

ADOLESCENT BRAIN DEVELOPMENT

Adolescence is a period of physical, mental, and emotional development, generally occurring between the ages of 12 and 18, often accompanied by distinct behavioral changes.¹

Neuroscience research shows that there are physical differences between the brains of adults and youth.

- According to recent findings, the human brain does not reach full maturity until at least the mid-20s.²
- The specific changes that follow young adulthood are not yet well studied, but it is known that they involve increased myelination and continued adding and pruning of neurons.³
- The prefrontal cortex of the brain is crucial for weighing risk vs. reward, future planning, impulse control, and is critical for a person to be able to make rational decisions.⁴ However, it is one of the last parts of the brain to develop and is still not fully mature by late adolescence.⁵
- The limbic system, which assists in processing and managing emotions, is still maturing during adolescence. As a result, adolescents are more prone to experiencing mood swings and acting in an impulsive, instinctive manner.⁶

In addition to structural differences, adolescent brains have an imbalance among these developing brain systems

- The subcortical region of the brain, responsible for novelty and emotions, will more frequently take precedent over the prefrontal cortex, responsible for self-control, in an adolescent brain.⁷
- As the National Research Council states, “In emotionally charged situations with limited time to react, as may be the case for most juvenile offenses, basic emotional circuits may drive adolescent actions. In more neutral contexts, more top-down cortical circuits may have a greater impact on decisions.”⁸

Youth, even in their late teens, do not have the same ability as adults to make mature decisions.

- Engaging in reckless actions during adolescence is socially normative behavior.⁹ However, although crimes peak around late adolescence, they begin a steep decline into adulthood.¹⁰
- It is harder for adolescents to exercise self-control than it is for adults.¹¹ In fact, it is unreasonable to expect that people younger than 18 will have a fully formed ability to resist impulses.¹²
- Adolescents and adults think differently in terms of risks and rewards when considering alternative choices. In particular, because of shifts in dopamine production, kids are more likely to place greater weight on rewards than on risks when making such a choice.¹³ This type of decision-making is likely to lead to risky behaviors.¹⁴
- Adolescents are less likely to consider the long-term consequences of the actions they choose because their capacity for thinking and planning for the future is still developing.¹⁵



Youth are more vulnerable to the negative influences of environment and peer pressure than adults are.

- Research shows that during youth and adolescence, people are more likely to engage in risky behaviors because of peer pressure.¹⁶
- Specifically, one study showed that adolescents experienced increased stimulation in reward-related circuitry when performing a difficult task in the presence of peers.¹⁷
- Negative characteristics of neighborhoods have a major influence on juvenile delinquency.¹⁸ Because youths have less freedom over their lives than adults, they are often unable to escape these environments.¹⁹
- Such negative environments often include emotional and physical trauma, which can inhibit effective adolescent brain development.²⁰

Crime is often a characteristic of the period of adolescence itself. It does not necessarily indicate the final character of a person.

- Adolescence is a time when a person is still forming an identity, a process that will not be complete until adulthood.²¹
- Because of the changes taking place during adolescence, most young offenders will not become adult offenders.²² Furthermore, there is no reliable way to tell which juveniles will be among the few that do continue their criminal behavior into adulthood.²³
- In fact, a male adolescent arrested at 16 for robbery has the same likelihood of being arrested as his peers at age 24.²⁴

The Supreme Court has acknowledged the fundamental differences between the brains of adults and adolescents.

- In *Roper v. Simmons*, the Supreme Court ruled that juveniles may not be sentenced to the death penalty, seeing it as cruel and unusual punishment for adolescents without fully developed brain systems responsible for behavior control.²⁵
- In 2012, with *Miller v. Alabama*, the Supreme Court ruled the sentencing of juveniles to mandatory life without parole unconstitutional. This judgment rested on the opinion expressed in *Roper v. Simmons* that adolescents have a, “‘Lack of maturity,’ and ‘Underdeveloped sense of responsibility,’ [which] lead to recklessness, impulsivity, and heedless risk-taking.”²⁶



END NOTES:

- 1 National Research Council. (2013). *Reforming Juvenile Justice: A Developmental Approach*. Committee on Assessing Juvenile Justice Reform, Richard J. Bonnie, Robert L. Johnson, Betty M. Chemers, and Julie A. Schuck, Eds. Committee on Law and Justice, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press. NIH, U.S. Library of Medicine, *Adolescent Development* (2013). Retrieved December 5, 2018 from <http://www.nlm.nih.gov/medlineplus/ency/article/002003.htm>
- 2 See The MIT Young Adult Development Project, available at <http://hrweb.mit.edu/worklife/youngadult/index.html> (last visited December 5, 2018).
- 3 Giedd, J. N., J. Blumenthal, et al. (1999). "Brain development during childhood and adolescence: A longitudinal MRI study." *Nature Neuroscience* 2(10): 861-863.
- 4 Antoine Bechara et al., *Characterization of the Decision-Making Deficit of Patients with Ventromedial Prefrontal Cortex Lesions*, 123 *Brain* 2189, 2198-2200 (2000) (patients with lesions in the prefrontal cortex suffered from impairments in the ability to make real-life decisions because of an insensitivity to future consequences, whether reward or punishment); Antoine Bechara et al., *Dissociation of Working Memory from Decision Making Within the Human Prefrontal Cortex*, 18 *J. Neurosci.* 428, 428, 434 (1998) (prefrontal cortex is necessary for decision-making in tasks involving evaluation of risk and reward); Antonio R. Damasio & Steven W. Anderson, *The Frontal Lobes, in Clinical Neuropsychology* 404, 434 (Kenneth M. Heilman & Edward Valenstein eds., 4th ed. 2003) (one "hallmark of frontal lobe dysfunction is difficulty making decisions that are in the long-term best interests" of the individual); see also Elizabeth R. Sowell et al., *In Vivo Evidence for Post-Adolescent Brain Maturation in Frontal and Striatal Regions*, 2 *Nature Neurosci.* 859, 860 (1999) (frontal lobes are essential for planning and organization); see also, e.g., Elkhonon Goldberg, *The Executive Brain: Frontal Lobes and the Civilized Mind* 23, 24, 141 (2001); see also B.J. Casey et al., *Structural and Functional Brain Development and its Relation to Cognitive Development*, 54 *Biological Psychol.* 241, 244-246 (2000).
- 5 Nitin Gogtay et al., *Dynamic Mapping of Human Cortical Development During Childhood Through Early Adulthood*, 101 *Proc. Nat'l Acad. Sci.* 8174, 8177 (2004); Casey et al., *supra* note 14, at 243; Linda Spear, *The Behavioral Neuroscience of Adolescence* 108-111 (2009).
- 6 National Juvenile Justice Network, *Using Adolescent Brain Research to Inform Policy*, (September 2012). Retrieved December 5, 2018 from http://www.njjn.org/uploads/digital-library/Brain-Development-Policy-Paper_Updated_FINAL-9-27-12.pdf p. 1.
- 7 National Research Council. (2013). *Reforming Juvenile Justice: A Developmental Approach*. Committee on Assessing Juvenile Justice Reform, Richard J. Bonnie, Robert L. Johnson, Betty M. Chemers, and Julie A. Schuck, Eds. Committee on Law and Justice, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.
- 8 National Research Council. (2013). *Reforming Juvenile Justice: A Developmental Approach*. Committee on Assessing Juvenile Justice Reform, Richard J. Bonnie, Robert L. Johnson, Betty M. Chemers, and Julie A. Schuck, Eds. Committee on Law and Justice, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.
- 9 Jeffrey Arnett, *Reckless Behavior in Adolescence: A Developmental Perspective*, 12 *Developmental Rev.* 339, 344 (1992).
- 10 Terrie E. Moffitt, *Adolescent-Limited and Life-Course-Persistent Antisocial Behavior: A Developmental Taxonomy*, 100 *Psychol. Rev.* 674-75, 685-686 (1993); see also Terrie E. Moffitt, *Natural Histories of Delinquency, in Cross-National Longitudinal Research on Human Development and Criminal Behavior* 3-4,7, 29 (Elmar G.M. Weitekamp & Hans-Jürgen Kerner eds., 1994); see also Arnett, *supra* note 1, at 343; see also DOJ Statistical Briefing Book, available at <https://www.ojjdp.gov/ojstatbb/crime/index.html> (last visited December 5, 2018) (statistics showing that arrests for both serious violent crimes and property crimes peak in late adolescence).
- 11 Elizabeth Cauffman & Laurence Steinberg, *(Im)Maturity of Judgment in Adolescence: Why Adolescents May Be Less Culpable Than Adults*, 18 *Behav. Sci. & L.* 741, 748-749, 754 & tbl. 4 (2000); see also Laurence Steinberg et al., *Age Differences in Sensation Seeking and Impulsivity as Indexed by Behavior and Self-Report: Evidence for a Dual Systems Model*, 44 *Developmental Psychol.* 1764, 1774-1776 (2008); see also Adriana Galvan et al., *Risk Taking and the Adolescent Brain: Who is at Risk?*, 10 *Developmental Sci.* F8, F13 (2007) (in study of individuals aged 7 to 29, finding that impulse control continues to develop over the course of adolescence and early adulthood); Rotem Leshem & Joseph Glicksohn, *The Construct of Impulsivity Revisited*, 43 *Personality & Individual Differences* 681, 684-686 (2007) (reporting significant decline in impulsivity from ages 14-16 to 20-22 on two different impulsivity scales).
- 12 Franklin E. Zimring, *Penal Proportionality for the Young Offender, in Youth on Trial* 271, 280, 282 (Thomas Grisso & Robert G. Schwartz eds., 2000).
- 13 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); see also Arnett, *supra* note 1, at 350-353 (summarizing evidence that adolescents' poor capacity for assessing probabilities plays a role in their reckless behavior); Bonnie L. Halpern-Felsher & Elizabeth Cauffman, *Costs and Benefits of a Decision: Decision-Making Competence in Adolescents and Adults*, 22 *J. Applied Developmental Psychol.* 257, 261, 264-270 (2001); Susan G. Millstein & Bonnie L. Halpern-Felsher, *Perceptions of Risk and Vulnerability, in Adolescent Risk and Vulnerability* 15, 34-35 (Baruch Fischhoff et al. eds., 2001); Elizabeth Cauffman et al., *Age Differences in Affective Decision Making as Indexed by Performance on the Iowa Gambling Test*, *Developmental Psychol.* 1, 11, 14 (2009). National Juvenile Justice Network, *Using Adolescent Brain Research to Inform Policy*, (September 2012). Retrieved December 5, 2018 from http://www.njjn.org/uploads/digital-library/Brain-Development-Policy-Paper_Updated_FINAL-9-27-12.pdf p. 1.

14 Arnett, *supra* note 1, at 344, 350-351 (noting that adolescents' distortion of perceived risks and rewards may explain why half or more adolescents reported driving while intoxicated, engaging in sex without contraception, illegal drug use, or some form of minor criminal activity).

15 See, e.g., Jari-Erik Nurmi, *How Do Adolescents See Their Future? A Review of the Development of Future Orientation and Planning*, 11 *Developmental Rev.* 1, 28-29 (1991); Laurence Steinberg et al., *Age Differences in Future Orientation and Delay Discounting*, 80 *Child Dev.* 28, 30, 35-36 (2009).

16 Thomas J. Berndt, *Developmental Changes in Conformity to Peers and Parents*, 15 *Developmental Psychol.* 608, 612, 615-616 (1979); Laurence Steinberg & Susan B. Silverberg, *The Vicissitudes of Autonomy in Early Adolescence*, 57 *Child Dev.* 841, 848 (1986); Elizabeth S. Scott & Laurence Steinberg, *Rethinking Juvenile Justice* 38 (2008); see also Kristan Erickson et al., *A Social Process Model of Adolescent Deviance: Combining Social Control and Differential Association Perspectives*, 29 *J. Youth & Adolescence* 395, 420-421 (2000) (discussing peer influence on delinquency); Fagan, *supra* note 8, at 382-384 (discussing coercive effect of social context on adolescents); Margo Gardner & Laurence Steinberg, *Peer Influence on Risk Taking, Risk Preference, and Risky Decision Making in Adolescence and Adulthood: An Experimental Study*, 41 *Developmental Psychol.* 625, 626-634 (2005); see also Laurence Steinberg & Kathryn C. Monahan, *Age Differences in Resistance to Peer Influence*, 43 *Developmental Psychol.* 1531, 1531 (2007) (describing Gardner and Steinberg study).

17 National Research Council. (2013). *Reforming Juvenile Justice: A Developmental Approach*. Committee on Assessing Juvenile Justice Reform, Richard J. Bonnie, Robert L. Johnson, Betty M. Chemers, and Julie A. Schuck, Eds. Committee on Law and Justice, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

18 Jeffrey Fagan, *Contexts of Choice by Adolescents in Criminal Events*, in *Youth on Trial* 371-394 (Thomas Grisso & Robert G. Schwartz eds., 2000).

19 Alan E. Kazdin, *Adolescent Development, Mental Disorders, and Decision Making of Delinquent Youths*, in *Youth on Trial* 33, 47 (Thomas Grisso & Robert G. Schwartz eds., 2000).

20 National Juvenile Justice Network, *Using Adolescent Brain Research to Inform Policy*, (September 2012). Retrieved December 5, 2018 from http://www.njjn.org/uploads/digital-library/Brain-Development-Policy-Paper_Updated_FINAL-9-27-12.pdf p. 2.

21 See, e.g., Alan S. Waterman, *Identity Development from Adolescence to Adulthood*, 18 *Developmental Psychol.* 341, 355 (1982) ("The most extensive advances in identity formation occur during the time spent in college."); Laurence Steinberg & Robert G. Schwartz, *Developmental Psychology Goes to Court*, in *Youth on Trial* 9, 27 (Thomas Grisso & Robert G. Schwartz eds., 2000) ("[M]ost identity development takes place during the late teens and early twenties."); Scott & Steinberg, *supra* note 10, at 52 (coherent integration of identity does not occur until late adolescence or early adulthood; the final stages of this process often occur in college years).

22 Moffitt, *Adolescent-Limited and Life-Course-Persistent Antisocial Behavior*, *supra* note 2, at 685-686; Steinberg & Scott, *supra* note 5, at 101-1015.

23 Edward P. Mulvey & Elizabeth Cauffman, *The Inherent Limits of Predicting School Violence*, 56 *Am. Psychologist* 797, 799 (2001) ("Assessing adolescents ... presents the formidable challenge of trying to capture a rapidly changing process with few trustworthy markers."); Thomas Grisso, *Double Jeopardy: Adolescent Offenders with Mental Disorders* 64-65 (2005) (discontinuity of disorders in adolescence creates "moving targets" for identification of mental disorders); John F. Edens et al., *Assessment of "Juvenile Psychopathy" and Its Association with Violence: A Critical Review*, 19 *Behav. Sci. & L.* 53, 59 (2001) (citing studies and noting difficulty of predicting juveniles' future behavior, such as antisocial conduct or psychopathy, because juveniles' social and emotional abilities are not fully developed).

24 National Research Council. (2013). *Reforming Juvenile Justice: A Developmental Approach*. Committee on Assessing Juvenile Justice Reform, Richard J. Bonnie, Robert L. Johnson, Betty M. Chemers, and Julie A. Schuck, Eds. Committee on Law and Justice, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

25 *Graham v. Florida* 560 U.S. 17 (2010). Retrieved December 5, 2018 from <https://www.law.cornell.edu/supct/pdf/08-7412P.ZO>

26 *Miller v. Alabama* 567 U.S. 2 (2012). Retrieved December 5, 2018 from <https://www.law.cornell.edu/supct/pdf/10-9646.pdf>