGA ET AL., COGNITIVE NEUROSCIENCE: THE BIOLOGY OF THE MIND 20-21, 138 (2d ed. 2002); Sarah Durston et al., *Anatomical MRI of the Developing Human Brain: What Have We Learned?*, 40 J. AM. ACAD. CHILD & ADOLESCENT PSYCHIATRY 1012, 1012, 1016 (2001)); *see also* Daniel P. Keating, *Cognitive and Brain Development*, *in* HANDBOOK OF ADOLESCENT PSYCHOLOGY 45, 48 (2d ed. 2004); Dobbs, *supra* note 20, at 48.

70. Graham AMA Brief, *supra* note 40, at 13.

71. Miller APA Brief, *supra* note 65, at 28; Dobbs, *supra* note 20, at 43, 59.

72. Dobbs, *supra* note 20, at 59.

73. *Id.* at 48, 59 ("This makes the period when a brain area lays down myelin a sort of crucial period of learning—the wiring is getting upgraded, but once that's done, it's harder to change.").

74. *Id.* at 48.

75. SCOTT & STEINBERG, *supra* note 20, at 44 (citing Casey et al., *supra* note 59, at 68); Elizabeth R. Sowell et al., In Vivo *Evidence for Post-Adolescent Brain Maturation in Frontal and Striatal Regions*, 2 NATURE NEUROSCIENCE 859, 860-61 (1999)); *see also* Dobbs, *supra* note 20, at 43, 59 (explaining that the clumsiness and adaptability of teenagers' brains "is the prolonged plasticity of those late-developing frontal areas as they slowly mature"); Ann MacLean Massie, *Suicide on Campus: The Appropriate Legal Responsibility of College Personnel*, 91 MARQ. L. REV. 625, 659-62 (2008) ("[Researchers at the National Institute of Mental Health] and others conducting similar or parallel work have learned, to their surprise, that a number of structural changes occur in the brain much later in adolescence than anyone had supposed." (footnote omitted)); Steinberg & Scott, *supra* note 52, at 1013 (explaining that certain cognitive capacities may not mature until late adolescence).

76. Graham AMA Brief, *supra* note 40, at 18 (citing B.J. Casey et al., *Structural and Functional Brain Development and Its Relation to Cognitive Development*, 54 BIOLOGICAL

"voluntary behavior control and inhibition[77] such as risk assessment,[78] evaluation of reward and punishment,[79] and impulse control."[80] These prefrontal cortex functions correspond with the deficiencies that developmental psychologists observe in adolescents. Its underdevelopment plays an important role in decision-making[81] and the "ability to judge and evaluate future consequences."[82] The structural immaturity of the prefrontal cortex is a result of incomplete pruning and continuing myelination.[83] Pruning involves the "programmed elimination of unused and cumbersome neuronal connections believed to support the ability for the brain to adapt to its environment," which "enhance[s] the ability to process complex information quickly allowing the brain to make executive plans supporting voluntary control of behavior."[84] Myelination consists of "the process by which the brain's axonal connections become progressively insulated with a fatty white matter called myelin," which "makes communication between different parts of the brain faster and more reliable."[85] "While the exact ages at which this brain activity occurs may differ from one person to another, there is a consistent developmental pattern" across minors.[86]

PSYCHOL. 241, 243 (2000)).

77. *Id.* at 16 (citing R. Dias et al., *Dissociable Forms of Inhibitory Control Within Prefrontal Cortex with an Analog of the Wisconsin Card Sort Test: Restriction to Novel Situations and Independence from "On-Line" Processing*, 17 J. NEUROSCIENCE 9285, 9296 (1997)).

78. *Id.* at 16-17 (citing Facundo Manes et al., *Decision-Making Processes Following Damage to the Prefrontal Cortex*, 125 BRAIN 624, 624-25, 631, 635, 637 (2002)).

79. *Id.* at 17 (citing J. O'Doherty et al., *Abstract Reward and Punishment Representations in the Human Orbitofrontal Cortex*, 4 NATURE NEUROSCIENCE 95, 95 (2001); Robert D. Rogers et al., *Choosing Between Small, Likely Rewards and Large, Unlikely Rewards Activates Inferior and Orbital Prefrontal Cortex*, 20 J. NEUROSCIENCE 9029, 9034 (1999)).

80. Graham AMA Brief, *supra* note 40, at 17 (citing Antoine Bechara et al., *Characterization of the Decision-Making Deficit of Patients with Ventromedial Prefrontal Cortex Lesions*, 123 BRAIN 2189, 2198 (2000)); *see also* Anne-Marie R. Iselin et al., *Maturity in Adolescent and Young Adult Offenders: The Role of Cognitive Control*, 33 LAW & HUM. BEHAV. 455, 455, 457 (2009) ("[The] expansive neural circuitry to and from the [prefrontal cortex] is most directly responsible for cognitive control skills such as memory, attention, and inhibition.").

81. Graham AMA Brief, *supra* note 40, at 17 (citing Samantha B. Wright et al., *Neural Correlates of Fluid Reasoning in Children and Adults*, FRONTIERS HUM. NEUROSCIENCE, Mar. 2008, at 1, 7).

82. *Id.* (citing Bechara, *supra* note 80, at 2199).

83. See *id.* at 18-24 for a more detailed discussion of the process and effects of pruning and myelination; *see also* Miller AMA Brief, *supra* note 55, at 21-26 (addressing the process of pruning and myelination in more detail); Dobbs, *supra* note 20, at 59 (discussing the myelination process and its effect on teenagers).

84. Miller AMA Brief, *supra* note 55, at 21-22.

85. *Id.* at 23-24.

86. Massie, *supra* note 75, at 660; *see also* Richard F. Walsh, *Raising the Age for Juvenile Jurisdiction in Illinois: Medical Science, Adolescent Competency, and Cost*, 39 LOY. U. CHI. L.J. 767, 774 (2008) ("[T]he brain undergoes massive changes between the ages of twelve and twenty-one.").

Significantly, this scientific research has provided a neurological explanation for much of the research describing adolescents' behavioral immaturities. Developmental science indicates that, although adolescents may be capable of understanding the particularities of a situation and identifying the various risks and rewards, they may not be able to respond to that knowledge in making appropriate decisions. For instance, teenagers may understand various options, but are prone to over-value the rewards of an action despite comprehending the risks. Teenagers may not fully appreciate future consequences even if able to verbally articulate those consequences.[87] This behavior is fully consistent with the unfinished development of the adolescent brain.[88]

In addition to these structural immaturities, developmental neuroimaging studies show that the adolescent brain *functions* differently than does an adult brain. Specifically, the research shows that "adolescents and adults exhibit different patterns of brain activity during decision-making tasks."[89] These functional differences help explain why "adolescents experience increasing motivation for risky and reward-seeking behavior without a corresponding increase in the ability to self-regulate behavior."[90] This includes minors' natural compulsion to imitate what they see others do,[91] which can cause them to carry out adult action even though they do not properly weigh its consequences.

Early on, following *Roper v. Simmons*,[92] a few scholars criticized the conclusions relied on by the Supreme Court, primarily disputing causation links.[93] While it is true that correlation does not infer causation, the research overwhelmingly supports the assertion that the ways in which the brain is structurally and functionally immature strongly correlates with observed adolescent behavior.[94] At a minimum,

87. Dobbs, *supra* note 20, at 54.

88. However, it is worth noting that although the structure seems to give a good explanation for behavioral immaturities, at this point, the direct evidence tying specific structural findings to specific behaviors is still limited. *See generally* Maroney, *supra* note 48.

89. Graham AMA Brief, *supra* note 40, at 25-26 (citing Amy L. Krain et al., *An fMRI Examination of Developmental Differences in the Neural Correlates of Uncertainty and Decision Making*, 47 J. CHILD PSYCHOL. & PSYCHIATRY 1023, 1028-29 (2006)).

90. *Id.* at 26.

91. *See* Kim H. Pearson, *Mimetic Reproduction of Sexuality in Child Custody Decisions*, 22 YALE J.L. & FEMINISM 53, 66 (2010) (discussing the role of imitation in child development).

92. 543 U.S. 551 (2005).

93. *See* Reply Brief for Petitioner at 12-13, Roper v. Simmons, 543 U.S. 551 (2005) (No. 84454); Cunningham, *supra* note 12, at 281 (citing Dorothy Otnow Lewis et al., *Ethics Questions Raised by the Neuropsychiatric, Neuropsychological, Educational, Developmental, and Family Characteristics of 18 Juveniles Awaiting Execution in Texas*, 32 J. AM. ACAD. PSYCH. & L. 408, 409 (2004)).

94. *See* Steinberg & Scott, *supra* note 52, at 1012-13. Even in the absence of a cause and effect relationship between the adolescent brain and behavioral immaturities, the research on the

most scholars concede that the behavioral differences in adolescents "*likely* have a neurobiological basis."[95] This dispute, although more likely a disagreement on the degree of connection, raises the question of how much scientific certainty is enough to rely on in developing legal policy, a topic discussed in further detail below.[96] We argue that the science shows, at least, that adolescent and adult neurology differs enough that the law should err on the side of caution in addressing the behavior and culpability of minors.

The existence of scientific findings on the workings of adolescence has profound implications in law making. When legislatures, judges, juries, and policymakers have traditionally relied on their perceptions and expert testimony from psychologists, now decisions about the development of law can be more solidly based on physical scientific research. The question of how to incorporate this research, however, is complex. In the next Part, we discuss a series of recent Supreme Court decisions involving adolescents and the role played by scientific evidence.[97] We explore various options for explaining what at first seems like contradictory behavior by the Court,[98] and then proceed in Part IV to explore standards for the proper use of scientific studies in adolescent law development.[99]

III. THE SUPREME COURT'S TREATMENT OF SCIENTIFIC EVIDENCE IN RECENT CASES

In the past decade, the Supreme Court has reviewed scientific findings about minors in a string of juvenile justice cases[100] and in a First Amendment challenge to a California law banning the sale of violent video games to minors.[101] In the juvenile justice cases—*Roper*, *Graham v. Florida*,[102] and *Miller*—the Court used developmental science to narrow the Eighth Amendment boundaries as they pertain to minors, and thus to expand minors' protections.[103] On the other hand, in *Brown v.*

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behavioral immaturities is sufficient to establish that juveniles, as a class, function differently than adults. The link to brain immaturities merely adds a measure of credibility and explanation.

95. *Id.* at 1013 (emphasis added).

96. *See infra* Part IV.A.

97. *See infra* Part III.

98. *See infra* Part III.C.

99. *See infra* Part IV.

100. *See* Miller v. Alabama, 132 S. Ct. 2455, 2464-65 (2012); Graham v. Florida, 560 U.S. 48, 68-69 (2010); Roper v. Simmons, 543 U.S. 551, 569-70 (2005).

101. *See* Brown v. Entm't Merchs. Ass'n, 131 S. Ct. 2729, 2739 (2011).

102. 560 U.S. 48 (2010).

103. *See Miller*, 132 S. Ct. at 2464-65, 2475, 2482 (combining the Court's lines of precedent from *Roper* and *Graham* to reach the conclusion that mandatory life without parole for juveniles

Entertainment Merchants Ass'n,[104] the Supreme Court discounted similar scientific arguments relating to the impact of violent video games on minors.[105] These seemingly inconsistent approaches to using adolescent developmental science are actually reconcilable and illustrate how courts and other policymakers should treat such studies.

A. Roper, Graham, *and* Miller

Before 2005, the law on the limits of punishment for juvenile offenders was based on *Eddings v. Oklahoma*,[106] *Thompson v. Oklahoma*,[107] and *Stanford v. Kentucky*,[108] which permitted the death penalty notwithstanding strong urging to seriously consider youth as a mitigating circumstance. The Court in *Eddings* observed: "Our history is replete with laws and judicial recognition that minors, especially in their earlier years, generally are less mature and responsible than adults. Particularly 'during the formative years of childhood and adolescence, minors often lack the experience, perspective, and judgment' expected of adults."[109]

The Supreme Court grabbed science with both hands when shaping the juvenile justice legal policies. The Supreme Court in *Roper*, *Graham*, and *Miller* used developmental science to conclude that juveniles are less culpable than adults and more likely to be deterred from future crime.[110] Based on this, the Court held that minors cannot be punished with the death penalty or life imprisonment without parole for a non-homicide crime, and cannot be sentenced under a mandatory sentencing scheme to life imprisonment without parole for homicide crimes.[111]

In 2005, the Supreme Court in *Roper* eliminated the death penalty for "offenders who were under the age of 18 when their crimes were committed."[112] In reaching its decision, the Court relied in part on an amicus curiae brief of the American Medical Association ("AMA"), the

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violates the Eighth Amendment); *Graham*, 560 U.S. at 59-60, 68-69, 82 (holding that the Eighth Amendment prohibits a sentence of life without the possibility of parole for a juvenile convicted of a non-homicide offense, comparing life without parole to the death penalty); *Roper*, 543 U.S. at 569-71, 578 (finding that the Eighth Amendment bars capital punishment for children).

104. 131 S. Ct. 2729 (2011).

105. *Id.* at 2739.

106. 455 U.S. 104 (1982).

107. 487 U.S. 815 (1988) (plurality opinion).

108. 492 U.S. 361 (1989) (plurality opinion).

109. *Eddings*, 455 U.S. at 115-16 (quoting Bellotti v. Baird, 443 U.S. 622, 635 (1979)).

110. *See, e.g.*, *Roper*, 543 U.S. at 571.

111. *Miller*, 132 S. Ct. at 2475; *Graham*, 560 U.S. at 82; *Roper*, 543 U.S. at 578.

112. *Roper*, 543 U.S. at 578.

APA, and other health professionals[113] that supported the position that juveniles as a class have diminished culpability for their actions based on immaturity, susceptibility to outside pressures, and transitory character.[114] The Court looked at prior cases that expressed concern about lack of maturity and responsibility,[115] and then used the scientific research presented in the amicus curiae brief to determine that "general differences between juveniles under 18 and adults demonstrate that juvenile offenders cannot with reliability be classified among the worst offenders."[116] These differences are: (1) "[a] lack of maturity and an underdeveloped sense of responsibility are found in youth more often than in adults;" (2) "juveniles are more vulnerable or susceptible to negative influences and outside pressures, including peer pressure;" and (3) "the character of a juvenile is not as well formed as that of an adult."[117]

In 2010, the Supreme Court had the opportunity to reconsider *Roper* in the case of *Graham*.[118] Again, the AMA and others filed an amici curiae brief, similar to the one in *Roper*, but with updated research.[119] In its opinion, the Court favorably cited the amicus brief to support the conclusion that "developments in psychology and brain science continue to show fundamental differences between juvenile and

113. The authors recognize that the brief for these medical organizations was submitted to advocate a certain position in the law. However, the underlying scientific evidence represents the collective expertise of a broad range of credible medical experts and researchers. Additionally, the AMA and APA, as organizations, are significant sources of authority on which of the available studies and developments in the science are reasonably reliable. Moreover, the Supreme Court accepted, and even quoted, many of the specific assertions from these briefs (which we collectively identify as AMA Briefs) in various cases. While our training in neuroscience is limited, for purposes of what a court could and should consider—based on Supreme Court precedent and medical community authority—we will cite the AMA briefs as well as the underlying science relied upon. For a thorough discussion of the neurobiological science in the briefs, oral arguments, and opinion of the Court in *Roper*, see Josie Foehrenbach Brown, *Developmental Due Process: Waging a Constitutional Campaign to Align School Discipline with Developmental Knowledge*, 82 TEMP. L. REV. 929, 983 (2009).

114. *Roper*, 543 U.S. at 569-70.

115. *See id.* at 569 (citing Johnson v. Texas, 509 U.S. 350, 359-62 (1993)). In *Johnson*, the Court held with respect to a nineteen-year-old, that "[t]here is no dispute that a defendant's youth is a relevant mitigating circumstance that must be within the effective reach of a capital sentencing jury . . . [because a] lack of maturity and an underdeveloped sense of responsibility are found in youth more often than in adults and are more understandable among the young." 509 U.S. at 353, 367.

116. *Roper*, 543 U.S. at 569.

117. *Id.* at 569-70; *see also* Steinberg & Scott, *supra* note 52, at 1014.

118. *See generally* Graham v. Florida, 560 U.S. 48 (2010).

119. *Compare* Graham AMA Brief, *supra* note 40, at iv-xix, *with* Brief of the Am. Med. Ass'n et al. as Amici Curiae in Support of Respondent at iv-xii, 543 U.S. 551 (2005) (No. 03-633) (comparing the list of scientific authorities cited).

adult minds."[120] Additionally, "[f]or example, parts of the brain involved in behavior control continue to mature through late adolescence."[121] The Court agreed with the AMA brief's conclusion: "Although adolescents can, and on occasion do, exhibit adult levels of judgment and control, their ability to do so is limited and unreliable compared to that of adults."[122] Ultimately, the Court extended *Roper* and held that persons under age eighteen "may not be sentenced to life without parole for a nonhomicide crime."[123]

Finally, in June 2012, the Court decided *Miller*.[124] Two sets of amici (led by the AMA and APA) filed amicus briefs with updated research supporting the conclusion that minors' brains are different than those of adults.[125] The Supreme Court extended the holding and reasoning of *Graham* and *Roper* to find that a sentencing scheme mandating life in prison without possibility of parole for juvenile homicide offenders is unconstitutional.[126] The Court cited the scientific evidence of *Roper* and *Graham* as updated with the new amicus briefs and included a footnote stating, "the science and social science supporting *Roper*'s and *Graham*'s conclusions have become even stronger."[127]

The Court's willingness to embrace this scientific research to protect juvenile offenders from extreme punishment is admirable. However, the Court did not appear to take such a protective approach when it decided *Brown* in 2011.[128]

B. Brown v. Entertainment Merchants Association

Brown centered on a California law that prohibited the "sale or rental of 'violent video games' to minors, and require[d] their packaging to be labeled."[129] Various studies were presented, concluding that violent video games cause aggressive behavior in minors who play them.[130] However, the Court rejected this argument by a vote of seven to two, summarily dismissing the scientific arguments as being based purely on a *correlation* between aggressive behavior and violent video games,

120. *Graham*, 560 U.S. at 68.
121. *Id.*
122. Graham AMA Brief, *supra* note 40, at 4 (footnote omitted).
123. *Graham*, 560 U.S. at 74-75.
124. Miller v. Alabama, 132 S. Ct. 2455, 2455 (2012).
125. *See* Miller AMA Brief, *supra* note 55, at 4; Miller APA Brief, *supra* note 65, at 8.
126. *Miller*, 132 S. Ct. at 2464.
127. *Id.* at 2464 & n.5.
128. *See* Brown v. Entm't Merchs. Ass'n, 131 S. Ct. 2729, 2738-39 (2011).
129. *Id.* at 2732.
130. *See id.* at 2768-70 (Breyer, J., dissenting).

rather than a *causal* relationship.[131] The Court held that the California law could not survive strict scrutiny analysis because it could not "identify an 'actual problem' in need of solving."[132]

In contrast, in the juvenile justice cases discussed in the prior Subpart, the Court accepted the neuroscience research presented by the AMA and APA, even though the connection between the brain immaturity and behavioral immaturity was not "proven."[133] In these cases, the Court decided that a "strong correlation" was sufficient evidence of causality.[134] The *Brown* Court's failure to give more credence to the studies that suggested a link between violent video games and harm to minors was sharply criticized by Justice Breyer in his dissenting opinion.[135] He found "sufficient grounds in these studies and expert opinions for [the] Court to defer to an elected legislature's conclusion that the video games in question are particularly likely to harm children."[136] When considered in tandem with the Court's recent opinions in *Roper*, *Graham*, and *Miller*—that, based on scientific research, juveniles are more susceptible to negative influences—it is worth inquiring into why the majority failed to consider the research on violent video games in favor of protecting minors. When the Court decided *Brown*, it had already decided both *Roper* and *Graham*, and was fully aware of the neuroscience suggesting that minors need greater protection, although it was not raised in the parties' briefs and the AMA and APA did not file amicus briefs.[137] Had the Court been inclined, it may have considered the neuroscience research to support a conclusion that minors make more impulsive decisions and were more likely to purchase and use, without parental consent, violent video games without proper concern for the risks. The Court may have decided that a legal distinction is to be drawn between the impulsivity that leads a minor to engage in criminal acts and the impulsivity that may cause a minor to purchase and consume violent video games, or the impulsivity that may lead a minor to lash out with similar violence when challenged or

131. *Id.* at 2738-39 (majority opinion).

132. *Id.* at 2738; *see also* Clay Calvert & Matthew D. Bunker, *Examining the Immediate Impact of* Brown*'s Proof-of-Causation Doctrine on Free Speech and Its Compatibility with the Marketplace Theory*, 35 HASTINGS COMM. & ENT. L.J. 391, 397 (2013) ("An actual problem in *Brown* would have existed only if it were established by empirical, quantitative, and causal evidence.").

133. *See, e.g.*, Graham v. Florida, 560 U.S. 48, 68-69 (2010); Roper v. Simmons, 543 U.S. 551, 569-71 (2005).

134. *See Graham*, 560 U.S. at 68-69; *Roper*, 543 U.S. at 569-71.

135. *Brown*, 131 S. Ct. at 2769-70 (Breyer, J., dissenting).

136. *Id.* at 2770.

137. *See generally id.*

threatened. However, the majority's unwillingness to consider the possible implications of principles derived from neuroscience and other fields applicable to minors is curious. We consider the implications of this choice and discuss some possible explanations for or approaches to reconciling *Brown* with the juvenile justice cases.

Recall that the Court concluded in the juvenile justice cases that: first, adolescents are more likely to engage in risky behavior than adults; second, adolescents are less able to control their impulses than adults; and finally, adolescents are less capable of regulating their emotional responses than adults. Assuming the truth of these conclusions, the Court could have found first that, to the extent there is any possibility that intense personal engagement as a perpetrator in violent video games may reduce the resistance to resorting to violence in real life situations, adolescents are sufficiently more likely to succumb to the impulse to do so, even knowing the risk of the consequences. Further, the Court could have found that, at some level, the response to images where the game player murders and maims other human beings in particularly gruesome ways has an emotional impact on the player. Since adolescents are less capable of regulating their emotional response, the impact of such images may be deeper and thus more harmful for them. These sample applications of neuroscience to minors and violent video games are naturally speculative. However, it is conceivable that analogies similar to these could have tipped the scales in favor of the California law.

On the other hand, based on the Court's language in *Brown*, even if the Court had applied neuroscience principles about minors' vulnerability, the result may not have been different. The Court may have interpreted the brain science evidence as most relevant to the compelling governmental interest in protecting minors in general,[138] but that was not the Court's focus. The Court's holding was based on what it perceived as the gaps in the specific link between using violent video games and harm to minors.[139] The largely social science research presented on this link was insufficient to persuade the majority of the Court. The Court may have been persuaded otherwise if one of the briefs had included results from MRI studies that observed adolescent brain activity while playing violent video games or while being confronted with a personal threat after playing such games. These studies could

138. *See* Preston & Crowther, *Minor Restrictions*, *supra* note 15, at 372 & n.185 (citing Ashcroft v. ACLU, 542 U.S. 656, 672-73 (2004); Reno v. ACLU, 521 U.S. 844, 863 & n.30 (1997)).

139. *See Brown*, 131 S. Ct. at 2738-42 (majority opinion).

have shown insufficient resilience to the impact of the images and greater likelihood to act on the impulses learned in the game based on areas of activation in the brain while playing these games.

The Court's failure to uphold a statute protecting minors in *Brown* may appear at odds with the juvenile justice cases of *Roper*, *Graham*, and *Miller*. But, upon closer examination, we find the treatment of the science presented by the briefs in these cases is reconcilable based on overarching principles that should continue to guide the development of legal policy regarding youth. The differences and similarities, and the possibility of reconciliation in the cases, are discussed in the next Subpart.[140]

C. Reconciling the Supreme Court's Decisions

The juvenile justice cases and *Brown* potentially may be distinguished on various grounds. The first possible distinguishing factor is the context. The juvenile justice cases required the Court to take an unusual and dramatic step to overturn, on Eighth Amendment grounds, laws that have been in place for decades.[141] The *Brown* opinion was also a surprising inroad into existing statutes and case law,[142] but *Brown* involved a First Amendment issue.[143] Although all the cases were decided as a matter of constitutional law, perhaps the Court's recent fervor regarding the First Amendment may explain why the Supreme Court required more proof of causality for the video game legislation to survive strict scrutiny analysis. The Court's current profound and particularized interest in the First Amendment began with *Brandenburg v. Ohio*[144] and *Hess v. Indiana*,[145] which "essentially turned the tables

140. *See infra* Part III.C.

141. Suzanne D. Strater, *The Juvenile Death Penalty: In the Best Interests of the Child?*, 26 LOY. U. CHI. L.J. 147, 150-52 (1995) (discussing the history of the juvenile death penalty from William Blackstone's *Commentaries* onward); *see supra* notes 100-05.

142. *See, e.g.*, Morse v. Frederick, 551 U.S. 393, 409-10 (2007) (limiting students' First Amendment rights in favor of school discipline); Bethel Sch. Dist. No. 403 v. Fraser, 478 U.S. 675, 685-86 (1986) (allowing a school to restrict a student monologue containing vulgar and sexual terms); Ginsberg v. New York, 390 U.S. 629, 636 (1968). The Court in *Ginsberg* stated:

> [M]aterial which is protected for distribution to adults is not necessarily constitutionally protected from restriction upon its dissemination to children. In other words, the concept of obscenity or of unprotected matter may vary according to the group to whom the questionable material is directed or from whom it is quarantined.

Ginsberg, 390 U.S. at 636; *see also* Erwin Chemerinsky, *Isaac Marks Memorial Lecture: Not a Free Speech Court*, 53 ARIZ. L. REV. 723, 728 (2011) (criticizing the Court's restrictive view of student speech in the *Morse* decision: "The banner at issue in this case was silly and incoherent. There was not the slightest evidence that it caused any harm; there was no claim that it was disruptive and certainly no evidence that it increased the likelihood of drug use.").

143. *Brown*, 131 S. Ct. at 2732.

144. 395 U.S. 444 (1969).

very dramatically, . . . [and] for most purposes . . . gave us guidance that we've had for essentially forty years."[146] Some have argued that the Roberts Court is "the most free speech Court in American history,"[147] and noted a willingness to "in some striking ways champion[] free speech rights."[148] Most scholars agree that this is true, except in cases involving school control of students, prisoners, government employees, and anti-terrorism efforts.[149]

Beyond the First Amendment distinction, another possible explanation lies in a comparison of the liberty interest outcomes. The Court's decisions in the juvenile justice cases and the video game case, notwithstanding arguably different reliance on science, all provided greater human rights and liberty for the juvenile defendants. Professor Frank Zimring drew a useful conceptual map when he separated adolescence law into three categories:[150] (1) liberty rights relate to the exercise of free choice with respect to the state; (2) entitlements are special opportunities (grants, licenses, etc.) the state may make available only to adults; and (3) responsibility protections address minors' accountability and protect them from harmful consequences.[151] Both the juvenile justice cases and the video game case may reflect the Court's belief that any doubts about the reliability of the neuroscience research should be pushed aside if in conflict with the liberty rights of minors.

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145. 414 U.S. 105 (1973).

146. Alan B. Morrison et al., *Panel Discussion on Recent U.S. Supreme Court Free Speech Decisions & the Implications of These Cases for American Society*, 76 ALB. L. REV. 781, 798 (citing generally Hess v. Indiana, 414 U.S. 105 (1973); Brandenburg v. Ohio, 395 U.S. 444 (1969)).

147. Chemerinsky, *supra* note 142, at 724 (stating later that this view "is inaccurate and hides the reality"). Erwin Chemerinsky cites, for example, Ken Starr as having declared the Roberts Court to be particularly interested in free speech. *Id.* at 724 n.14 (citing Ken Starr, President, Baylor Univ., Address at the Pepperdine Judicial Law Clerk Institute (Mar. 18, 2011)); *see also* Morrison et al., *supra* note 146, at 786-87 (statement of Adam Liptak) (noting that the Supreme Court is "willing to place First Amendment values ahead of other[s]").

148. Kathleen M. Sullivan, *Free Speech*, 35 PEPP. L. REV. 533, 540 (2008).

149. Chemerinsky, *supra* note 142, at 725 ("The pattern is uniform and troubling: when the government is functioning as an authoritarian institution, freedom of speech always loses."); *see also* Ronald K.L. Collins, *Exceptional Freedom–The Roberts Court, the First Amendment, and the New Absolutism*, 76 ALB. L. REV. 409, 414-15 (2013) (arguing that the Court is returning to dicta in *Chaplinsky v. New Hampshire*, 315 U.S. 568, 571-72 (1942), in which the Court delineated classes of speech that had historically been protected and considered others as low-value speech); Sullivan, *supra* note 148, at 540 ("In sum, the key to understanding the pattern of free speech cases in the Roberts Court lies not in a distinction between speakers espousing conservative or liberal causes, but rather in a distinction between speakers who speak with private resources and speakers who depend upon government largesse.").

150. FRANKLIN E. ZIMRING, THE CHANGING LEGAL WORLD OF ADOLESCENCE 111 (1982).

151. *Id.* Zimring suggests that eighteen is the appropriate age for liberty rights, and twenty-one is the appropriate age for entitlement and responsibility. *Id.*

Indeed, the juvenile justice cases cannot be seen as removing any "protections" or beneficial treatment historically accorded to minors, rather the opposite. This liberty analysis, however, is more troubling with respect to the video game case. *Brown*, although dealing with the relatively new phenomenon of violent video games, was in essence a revisit to the concept that teenagers must be protected in areas where they may make self-defeating and harmful decisions and parents should continue as the primary decision makers in such circumstances.

Another possible distinction among the cases is that the Court looks more favorably upon "hard science" research, which relies on precise measurement, calculation, and prediction, than on "soft science" research, which is more abstract, and includes fields such as psychology, economics, and sociology.[152] The neuroscience research in *Roper*, *Graham*, and *Miller* has been praised as lending a "hard science" edge to "soft science" research,[153] but the research presented in *Brown* supporting a link between violent video games and harm consisted of "soft" social science research. While the conclusions and the causality link may be just as real, there is extra persuasive power in the hard sciences. Thus, the distinction may be that, while the Court accepts hard science, it is not particularly persuaded by "soft science," and the briefs in *Brown* did not include the MRI science.

Using the treatment of science in these Supreme Court cases as a springboard, we next consider what principles should apply to the use of the science of adolescence in future cases.[154]

IV. HOW SCIENCE SHOULD GUIDE LEGAL POLICY

New science research on adolescent development and brain function has the potential for a much larger impact on legal principles if courts and legislatures were to incorporate it more consistently. But application of this scientific research to legal principles is not a simple matter. When legal policymakers attempt to base legal changes on

152. *See* Miller v. Alabama, 132 S. Ct. 2455, 2464 & n.2 (2012). For a definition of terms, see generally Larry V. Hedges, *How Hard Is Hard Science, How Soft Is Soft Science?: The Empirical Cumulativeness of Research*, 42 AM. PSYCHOL. 443 (1987). *See also* 25 TEX. JUR. 3D *Criminal Procedure: Trial* § 1020 (2012).

153. Maroney, *supra* note 48, at 109; *see also* ROBIN FELDMAN, THE ROLE OF SCIENCE IN LAW 155 (2009) ("If law is searching for certainty and reliability, the hard sciences would seem to offer stronger models to reach for than the social sciences."). *But see* Margaret A. Berger & Lawrence M. Solan, *The Uneasy Relationship Between Science and Law: An Essay and Introduction*, 73 BROOK. L. REV. 847, 855 (2008) ("While social science research may lack the crispness of the hard sciences, it can be conducted responsibly and should certainly not be ignored when its findings are relevant to the concerns of the legal system . . . .").

154. *See infra* Part IV.

scientific principles, they must do so carefully to ensure they reach the correct result.

Just because science cannot offer unlimited risk-free insights into adolescence does not mean that the law should forego its use. The broader benefits of using science to guide legal policy include working from a better, more consistent understanding and having a basis for widespread agreement. These advantages are substantial, and the knowledge gained from science could greatly help the law to more fully recognize and account for the nature of childhood.[155] However, despite its numerous advantages, a wholesale adoption of scientific knowledge also comes with some challenges for legal policymakers. Even in the best case scenario, competing legal policies may override the conclusion reached by clear scientific principles. For general legal policy-making, the benefits often outweigh the potential disadvantages, especially when careful thought and action can reduce the disadvantages. However, when applied to a particular case and a particular person, the challenges inherent with applying science in the law become amplified and can completely undermine the potential benefits.

This Part analyzes some of the key challenges that legal policymakers need to consider when choosing to allow science to direct legal policy and how those challenges can be minimized.[156]

A. The Changing Nature of Science

If science is ultimately concerned with ascertainable truth, then perhaps the truest statement about science is that our understanding of it evolves over time. Some commentators are quick to warn that neuroimaging research is still a fairly new discipline.[157] The essence of the scientific method is that hypotheses can be tested, and if proved

155. *See* Vivian E. Hamilton, *Immature Citizens and the State*, 2010 BYU L. REV. 1055, 1099 (2010) ("To the extent that researchers can reliably identify certain contexts in which adolescents are likely to make competent decisions, and others in which they are less likely to do so, developmental science might usefully inform law or policy."); *see also* Maroney, *supra* note 48, at 166 ("[Neuroscience research] contributes marginally to our understanding of general principles about the distinctiveness of adolescence as a developmental stage. . . . [This is] directly relevant to [adolescents'] relative culpability, ability to be deterred, and potential for rehabilitation."); Kevin W. Saunders, *A Disconnect Between Law and Neuroscience: Modern Brain Science, Media Influences, and Juvenile Justice*, 2005 UTAH L. REV. 695, 738-39 (discussing juvenile justice inferences from the latest neuroscience research).

156. *See infra* Part IV.A–C.

157. Sara B. Johnson et al., *Adolescent Maturity and the Brain: The Promise and Pitfalls of Neuroscience Research in Adolescent Health Policy*, 45 J. ADOLESCENT HEALTH 216, 218 (2009) ("In many respects, neuroimaging research is in its infancy; there is much to be learned about how changes in brain structure and function relate to adolescent behavior."); *see also* Steinberg & Scott, *supra* note 52, at 1013, 1016-17.

correct, they can add to existing theories or overturn theories to more accurately explain the available data. Thus, the fact that science changes is to be extolled as a virtue rather than criticized for inconsistencies that may arise.

Law and science both seek to discover overarching guiding principles to find solutions to issues of human interaction. In the effort of finding workable solutions, the law must consider the possible explanations of the behavior that leads to problems and the likely behavioral responses to changes in the law.[158] In this respect, law and science should be inherently compatible. However, one kink in this relationship is the lag between science realizing something is broken, and the time it takes the law to come to the same realization.[159] This is particularly true when the law is based on scientific knowledge, and later discoveries put the earlier science in question.[160] Even if judges were required to have some scientific expertise, it would be extremely difficult for judges to keep up with the rapid advances in many fields.[161]

Scientific knowledge grows and expands, and sometimes changes radically. For example, *Roe v. Wade*[162] and its progeny established rules for state intervention in abortions based on the scientific evidence of fetal development, generally divided along lines of trimesters, and medical predictions of the risk of harm to the mother.[163] As one commentator put it, "[t]he trimester line was not only unsatisfactory

158. Of course, in practice, law is also beholden to a series of other values and restrictions in finding solutions to society's problems, such as minimizing economic inefficiencies and social costs, and establishing a system that respects rights, among many others. A large body of literature has developed, reflecting the potential tensions between law and science. *See, e.g.*, Jeremy A. Blumenthal, *Law and Social Science in the Twenty-First Century*, 12 S. CAL. INTERDISC. L.J. 1, 47 (2002); Jean Macchiaroli Eggen & Eric J. Laury, *Toward A Neuroscience Model of Tort Law: How Functional Neuroimaging Will Transform Tort Doctrine*, 13 COLUM. SCI. & TECH. L. REV. 235, 274-78 (2012); Susan E. Cowell, Note, *Pretrial Mediation of Complex Scientific Cases: A Proposal to Reduce Jury and Judicial Confusion*, 75 CHI.-KENT L. REV. 981, 983-84 (2000). A discussion of this ongoing dialogue is beyond the scope of this Article.

159. FELDMAN, *supra* note 153, at 4 ("Most authors who explore problems at the intersection of law and science frame the issue in terms of how rapidly scientific information changes and how slowly the legal system responds."). Justice Blackmun touched on this problem, when he said that: "Scientific conclusions are subject to perpetual revision. Law, on the other hand, must resolve disputes finally and quickly." Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 597 (1993); *see also* Robin Feldman, *Historic Perspectives on Law & Science*, 2009 STAN. TECH. L. REV. 1, ¶ 4 ("Delay in the legal system is certainly a problem when law and science interact.").

160. FELDMAN, *supra* note 153, at 35 ("When courts adopt science rules, grafting them onto legal doctrines, the legal system can easily become fixated on those rules. We do not understand the subtleties of the underlying science, and we tend to endow it with mythical powers.").

161. Mary Jane Angelo, *Harnessing the Power of Science in Environmental Law: Why We Should, Why We Don't, and How We Can*, 86 TEX. L. REV. 1527, 1532 (2008).

162. 410 U.S. 113 (1973).

163. FELDMAN, *supra* note 153, at 21-22.

from a philosophical standpoint, it was also inadequate from a scientific standpoint," because new research showed "the safety point for the mother to have an abortion moved later than the first trimester and the viability point for the fetus moved earlier than the third trimester."[164] However, the trimester lines persisted for nearly twenty years before the Supreme Court ruled in *Planned Parenthood v. Casey*[165] that the state had interests throughout the gestational period.[166]

Critics of the Supreme Court's juvenile justice decisions have focused on that risk of change.[167] In this context, one commentator stated that "as a basis for constitutional doctrine, science may undermine tomorrow what it builds up today."[168] Certainly, if all of the scientific evidence relied on by the Supreme Court were undermined in the near future, the precedent set by the Supreme Court, and all subsequent cases that have resulted from the recent juvenile justice cases, would also be undermined. On the other hand, if the scientific evidence supporting the decision remains sound, the Supreme Court's decision will have added credibility. In either event, a decision must be made in individual matters of controversy. The Supreme Court, through the process of certiorari, makes decisions about when a matter of national significance must be addressed. It can either use science in making its decision or not. There is always some risk that what appears to be solid, well documented, long-term scientific findings will be thrown out with some new discovery. But making a decision without science is hardly an improvement. Science adds a foundation and credibility to a decision, and makes better law than no science. As one commentator stated, "[w]hen parties and interested observers can weigh the evidence for themselves and conclude that the factfinder has drawn reasonable inferences and reached warranted conclusions, public confidence in authoritative rulings will be at its zenith."[169] Where a court uses science appropriately, those involved in a case, or otherwise interested in the

164. *Id.* at 23.

165. 505 U.S. 833 (1992).

166. FELDMAN, *supra* note 153, at 22-23. The same has held true for regulating environmental hazards. David Kriebel, *How Much Evidence Is Enough? Conventions of Causal Inference*, LAW & CONTEMP. PROBS., Winter 2009, at 121, 121 ("There are far too many examples of environmental hazards that were permitted to be produced long after the evidence for harm was substantial.").

167. *See* John F. Stinneford, *Youth Matters:* Miller v. Alabama *and the Future of Juvenile Sentencing*, 11 OHIO ST. J. CRIM. L. 1, 2-3 (2013).

168. *Id.* at 3.

169. Richard B. Katskee, *Science, Intersubjective Validity, and Judicial Legitimacy*, 73 BROOK. L. REV. 857, 865 (2008).

case, may have greater confidence in the outcome, knowing that the result is based on measurable characteristics beyond the judge's personal opinion or ideological leanings.

When the science changes, the system allows the Supreme Court to take another case and modify its conclusions. Similarly, a lower court may make a decision without science and hope it reflects reality, or use science and make a better decision, even if future developments suggest changes in analysis in a future case. As long as there is a reasonable basis to believe that the science presented is accurate as of present knowledge, using it is better than guessing.

In close cases, perhaps legislatures, rather than courts, should lead the task of incorporating science into laws affecting adolescents. Under the common law system, courts are restricted to some extent from realizing the full benefits of science. Although incorrect or bad law usually gets overturned eventually, *stare decisis* suggests that for a time courts may tend to follow bad precedent for clarity and consistency, regardless of the best and most correct approach to the law. Legislatures, on the other hand, may have more freedom to react to scientific advancements with new laws or amendments to older laws. The process is still burdensome and marked by some lethargy, but a legislature is not bound by prior court decisions unless the court decisions have identified certain conclusions as constitutionally impermissible. The courts should provide some deference to the legislature if it has conducted substantial investigation using science and other expertise. The legislature has more time and resources for such investigation.

Another guidepost is, of course, adopting proper procedures to determine if the science is sound. Because of the risk in evaluating science, it is safer to use science to support the status quo rather than use science to upend it. This principle is particularly applicable in the law of adolescence. The latest neurological studies reinforce the historical protections, such as the contract infancy doctrine, which are currently under attack as being outdated and irrelevant.[170] While the brain research described in Part II[171] and used by the Supreme Court as explained in Part III[172] is, at present, very solidly supported, there are other areas where the research is not as clear. In those cases, courts and legislatures should be guided by the principles we propose below.[173]

170. *See* Preston & Crowther, *Infancy Doctrine Inquiries*, *supra* note 15, at 64-65.
171. *See supra* Part II.
172. *See supra* Part III.
173. *See infra* Part IV.B.

B. Acting with Scientific Uncertainty

Another key issue for incorporating science into the law is deciding how much certainty is needed for a court (or a legislature) to act based on science. This is especially true since scientific research is frequently divided for and against most propositions. As one commentator put it, "[o]ne of the biggest challenges of the legal system is to be able to address the uncertainty inherent in science."[174] Courts must determine at what point the scientific evidence is certain enough to be worth using.

One of the difficulties in addressing this issue is that there is no one-size-fits-all answer. What may be sufficient foundation for the science in civil proceedings may not hold up in criminal proceedings or as the basis for constitutional interpretation. As noted above, where First Amendment issues are involved, even very strong supporting evidence may not be sufficient.[175]

We cannot expect fully unified views on any scientific data. The APA felt so confident in the existing research that in its brief submitted to the *Miller* court, it declared that "[b]y now, '[t]here is incontrovertible evidence of significant changes in brain structure and function during adolescence,' and '[a]lthough most of this work has appeared just in the last 10 years, there is already strong consensus among developmental neuroscientists about the nature' of these changes."[176] Even so, some critics emerged charging that "at least some of the studies are unsound."[177]

A court need not wait until every relevant study is uniformly believed to be "sound," because that will never happen. Individuals, groups, and even scientists may have agendas for challenging studies, but a strong consensus in the educated, relevant scientific community is sufficient. Thus, the issue for legal policymakers is whether the underlying scientific research is enough. Although by the time of *Miller*, neuroscience research on adolescents had emerged into a "strong consensus," the Supreme Court had initially acted upon the research seven years earlier in *Roper* when the science was not as well established. The decision to rely on the then-existing science has since

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174. Angelo, *supra* note 161, at 1531.

175. *See, e.g.*, Brown v. Entm't Merchs. Ass'n, 131 S. Ct. 2729, 2768-70 (2011) (Breyer, J., dissenting) (summarizing the vast quantities of scientific evidence that the majority rejected about the harm that violent video games cause). Outside of the First Amendment, conclusive proof may not be required.

176. Laurence Steinberg, *Should the Science of Adolescent Brain Development Inform Public Policy?*, 64 AM. PSYCHOLOGIST 739, 742 (2009).

177. Stinneford, *supra* note 167, at 3 (citing Deborah W. Denno, *The Scientific Shortcomings of* Roper v. Simmons, 3 OHIO ST. J. CRIM. L. 379, 379 (2006)).

been validated, but at the time, the Court made the decision whether the research was reliable enough.

Legal policymakers need not err on the side of requiring too much certainty in the conclusions of scientific research.

> All scientific work is incomplete—whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us a freedom to ignore the knowledge we already have, or to postpone the action that it appears to demand at a given time.[178]

To require near certainty in scientific research before making decisions, especially decisions that affirm historical rights and protections, is irresponsible when useful, valid scientific expertise is available.[179]

Despite these challenges to applying science to legal policymaking, it is possible to do so successfully, as discussed next.[180]

C. Managing Science to Make Good Legal Policy

"Science has been and can be enormously helpful to the legal system. The question is how to effectively manage the role that science can play."[181] Casting the teachings of science aside would be an enormous disservice to the real people who must operate under legal schema, particularly in the case of the young and impressionable who will carry the burden of gaps in the legal system for the rest of their lives. However, we should not throw the bathwater with the baby into the stroller. Responsible decisions must be made at various points in the process of using scientific findings in reaching legal policy. Ideally, good science guides, but does not, except in very exceptional cases, dictate legal policy.[182] We propose various principles to guide these decisions.

A precursor to useful incorporation of science requires policymakers to maintain a healthy appreciation for the fact that science

178. Kriebel, *supra* note 166, at 128.

179. Emily Hammond Meazell, *Super Deference, The Science Obsession, and Judicial Review as Translation of Agency Science*, 109 MICH. L. REV. 733, 748 (2011) (citing SHEILA JASANOFF, THE FIFTH BRANCH: SCIENCE ADVISERS AS POLICYMAKERS 50 (1990)) ("[A] scientific determination may be considered valid even if there is not universal scientific consensus to that effect.").

180. *See infra* Part IV.C.

181. FELDMAN, *supra* note 153, at 11.

182. Meazell, *supra* note 179, at 744 ("Certainly, our institutions ought to do their best to incorporate good science into decision making, but the ultimate decisions that must be made are policy choices."); *see also* FELDMAN, *supra* note 153, at 169 ("[S]cience works best, not when law defers to science, but rather when we use scientific insights to help craft legal rules within the proper parameters of a legal inquiry.").

will evolve, and in some cases, change. This fact alone is not a barrier to its use, but is one piece in thinking about the role of science in decisions. The law can potentially keep up with the changes, and the legislature and courts have, in the system, the ability to respond to major changes in the direction of science, even though there are some costs involved with changes. Both courts and legislatures need to be open to new science, rather than rigidly applying precedent where it does not make sense to do so. Because of the nature of ongoing scientific research, policymakers must wait until findings are at least well established. In some situations, this might entail significant delay in adopting good policies and perpetuate the cycle of the law lagging behind science. Nonetheless, it is better to postpone radical changes until a reasonable consensus evolves.

There is no magic standard for what is the right amount of consensus. Determining when scientific evidence is enough is never going to be an easy task, and will almost never produce a certain result. The optimal solution, therefore, is a balancing of factors. When evaluating conflicting evidence, lawmakers should consider: (1) the relative quantity of studies whose conclusions support each side of the argument; (2) the relative quality of the studies;[183] and (3) the degree of harm from a decision based on incorrect science. The quality of the studies is typically the most difficult determination in most situations, but is not an insurmountable hurdle. A legislature has no excuse for not doing a proper investigation into the available research. A judge has less time and is largely limited by the investigations offered by the competing parties, but judges make difficult decisions as a career and are well equipped to understand the significance of the language used and the credibility of the sources.

Other guiding principles include using science as the foundation for policy, rather than for rigid or formulaic rules, and a preference for using science when it reinforces and supports historical rights and protections. These standards help eliminate or vastly diminish the risk of using science to guide law. Professor Robin Feldman explains:

> [W]hile science cannot tell us how to craft an appropriate legal rule, science can play an important role in testing the assumptions underlying legal rules as the legal system develops those rules. This evaluative role integrates well with law's natural process of interpretation and adaptation. Science thereby operates within law's domain but consistent with the parameters of the legal process.[184]

183. The quality of the studies can be evaluated using the *Daubert* factors. *See* Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 592-95 (1993).

184. FELDMAN, *supra* note 153, at 174.

For example, in the contract infancy doctrine setting, courts could use evidence of adolescents' brain immaturities to create a general policy that, because children are not fully developed and are subject to impulsive behavior, contracts they enter into are generally susceptible to being unfair to the minor. This policy does not dictate a rule, and can be weighed along with numerous other factors. This use of science is better adapted to an approach, based on centuries of law, that many or most juveniles as a group are less able to protect themselves from overreaching sales tactics than are adults. Creating a broad guiding policy is much better than using the same research to conclude that minors might be individually capable based upon how developed their individual brains have become.

The court will not have the benefit of rigorous scientific study comparing the particular minor before it to others or to adults. Courts tread on weaker ground when asked to analyze scientific evidence to split hairs to attempt a determination of whether or not a particular minor's brain function is sufficiently developed to bar the use of the infancy doctrine. We discuss elsewhere the reasons behind the development of a rigid age rule,[185] and the additional problems in subjecting individual minors to unnecessary and costly litigation that can be avoided with clear policy rules.[186] In addition, in the case of adolescent law, the scientific findings support the historical laws, and thus, are not being introduced for the purpose of a radical change in centuries of legal analysis. While scientific findings can, and should, be used—as by the Supreme Court in the juvenile justice cases—to dramatically alter existing norms, the use of scientific evidence is more secure in support of existing policy, and lower levels of reliability are acceptable. The use of science creates a sliding scale for deciding when the studies are sufficiently embraced by the scientific community. Less reliability should be required when supporting longstanding legal principles; more should be required when science is used to overturn established law.

The above principles are admittedly partial and perhaps imperfect, but they provide workable guidelines for legislatures and courts to appropriately incorporate scientific insights of adolescence into the law.

185. *See* Preston & Crowther, *Minor Restrictions*, *supra* note 15, at 369 ("As a matter of constitutional law, categorical lines are perhaps not ideal nor necessary for determinations in a world of unlimited resources. But, the Supreme Court is quite clear that the age of minority requires a fixed line and that the line is appropriate at age eighteen.").

186. *See id.* at 368-71 (arguing that, because it is impossible for a fact finder to determine brain maturity, minors' rights would be brought into uncertainty, while adults who repeatedly interact and contract with minors would have the greatest incentive and capability to shape the law according to their own desires).

This is not to say that all challenges will go away. As one commentator expounded, "science and law remain uncomfortable bedfellows; but twin beds are not an option. We may expect, therefore, that jumbled together, they will toss and turn for a long time to come."[187] While this statement may prove true, it is imperative that legislatures and courts continue to work towards an appropriate balance of science and law that will allow the law to fully recognize the limitations, challenges, and opportunities unique to adolescence. The benefits of this can be seen in the potential to strengthen doctrines, such as the contract infancy doctrine, as discussed in the following Part.[188]

V. REINFORCING THE INFANCY DOCTRINE WITH SCIENCE

The infancy doctrine is one instance in which scientific evidence can inform the law to the benefit of minors. Elsewhere we discuss the infancy doctrine in more detail, but simply put, it allows minors to disavow certain contracts.[189] The infancy doctrine remains relatively unchanged from its inception in early common law.[190] Judges have relied almost exclusively on precedent and prudence to craft necessary exceptions to the doctrine to serve its overall purpose.[191] Now, scientific research can inform the infancy doctrine and reinforce its foundations.

Without the protections of the infancy doctrine in place, adolescents would be bound to imprudent and harmful contracts that present prospects of immediate rewards, but come with great risks as well. Current scientific evidence on adolescence suggests two broad conclusions that the law can incorporate. First, adolescents are, in fact, different from adults. Because these differences are neurobiological and significant, the law needs to account for them. Second, adolescents need protections from themselves as much as from others. Both of these conclusions reinforce the current contract infancy doctrine, and even suggest that the current doctrine may be underinclusive.

Additionally, the lack of impulse control and emotional regulation in adolescents means that, as a class, they are more likely to act

187. Jed S. Rakoff, *Science and the Law: Uncomfortable Bedfellows*, 38 SETON HALL L. REV. 1379, 1393 (2008).

188. *See infra* Part V.

189. *See* Cheryl B. Preston, *CyberInfants*, 39 PEPP. L. REV. 225, 231-34, 252-54 (2012) (explaining why minors need more, and not less, protection because of their adeptness at using technology, such as the Internet); Preston & Crowther, *Infancy Doctrine Inquiries*, *supra* note 15, at 50-51; Preston & Crowther, *Minor Restrictions*, *supra* note 15, at 346-48.

190. *See* Preston & Crowther, *Infancy Doctrine Inquiries*, *supra* note 15, at 47 (tracing the basic doctrine to the fifteenth century).

191. *See id.* at 51-63; Preston & Crowther, *Minor Restrictions*, *supra* note 15, at 346-48; Preston, *supra* note 189, at 232-52.

irrationally than adults.[192] Without the ability to consistently exercise good judgment[193] and act with full appreciation of the consequences,[194] minors are more likely to enter into disadvantageous contracts, regardless of whether the contracting adult is intentionally taking advantage of the minors. The infancy doctrine protects minors from both of these situations by guarding them against their own mistakes and discouraging adults from contracting with them.[195] Justifying the infancy doctrine on this recent scientific research can help judges to refine the doctrine (or retain the doctrine unchanged), rather than undermine its necessary protections on the grounds that the doctrine may seem antiquated and outdated.

VI. CONCLUSION

Relying on adolescent developmental science, two prominent juvenile justice scholars concluded that "juveniles are different in fundamental ways that bear on decisions about their appropriate treatment within the justice system—and that this scientific knowledge should be the foundation of the legal regulation of juvenile crime."[196] Even in the absence of a clear cause-and-effect relationship between the adolescent brain and behavioral immaturities, the research on the behavioral immaturities is sufficient to establish that juveniles, as a class, function differently than adults. The link to brain immaturities merely adds a measure of credibility and explanation. Thus, we argue that this scientific knowledge should be the foundation of any policy decisions involving adolescents.

The Supreme Court's recent forays into evaluating science when deciding issues related to adolescents is significantly instructive. The Court's adoption of scientific evidence of minors' vulnerabilities and limitations in resisting bad choices in *Roper*, *Graham*, and *Miller* stands in seeming contrast to the Court's failure to rely on the same studies in *Brown*. The *Brown* Court considered some scientific evidence that violent video games caused harm to minors, but then dismissed such evidence as insufficient. It is curious that the Court did not reference the brain science that suggested in the juvenile justice cases that minors are

192. *See* Massie, *supra* note 75, at 653-54 ("[O]ngoing research into brain development, revealing later development in the cerebral cortex than scientists had once thought to be the case, might correlate with lower faculties of judgment and impulse control than can be expected in more mature adults.").

193. Graham AMA Brief, *supra* note 40, at 8-9 (citing Luna, *supra* note 61, at 251).

194. *Id.* at 10-11 (citing Steinberg & Scott, *supra* note 52, at 1538).

195. 43 C.J.S. *Infants* § 210 (2010).

196. SCOTT & STEINBERG, *supra* note 20, at 29.

more vulnerable and need protection. Regardless, the Court's seemingly divergent approaches to science in the juvenile justice cases and *Brown* are reconcilable, and show a willingness for the Court to use science to protect adolescents, as long as doing so does not threaten constitutional rights. The cases also suggest that current legal policy is more susceptible to "hard science," such as studies based on MRI research, than "soft behavioral science."

The existing science about adolescent behavior and neural development paints a picture of minors who, as a class, are less able to evaluate risks, control their impulses, and regulate their emotions. Recent neuroscience has provided a physiological basis to explain these long developed traits. The evidence shows that adolescents' brains are functionally and structurally different than those of adults.

This scientific evidence has been useful for cases involving juvenile justice, but has not been applied outside that setting, despite its potential to reinforce existing protections for adolescents and redefine or add others.[197] As legal policymakers incorporate this evidence and other scientific evidence regarding adolescents, they must act with caution. However, if used appropriately, science has great potential to tailor the law to the needs and realities of adolescence.

197. We conducted a Westlaw search on March 4, 2014 in the "all cases" database for "MINORS CHILD! ADOLESCENTS YOUTH TEENS /100 "BRAIN SCIENCE," NEUROBIOL! NEUROSCIEN!." Outside of cases involving juvenile justice, no case discussed this kind of science in connection with making policy and developing law. The cases where these words were found generally were discussing the condition or needs of individual children in the family law system or in an unrelated casual reference.