CLBB NeuroLaw Library

Brain Development & Sentencing: A Toolkit for Juvenile (Under 18) and Emerging Adult (18 - 25) Justice

Overview:

Neuroscience, the study of the brain, has made clear that the brain of an adolescent differs from that of a grown adult. The parts of the brain that detect threat and trigger emotional responses develop early, while the prefrontal cortex—the region that allows for planning, impulse control, and considering future consequences—develops more slowly. This brain-based gap explains why adolescents are both less likely to think ahead and appreciate risks and more heavily influenced by their peers and immediate rewards. The Supreme Court acknowledged that these developmental differences warrant different treatment of adolescents under the law.

Critically, these differences do not disappear at one's 18th birthday. Neuroscience shows that key brain regions continue developing and connecting into the mid-to-late 20s, an age range referred to as "emerging adulthood." The science also shows that experiencing trauma or chronic stress can further slow this development. Emerging adults may therefore look physically mature, yet their cognitive control systems are still under construction. Accordingly, the legal system's longstanding bright-line rule for sentencing at age 18 does not reflect what science now makes clear. Some courts, however, have begun to apply these neuroscience-based insights to sentencing decisions.

This document is a guide for understanding how brain science can be incorporated into sentencing decisions for crimes committed by adolescents and emerging adults. It begins with important U.S. Supreme Court cases that ruled that children's developing brains make them less culpable and less deserving of the harshest penalties. It then highlights recent state-level legal decisions that in part relied on growing scientific evidence about young adult brain development in Massachusetts, Kentucky, New Jersey, Florida, and Washington. The guide then offers a curated selection of summaries, quotes, and charts from relevant scientific articles. All cases and articles include a corresponding legal "Bluebook" citation and a link to view the resource within the CLBB NeuroLaw Library (www.clbbneurolawlibrary.com) at multiple reading levels. The guide then concludes with an example expert affidavit from clinical and forensic psychologist Dr. Christen A. Carson. Together, these resources aim to support science-informed legal decision-making as it relates to cases involving adolescents and young adults who have committed crimes.

In This Guide:

I. Federal Cases

U.S. Supreme Court

Roper v. Simmons, 543 U.S. 551 (2005). [View in NeuroLaw Library ↗]

This U.S. Supreme Court decision abolished the death penalty for minors. Citing evolving national standards of decency, adolescent brain development, and potential for rehabilitation, the court ruled executing juveniles is "cruel and unusual punishment" and therefore violates the Constitution.

Graham v. Florida, 560 U.S. 48 (2010). [View in NeuroLaw Library ↗]

Building on the *Roper* decision, this U.S. Supreme Court decision established that juveniles convicted of crimes cannot be sentenced to life in prison without parole for non-homicide offenses.

Miller v. Alabama, 567 U.S. 460 (2012). [View in NeuroLaw Library ↗]

This U.S. Supreme Court decision banned mandatory life without parole for juveniles who commit murder. Recognizing juveniles' potential for change, the ruling required sentencing practices that consider age and background of a juvenile before imposing life sentences.

II. State Cases

Massachusetts

Diatchenko v. District Attorney for the Suffolk District, 466 Mass. 655 (2013). [View in NeuroLaw Library ↗]

In this case, the Massachusetts Supreme Court held that life without parole sentences for juveniles who committed murder violates the Massachusetts state Constitution's prohibition on cruel or unusual punishment because of the "unique characteristics of juvenile offenders."

Commonwealth v. Mattis, 493 Mass. 201 (2024). [View in NeuroLaw Library ↗]

The Massachusetts Supreme Court ended life without parole for emerging adults (18–20-year-olds). The court found that such sentences violate the state Constitution's ban on cruel or unusual punishment, citing research on brain development showing that critical brain development continues past the age of 18.

Washington

State v. O'Dell, 183 Wn.2d 841, 365 P.3d 356 (2015). [View in NeuroLaw Library ↗]

The Washington Supreme Court upheld O'Dell's conviction for second-degree child rape but held that trial courts may consider youth as a mitigating sentencing factor, even for individuals above the age of 18.

Restraint of Monschke, 197 Wn.2d 305, 482 P.3d 276 (2021). [View in NeuroLaw Library ↗]

Citing neuroscience, the Washington Supreme Court held that mandatory life without parole sentences for crimes committed between age 18 and 20 violate the state Constitution's ban on cruel punishment.

State v. Haag, 198 Wn.2d 309, 495 P.3d 241 (2021). [View in NeuroLaw Library ↗]

The Washington Supreme Court rejected Haag's 46-year term for a murder committed at 17, ruling the resentencing court wrongly prioritized retribution over mitigation due to youth. Additionally, the court ruled that the 46-year term was in effect a life sentence and therefore unconstitutional.

State v. Anderson, 200 Wash.2d 266, 516 P.3d 1213 (2022). [View in NeuroLaw Library ↗]

The Washington Supreme Court considered whether a 61-year sentence for a crime committed at the age of 17 was cruel punishment in light of the decision in *Haag*. The Court upheld the sentence for Anderson, narrowing the decision in *Haag* and holding that de facto life sentences are unconstitutional only when the crime committed reflected the mitigating qualities of youth.

State v. Carter & State v. Reite, 3 Wn.3d 198, 548 P.3d 935 (2024). [View in NeuroLaw Library ↗]

The Washington Supreme Court upheld resentencing decisions for Carter and Reite, ruling that courts may impose sentencing lengths less than life without parole (LWOP) for 18–20-year-olds under *Monschke*. Both

Carter and Reite showed rehabilitation, but only Carter's crime reflected the mitigating qualities of youth because Reite's crime involved financial crimes that required long-term planning. Nonetheless, the court upheld a resentencing decision that found youth to be a mitigating factor in both cases.

Florida

Romero v. State, 105 So. 3d 550 (Fla. 1st DCA 2012). [View in NeuroLaw Library ↗]

The Florida First District Court of Appeal upheld Bryan Romero's life without parole sentence for second-degree murder, rejecting claims of juror bias and that *Graham v. Florida* barred his sentence. The court held *Graham* applies only to juveniles in non-homicide cases and not to this case since the defendant was 18 at the time of the crime.

Marshall v. State, 266 So. 3d 1275 (Fla. 1st DCA 2019). [View in NeuroLaw Library ↗]

A Florida court upheld Marshall's 15-year mandatory sentence for burglary, rejecting claims that *Graham* and *Miller* apply. Because he was 21 at the offense and not sentenced to life, juvenile sentencing protections were therefore found inapplicable.

New Jersey

State v. Suarez, 519 N.J. Super. 1 (App. Div. 2025). [View in NeuroLaw Library ↗]

The Appellate Division of New Jersey's Superior Court rejected Michael Suarez's bid for resentencing, holding *Comer* applies only to juveniles under 18. Suarez, 19 at the time of a 1991 murder and robbery, remains ineligible for resentencing. The court affirmed denial of relief.

State v. Abruzia, No. A-3496-22 (N.J. Super. Ct. App. Div. 2024). [View in NeuroLaw Library ↗]

The Appellate Division of New Jersey's Superior Court affirmed denial of Abruzia's resentencing bid, holding that *Comer* review applies only to juveniles under 18 and that the court had to follow *Roper* which recognized that 18 is "where society draws the line for many purposes between childhood and adulthood." Abruzia therefore remained ineligible because he was 20 when he committed murder and robberies.

Kentucky

Commonwealth v. Bredhold, 599 S.W.3d 409 (Ky. 2020). [View in NeuroLaw Library ↗]

In this Kentucky Supreme Court case, the court considered whether defendants facing the death penalty but not yet convicted could challenge the constitutionality of Kentucky's death penalty statute for people under 21 years old. The trial court had ruled that the death penalty violated the Eighth Amendment's prohibition on cruel and unusual punishment for defendants under the age of 21. However, the Kentucky Supreme Court rejected the ruling, finding that the defendants could not raise this legal challenge because they had not been sentenced to death yet.

III. Relevant Scientific Literature

Below is a curated set of peer-reviewed articles featured within the CLBB NeuroLaw Library (www.clbbneurolawlibrary.com). Incorporating relevant scientific literature into legal strategies can play a critical role in demonstrating to judges that juvenile and emerging adult brains are different from that of fully mature adults. This section first provides summaries and quotes from scientific articles. It then provides charts from seminal scientific articles on brain development and criminal behavior that describe developmental trends that are important to consider when engaging with the topic of juvenile and emerging adult justice.

Emotion and Impulse Control: Reactive Systems Dominate	
Madeline Dreyfuss et al., Teens Impulsively React Rather than Retreat from Threat, 36 *Dev. Neurosci.* 220, 226 (2014). [View in NeuroLaw Library ↗]	
Summary:	Adolescent brains activate emotional regions when threatened, negatively impacting decision-making abilities. In calmer, controlled environments, teenagers are able to make more effective decisions. Teenage risk taking and crime is linked to increased negative emotions and reduced self-control.
Quote:	"The present study demonstrates that impulsive behavior during adolescence is as likely to occur in the presence of threat as reward cues. We show that rather than retreating or withholding a response to threat cues, adolescents are more likely than children or adults to impulsively react to them, even when instructed not to respond. This developmental pattern is mirrored by adolescent-specific changes in limbic cortical circuitry implicated in detection and assignment of emotional value to inputs and in the subsequent regulation of responses to them."
Elizabeth P. Shulman et al., The Dual Systems Model: Review, Reappraisal, and Reaffirmation, 17 *Dev. Cognitive Neurosci.* 103, 103 (2016). [View in NeuroLaw Library ↗]	
Summary:	Teenage brains prioritize reward, emotion, and social pressures, while decision-making and self-control lag behind until early adulthood. This imbalance leads to increased risk taking for pleasurable and new experiences during adolescence and early adulthood.
Quote:	"Although there are occasional exceptions to the general trends, studies show that, as predicted, psychological and neural manifestations of reward sensitivity increase between childhood and adolescence, peak sometime during the late teen years, and decline thereafter, whereas psychological and neural reflections of better cognitive control increase gradually and linearly throughout adolescence and into the early 20s."
B. J. Casey, Aaron S. Heller, Dylan G. Gee & Alexandra O. Cohen, Development of the Emotional Brain, 693 *Neurosci. Lett.* 29, 32 (2019). [View in NeuroLaw Library ↗]	
Summary:	Brain rewiring in adolescence changes connections between brain areas controlling cognition and emotional regulation, contributing to improved emotional self-control and social understanding through adolescence and young adulthood.
Quote:	"Together, the findings suggest that hierarchical changes in circuit connectivity appear to be critical for the continuous development of regulatory processes in emotionally charged situations from late childhood to young adulthood. These findings have important implications for legal and social policies relevant to both the protection and treatment of youth and suggest a need for rethinking specific ways in which we meet the needs of young people as they transition across these development stages and into adult societal roles."
Dienke J. Bos, Michael Dreyfuss, Nim Tottenham, Todd A. Hare, Adriana Galván, B. J. Casey & Rebecca M. Jones, Distinct and Similar Patterns of Emotional Development in Adolescents and Young Adults, 62 *Dev. Psychobiology* 591, 597 (2020). [View in NeuroLaw Library ↗]	
Summary:	Teenagers and young adults have greater sensitivity to emotional cues and respond significantly to negative cues such as fear.

Quote:	"In conclusion, the findings suggest protracted development of social emotional processing, showing that response speed and variability were differentially modulated by emotional information in adolescents and young adults. These findings fit with recent suggestions of circuit-based hierarchical development of emotional processing, demonstrating that in addition to adolescence, young adulthood is a developmental phase that is associated with distinct processing for emotional cues relative to older adults."
Reward Sensitivity and Risk-Taking: Motivation Outpaces Control	
D. M. Walker et al., Adolescence and Reward: Making Sense of Neural and Behavioral Changes amid the Chaos, 37 *J. Neurosci.* 10855, 10856 (2017). [View in NeuroLaw Library ↗]	
Summary:	Teenagers' increased susceptibility to rewards and to risk taking (e.g., drugs) stems from brain changes, hormones, social interactions, and environment, potentially shaping future brain development.
Quote:	"Studies in humans and laboratory animals generally support the notion that adolescents are more sensitive to reward than adults. This is behaviorally manifest in multiple ways, including elevated levels of sensation seeking and risk taking, as well as reduced inhibitory control, which are maximal during the early to mid-adolescent period."
Deena M. Rudolph et al., At Risk of Being Risky: The Relationship Between "Brain Age" Under Emotional States and Risk Preference, 24 *Dev. Cognitive Neurosci.* 93, 93 (2017). [View in NeuroLaw Library ↗]	
Summary:	The brains of teenagers have immature emotional responses, which influences how young people assess risk. Notably, 18-21-year-olds show the greatest decrease in their observed "brain age" when facing risky situations, responding more like younger individuals in risky situations.
Quote:	"On average, that 'brain age' across the group during the teen years has the propensity to look younger in emotional contexts. Further, we show this phenotype (i.e. a younger brain age in emotional contexts) relates to a group mean difference in risk perception - a pattern exemplified greatest in young-adults (ages 18-21)."
Laurence Steinberg et al., Around the World, Adolescence Is a Time of Heightened Sensation Seeking and Immature Self-Regulation, 21 *Dev. Sci.* e12532, 11 (2018). [View in NeuroLaw Library ↗]	
Summary:	This global study finds that teenage risk taking peaks at 19, with the capacity for self-control increasing until the mid-20s. This supports the notion of universal brain development patterns in youth.
Quote:	"Generally speaking, self-regulation develops linearly and gradually over the course of adolescence, reaching a plateau somewhere during the mid-20s, whereas reward seeking follows a ∩-shaped pattern, increasing between preadolescence and late adolescence, peaking around age 19, and then declining as individuals move into and through their twenties."
Peer and Social Influences: Effects on Decision-Making	
Jason Chein et al., Peers Increase Adolescent Risk Taking by Enhancing Activity in the Brain's Reward Circuitry, 14 *Dev. Sci.* F1, F1 (2011). [View in NeuroLaw Library ↗]	
Summary:	Peer presence increases risk taking in adolescents by activating reward-related brain regions, as shown in an fMRI study using a simulated driving task where peers observed their performance. This pattern was not found among adults.
Quote:	"During peer observation blocks, adolescents selectively demonstrated greater activation in reward-related brain regions, including the ventral striatum and orbitofrontal cortex, and activity in these regions predicted subsequent risk taking. Brain areas associated with cognitive control were less strongly recruited by adolescents than adults, but activity in the cognitive control system did not vary with social context. Results suggest that the presence of peers increases adolescent risk taking by heightening sensitivity to the potential reward value of risky decisions."

Leah H. Somerville, The Teenage Brain: Sensitivity to Social Evaluation, 22 *Current Directions Psychol. Sci.* 121, 125 (2013). [View in NeuroLaw Library ↗]	
Summary:	Studies suggest teen brains react more intensely to social judgment, affecting different brain regions for emotions and social cues. This could explain why teens are especially sensitive to what others think and therefore more impacted by peer influence.
Quote:	"Convergent evidence suggests that adolescents display heightened sensitivity to social evaluation at various levels of complexity and continue to refine their capacity to represent the thoughts and feelings of others. These features of social sensitivity appear to be instantiated by robust response properties in neural circuitry important to assigning value to social-affective information during adolescence."
M. Ambrosia et al., Temptations of Friends: Adolescents' Neural and Behavioral Responses to Best Friends Predict Risky Behavior, 13 *Soc. Cognitive & Affective Neurosci.* 483, 488-89 (2018). [View in NeuroLaw Library ↗]	
Summary:	This study found that teens who reacted significantly—both in their behavior and in their brain activity—to their best friend's positive emotions were more likely to engage in real-world risky behaviors like substance use, fighting, or unsafe sex. Interestingly, both very high and very low sensitivity to a friend's positive emotions were linked to higher risk taking, suggesting that either strong or low thrill-seeking can set the stage for risky behavior.
Quote:	"Adolescents' combined neural response and behavioral response to their best friends' PA [positive affect]—but, tellingly, neither type of response alone—was associated with their engagement in a range of real-world risky behaviors. Surprisingly, greater engagement in risky behaviors was associated with the combination of higher neural and higher behavioral response and the combination of lower neural and lower behavioral response to best friends' positive affect."
J. Salas-Rodríguez et al., Motivated to Compete but Not to Care: The Fundamental Social Motives of Risk-Taking Behaviors, 205 *Pers. & Individ. Differences* 112093, 4 (2023). [View in NeuroLaw Library ↗]	
Summary:	This study found that teenagers and young adults take risks to fit in but are less risky when they feel responsible for their family. This study shows social pressure is a big reason teenagers and young adults engage in risky behavior.
Quote:	"[Our] findings show that individuals who engage in risk-taking behaviors are more motivated to seek status but less motivated towards kin care. Our findings suggest that the search for status promoted engagement in risk-taking behaviors which supports the adaptive function of risktaking as a means of attaining the respect and deference from others in adolescence and youth."
J. J. Tielbeek et al., The Association Between Delinquent Peer Affiliation and Disruptive Behavior Interacts with Functional Brain Correlates of Reward Sensitivity: A Biosocial Interaction Study in Adolescent Delinquents, 54 *Psychol. Med.* 1544, 1548 (2024). [View in NeuroLaw Library ↗]	
Summary:	The study found that teenagers who were more drawn to rewards were especially likely to show more disruptive behavior when they spent time with delinquent peers. In other words, being highly reward-sensitive seemed to make some adolescents more vulnerable to the influence of risky friends.
Quote:	"Our findings indicate that individual differences in neural reward processing may be linked to the sensitivity towards peer affiliation, when examining their effects on DBD [disruptive behavior disorders]. Therapeutic interventions focusing on hypersensitive adolescents may thus specifically target peer affiliation to modify the environment by withholding adolescents from negative peer influences and promoting positive, healthy peer interactions."

Trauma and Adversity: Disrupted Development and Vulnerability	
A. Williams, Early Childhood Trauma Impact on Adolescent Brain Development, Decision Making Abilities, and Delinquent Behaviors: Policy Implications for Juveniles Tried in Adult Court Systems, *71 Juv. & Fam. Ct. J.* 5, 14 (2020). [View in NeuroLaw Library ↗]	
Summary:	Because teen brains are developing, they may struggle with self-control, especially if they have experienced trauma. This can lead to bad choices. Considering development and trauma is important when dealing with teenagers who committed a crime.
Quote:	"Early childhood trauma includes a variety of experiences that have last[ing] effects on youth behavior. Furthermore, Early Childhood trauma significantly impairs brain development which impacts the way a young person makes decisions leading to potential delinquency."
Katie A. McLaughlin, David Weissman & Debbie Bitrán, Childhood Adversity and Neural Development: A Systematic Review, 1 *Ann. Rev. Dev. Psychol.* 277, 299 (2019). [View in NeuroLaw Library ↗]	
Summary:	Early childhood adversity or trauma impacts brain development: threatening situations impact brain regions tied to negative emotions, self-control, and memory while deprivation—like not having enough care or chances to learn—impacts attention, problem-solving, and memory.
Quote:	"A majority of studies examining children exposed to violence observed reductions in amygdala volume, increased amygdala reactivity to threat cues, and greater threat-related activation in the anterior insula, a key node of the salience network […] These neural differences are consistent with a long history of behavioral studies demonstrating enhanced threat processing in children exposed to violence […] and likely reflect an adaptation to growing up in a dangerous environment."
Charlotte C. Schulz et al., Emotional Maltreatment and Neglect Impact Neural Activation upon Exclusion in Early and Mid-Adolescence: An Event-Related fMRI Study, 34 *Dev. & Psychopathol.* 573, 582 (2022). [View in NeuroLaw Library ↗]	
Summary:	This study used brain scans to look at how teens with histories of emotional maltreatment or neglect react when they are left out of an online ball-tossing game. Youth who experienced this kind of mistreatment showed different patterns of brain activation scans during social exclusion, suggesting that hurtful or emotionally absent caregiving can change how the adolescent brain responds to feeling rejected by peers.
Quote:	"Our data offer some first indications that EM [emotional maltreatment] at least partly impinges on development via a unique set of neural mechanisms which may be particularly relevant for processing social information (i.e., saliency processing, mentalizing). […] Acting as threatening or insufficient sources of co-regulation, emotionally maltreating caregivers may engender disruptions in the species-expected child–caregiver attachment relationship, which, in turn, is thought to facilitate crucial capacities for forming and maintaining relationships."
Franziska Schlensog-Schuster et al., From Maltreatment to Psychiatric Disorders in Childhood and Adolescence: The Relevance of Emotional Maltreatment, 29 *Child Maltreatment* 142, 150 (2024). [View in NeuroLaw Library ↗]	
Summary:	This study of 778 children ages 3-16 found that emotional maltreatment was strongly linked to youth with mental health problems. Emotional maltreatment was linked to anxiety and depression in older youth and behavioral problems in younger children.
Quote:	"In conclusion, emotional maltreatment (EM) still represents an underappreciated subtype that may interfere with the species-expected need for a caregiving relationship. Acting most strongly on internalizing disorders, our data suggest a central role for EM. The high level of early dependence on the parent-child relationship may therefore place EM at the heart of the pathogenic influence of maltreatment experiences, alerting practitioners to the importance of taking it into account for decision-making in clinical practice. However, despite significant advances in our knowledge regarding the developmental sequelae and intervention following

	(emotional) maltreatment, translation to social, clinical, and legal work practices still lags behind this knowledge."
Akemi Tomoda et al., The Neurobiological Effects of Childhood Maltreatment on Brain Structure, Function, and Attachment, 275 *Eur. Arch. Psychiatry & Clinical Neurosci.* 1939, 1940 (2025). [View in NeuroLaw Library ↗]	
Summary:	This review examines how childhood maltreatment—including abuse and trauma—impacts brain development, influencing how we perceive things, brain structure, and attachment. The review also talks about ways to build resilience and reverse these changes in the body.
Quote:	"Children who have experienced maltreatment, such as neglect, abuse, or inconsistent caregiving, may develop insecure or disorganized attachment styles that can disrupt the normal development of sensory systems, leading to problems in perceiving, processing, and integrating sensory information. For example, children with insecure attachment patterns may exhibit heightened sensitivity or hypervigilance to sensory stimuli, resulting in sensory over-responsivity."

Important Charts for Science-Informed Juvenile and Emerging Adult Justice

B.J. Casey et al., Making the Sentencing Case: Psychological and Neuroscientific Evidence for Expanding the Age of Youthful Offenders, 5 *Ann. Rev. Criminol.* 321, 332 (2022). [View in NeuroLaw Library ↗]

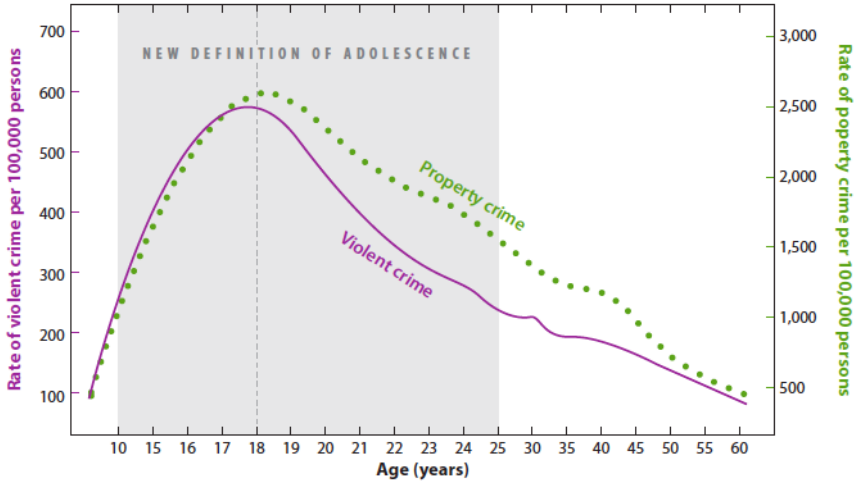

Figure 1: *Casey et al. 2022. The "age-crime curve" indicates the decreasing level of criminal offending over the course of development, as sensation seeking peaks and then declines while self-regulation increases.*

Generally, over 90 percent of individuals engaged in criminal behavior during adolescence naturally desist as they enter their early twenties and do not go on to commit further crimes. Given the approximate age at which sensation-seeking peaks and then declines, it is no surprise that violent crime peaks at age 17 – 19 and then decreases, as reflected above.

Leah H. Somerville, Searching for Signatures of Brain Maturity: What Are We Searching For?, 92 *Neuron* 1164, 1165 (2016). [View in NeuroLaw Library ↗]

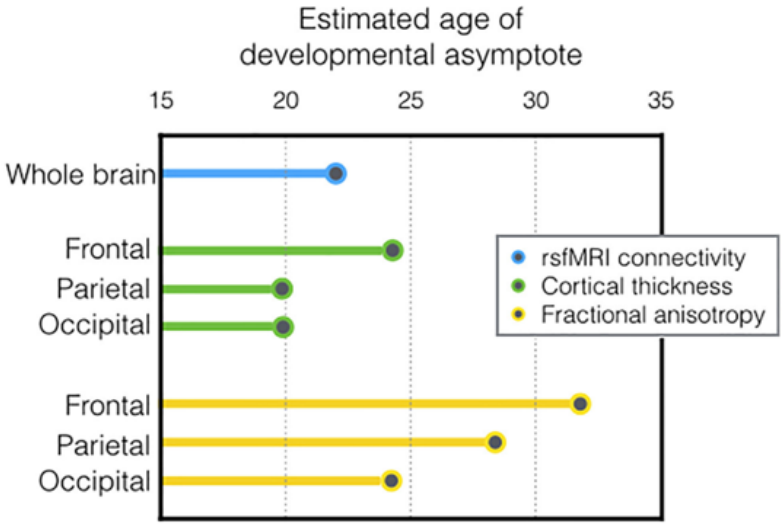

Figure 2: *Somerville 2016. Age of developmental asymptote—the point at which the development of a brain system stabilizes—for various brain measures. rsfMRI is a neuroimaging technique that measures whole brain connectivity.*

The figure above summarizes the estimated ages at which major brain systems reach their "developmental asymptote," meaning the point at which these different neural features stabilize or plateau in development, reflecting near-adult levels of structure or function. The chart includes three different neurodevelopmental measures:

- **Resting-state functional MRI connectivity** (top/blue): indicates the maturity and stability of communication between brain regions and network-level synchronization.
- **Cortical thickness** (middle/green): indicates structural maturation of the cortex. Cortical thinning over time reflects synaptic pruning and increases neural efficiency.
- **Fractional anisotropy** (bottom/yellow): indexes white-matter microstructure; higher values reflect stronger, more efficient long-range connections between brain regions that support impulse control, planning, and emotional regulation.

Across all measures, the data demonstrate that the frontal lobe—the region responsible for functions such as judgment, planning, impulse inhibition, and consideration of future consequences—does not reach adult-like maturity until the mid-20s to early 30s**.**

Laurence Steinberg et al., Around the World, Adolescence Is a Time of Heightened Sensation Seeking and Immature Self-Regulation, 21 *Dev. Sci.* e12532, 10 (2018). [View in NeuroLaw Library ↗]

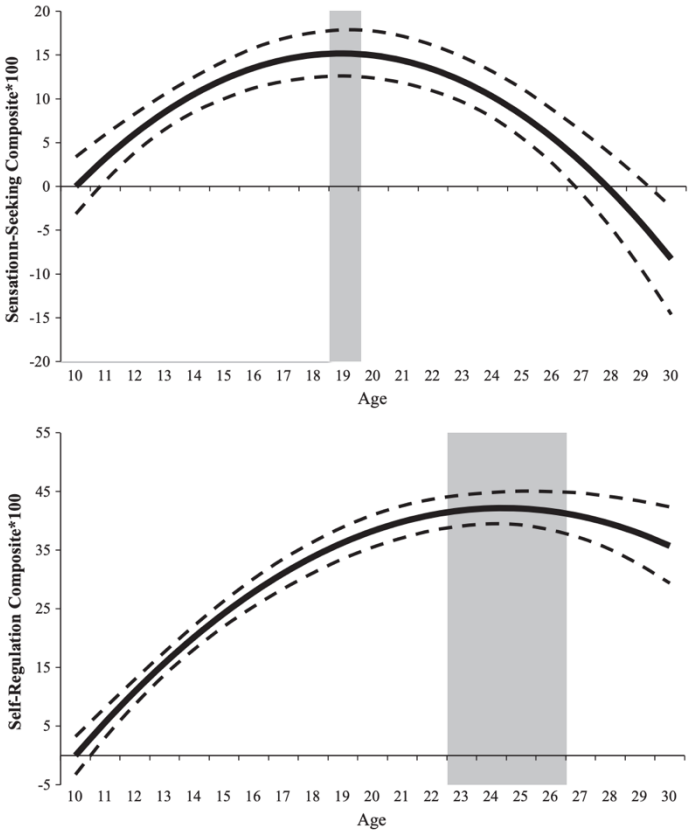

Figure 3: *Steinberg et al. 2018. Age differences in sensation seeking (top) and self-regulation (bottom). Sensation seeking peaks in late adolescence, while self-regulation does not stabilize until young adulthood.*

The figure illustrates two key developmental trajectories relevant to behavior in adolescence and emerging adulthood: sensation-seeking and self-regulation. These curves are drawn from large-scale longitudinal research on developmental neuropsychology. Research indicates that sensation-seeking peaks at approximately age 19 while self-regulation—which is a behavior that counteracts sensation-seeking—develops gradually throughout adolescence and stabilizes in the mid-20s.

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I, Dr. Christen A. Carson, state that the following is true to the best of my knowledge, information, and belief:

1. I practice clinical and forensic psychology in Seattle, Washington, and am the past president of the Washington State Psychological Association.

2. I am Board Certified in Forensic Psychology by the American Board of Professional Psychology and serve as a Faculty Member of the American Board of Forensic Psychology.

3. I am Board Certified in Couple and Family Psychology by the American Board of Professional Psychology and currently serve as President of the American Board of Couple and Family Psychology.

4. I serve as a consultant for the Center for Law, Brain & Behavior (CLBB), an academic center based at Massachusetts General Hospital and affiliated with Harvard Medical School.

5. I served as a clinical case consultant and panelist for the Federal Judicial Center - Center for Law, Brain & Behavior workshop, *Science-Informed Decision-Making* (Harvard Law School, June 2024).

6. I provide regional and national training on sentencing and resentencing considerations, including for the American Board of Forensic Psychology and the American Psychological Association national conferences.

7. Among other areas, I specialize in juvenile and adult sentencing mitigation. I have completed more than 100 forensic evaluations and provided oral testimony approximately 40 times.

8. A current copy of my Curriculum Vitae is attached as Exhibit “A.”

9. The statements below are based on my education and training regarding adolescent and emerging adult brain development and its relationship to criminal offending.

10. The science of youthful brain development has significant implications for the culpability of youth involved in the criminal justice system.

11. Offense behavior and decision-making exhibited by an individual before their mid-20s reflect the neurodevelopmentally limited capabilities of a brain still growing and maturing. Decades of neurodevelopmental research have concluded: "It is well established that the brain undergoes a 'rewiring' process that is not complete until approximately 25 years of age."[1] By rewiring, neuroscientists mean that intricate connections are formed and pruned throughout adolescence and young adulthood. During this time, the full capabilities of the brain, from decision-making to emotional regulation, are steadily developing. A brain in adolescence or late adolescence (ages 18 through the early 20s) is one still in progress.

12. Youth between the ages of 18 and the early 20s are more similar to younger adolescents than adults in their brain development, primarily in terms of reduced capacity for emotional regulation, judgment, and risk appraisal. These reduced capabilities are particularly evident in contexts of "hot cognition."[2] When late adolescents are in situations of hot cognition, strong emotions, immediacy, and stress adversely impact their mental processing of information. Unsurprisingly, much youthful criminal or illegal behavior is perpetrated in such hot cognition contexts.

13. A hallmark sign of immaturity in adolescence is "sensation-seeking." Sensation-seeking is evidenced when individuals exhibit a strong desire to seek out intense, exciting experiences with decreased regard for risk. Data indicate that sensation-seeking peaks around age 19, while the capacity for self-regulation, a behavior that opposes sensation-seeking, develops gradually throughout adolescence and plateaus around the mid-20s.[3]

14. The reduced sensation-seeking and increased ability to self-regulate demonstrated by adults flow from the progressive development and wiring of the prefrontal cortex. The prefrontal cortex and related networks are responsible for executive functioning, including impulse control and modulation of emotions. The maturation of the prefrontal cortex and its associated networks throughout adolescence and young adulthood accounts for improvements in a wide variety of domains, from planning and strategizing to the

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[1] Arain, M., Haque, M., Johal, L., Mathur, P., Nel, W., Rais, A., Sandhu R., & Sharma, S. (2013). Maturation of the adolescent brain. *Neuropsychiatric disease and treatment*, *9*, 449.

[2] Casey, B. J., Taylor-Thompson, K., Rubien-Thomas, E., Robbins, M., & Baskin-Sommers, A. (2020). Healthy Development as a Human Right: Insights from Developmental Neuroscience for Youth Justice. *Annual Review of Law and Social Science, 16,* 295-315. https://doi.org/10.1146/annurev-lawsocsci-101317-031101

[3] Steinberg, L., Icenogle, G., Shulman, E. P., Breiner, K., Chein, J., Bacchini, D., Chang, L., Chaudhary, N., Giunta, L. D., Dodge, K. A., Fanti, K. A., Lansford, J. E., Malone, P. S., Oburu, P., Pastorelli, C., Skinner, A. T., Sorbring, E., Tapanya, S., Tirado, L. M. U., Alampay, L. P., … Takash, H. M. S. (2018). Around the world, adolescence is a time of heightened sensation seeking and immature self-regulation. *Developmental science*, *21*(2), 10.1111/desc.12532. https://doi.org/10.1111/desc.12532

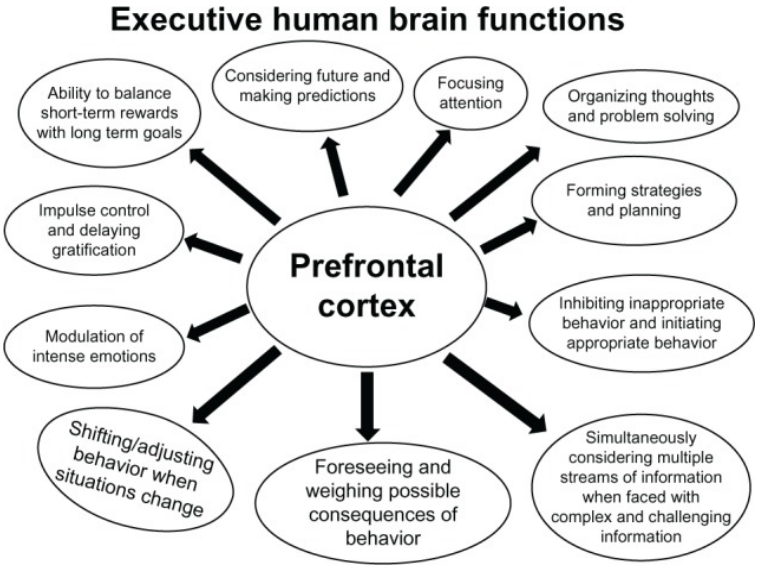
modulation of intense emotions and focusing of attention. These domains are essential to the regulation of emotion and well-reasoned decision-making.

15. Adolescent and late-adolescent *neurological* immaturity is expressed in *functional* immaturity, which may be evidenced in underdeveloped moral reasoning, faulty weighing of risks and benefits, and judgment impulsivity in offense conduct.[4]

16. Initial judicial adoption of neurodevelopmental research focused on the limitations of youth who were younger than 18. This focus may have prompted a misunderstanding that late teens and early 20s possess fully mature capabilities. However, there is no bright line separating offenders younger than 18 from those who are in the "late adolescent" category. There is diverse evidence for this neurodevelopmental continuum. Four lines of research demonstrate that brain development and its functional expressions continue up to age 25: psychosocial-behavioral assessments, morbidity and mortality data, functional neuroimaging during task performance, and neuroimaging.[5]

    a. *Psycho-social-behavioral assessment:*

    Important pro-social psychological capabilities develop from the teens to the mid-20s. Psycho-social-behavioral assessment during the late teens and early 20s demonstrates continued progression in a number of executive functions, as reflected in the model below:[6]



[4] Cunningham, M. D. (2023). Miller evaluations. In R. Gurung and R. Roesch (Ed.), *Routledge encyclopedia of psychology in the real world: Psychology and law.* Routledge, Taylor & Francis Group.
[5] Cunningham, M. D. (2023). Miller evaluations. In R. Gurung and R. Roesch (Ed.), *Routledge encyclopedia of psychology in the real world: Psychology and law.* Routledge, Taylor & Francis Group.
[6] Arain M, Haque M, Johal L, Mathur P, Nel W, Rais A, Sandhu R, Sharma S. Maturation of the adolescent brain. *Neuropsychiatr Dis Treat*. 2013;9:449-461
https://doi.org/10.2147/NDT.S39776

As the brain matures from the late teens to the mid-20s, psychosocial capabilities develop for complex thinking, greater appreciation for diverse views, improved understanding of mutuality in relationships, increased emotional regulation, and greater ability to weigh risks and benefits.[7]

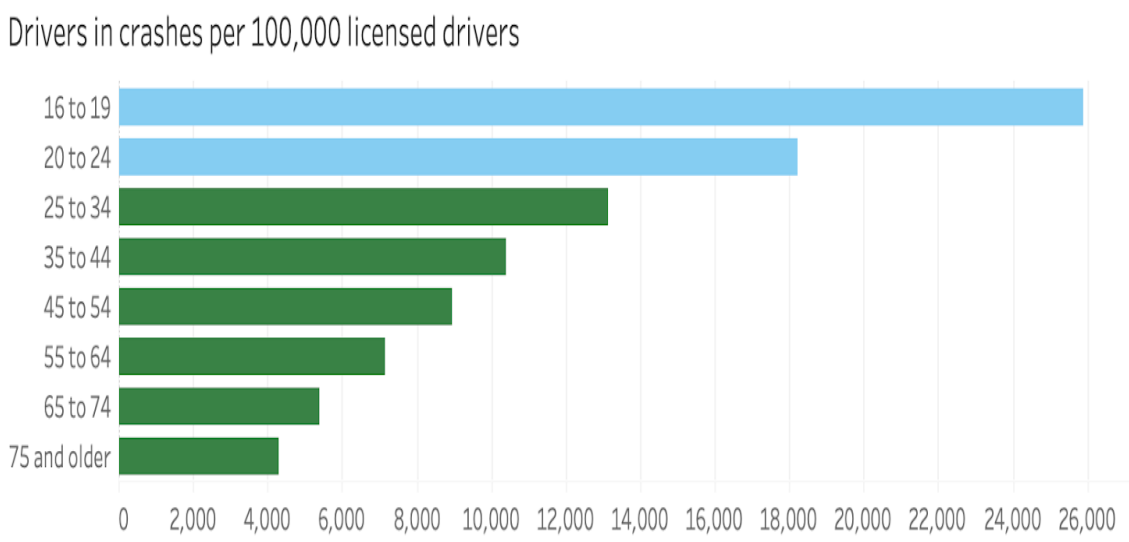
With progressive emotional, social, and intellectual maturity, better control over behavior develops. Steinberg, Cauffman, and Monahan[8] described three aspects of such psychosocial maturity essential to desistance from crime:

- *Temperance:* The ability to control impulses, including aggressive impulses.
- *Perspective*: The ability to consider other points of view, including those that take into account longer-term consequences or that take the vantage point of others.
- *Responsibility*: The ability to take personal responsibility for one's behavior and resist the coercive influences of others.

b. <u>*Morbidity and mortality data:*</u>

Various sources of morbidity and mortality data demonstrate the behavioral implications of brain immaturity and associated decision-making, as well as the steadily accruing benefits of psychosocial maturity with age in the late teens and early 20s. Studies of data from car crashes prove instructive in highlighting the consequences of this neurodevelopment. To illustrate, the graph below from the National Safety Council (2021)[9] reflects driver crash rates per 100,000 licensed drivers by age group. Note that crashes in the 16 to 19-year-old age group and the 20 to 24-year-old age group are significantly higher than those of older cohorts.

[7] Simpson, R. (2008). *Young adult development project.* Massachusetts Institute of Technology, Workplace Center.
[8] Steinberg, L., Cauffman, E., & Monahan, K. (2015, March). *Psychosocial maturity and desistance from crime in a sample of serious juvenile offenders*. U.S. Department of Justice, Office of Juvenile Justice and Delinquency Prevention. https://ojjdp.ojp.gov/library/publications/psychosocial-maturity-and-desistance-crime-sample-serious-juvenile-offenders
[9] National Safety Council. (2021). *Motor vehicle — Age of driver.* In *Injury Facts.* https://injuryfacts.nsc.org/motor-vehicle/overview/age-of-driver/



Recognition of the actuarial and statistical implications of a driver being less than 25 years old is demonstrated by the policies of car rental companies toward drivers younger than 25 (e.g., declining to rent to these drivers, applying significant surcharges, and restricting these drivers to specific vehicles). The data supporting these restrictions is sufficiently broad that there is no attempt to make a case-by-case determination based on driving history or other individualized metrics.

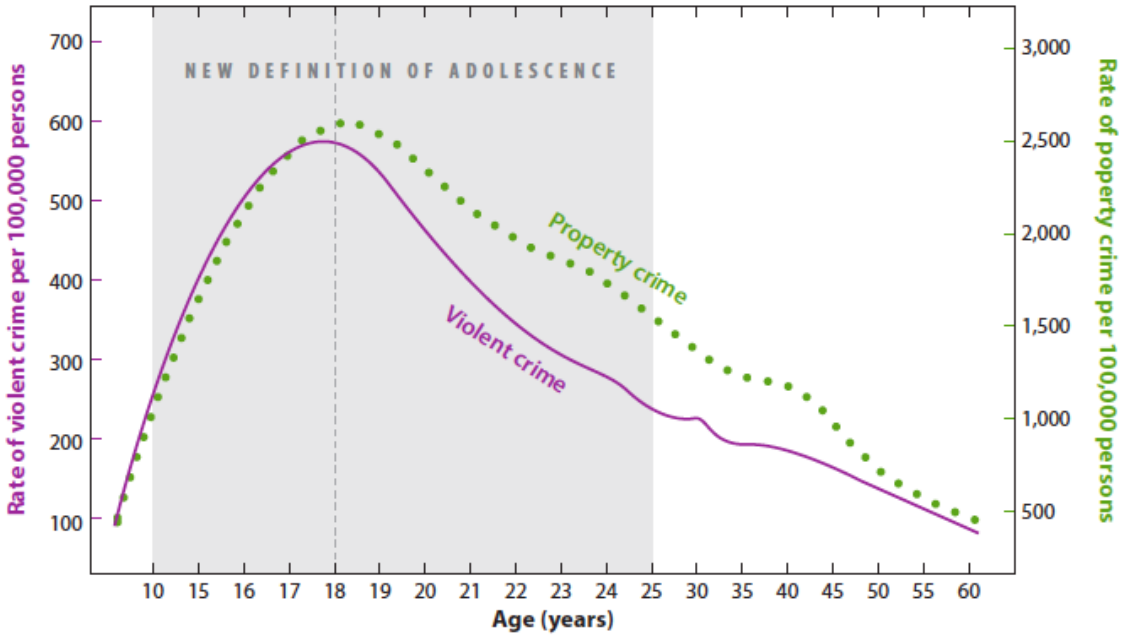
The Center for Law, Brain, and Behavior's White Paper on the Science of Late Adolescence: *A Guide for Judges, Attorneys, and Policy Makers* (2022) similarly notes adolescents' elevated risk-taking decisions and behaviors in multiple behavioral domains:

> Compared to adults, middle and late adolescents are more likely to engage in behaviors that risk their lives and well-being. Many health risk behaviors peak in late adolescence and young adulthood. This includes risk-taking behaviors and risk-related outcomes such as reckless driving, unprotected sex, and unintentional injuries—further, overdose deaths and substance misuse peak in late adolescence and early adulthood. [10]

Age-crime data similarly demonstrate the behavioral implications of brain immaturity through age 25 as reflected in offending patterns mapped over the lifespan. Violent crime

[10] Center for Law, Brain & Behavior. (2022). *The science of late adolescence: A guide for judges, attorneys, and policymakers.* Massachusetts General Hospital, Harvard Medical School. https://clbb.mgh.harvard.edu/white-paper-on-the-science-of-late-adolescence/

and property crime markedly decrease after age 25 compared to age 17-19, as reflected in the figure below:[11]



(Casey et al., 2022)

The age-crime curve demonstrates the decreased level of offending subsequent to brain development and increased psychosocial capacities.

c. *Functional neuroimaging during task performance*

The chronology of brain development can be followed using neuroimaging measurements, in particular, functional MRI (fMRI). Neuroimaging through fMRI can evaluate the brain and its various circuits and connectivities in action. In fMRI studies analyzing large-scale brain activity over several years, there is a noticeable lag in the development of the prefrontal cortex and the associated frontoparietal network (as compared to other regions of the brain). These later-developing regions are responsible for evaluative decision-making, impulse control, and emotional regulation, and account for diminished behavioral control in adolescents.

d. Neuro-imaging (MRI/CT)

Brain maturation does not reflect a singular developmental track. Instead, it is a multilayered and parallel process. There is an early priority in the development of subcortical limbic circuits - the reward circuits involved in immediate need attainment (such as desire, fear, and rage) - over the prefrontal cortex, which is involved in executive functions of impulse control, planning, and predicting outcomes

[11] Casey, B. J., Simmons, C., Somerville, L. H., & Baskin-Sommers, A. (2022). Making the sentencing case: Psychological and neuroscientific evidence for expanding the age of youthful offenders. *Annual Review of Criminology, 5*, 321-343. https://doi.org/10.1146/annurev-criminol-030920-093346.

such as negative consequences. In emotionally charged situations, the limbic circuits are prioritized, as they are better developed than the executive systems of the prefrontal cortex. The latter reaches full capability in the mid-20s.

17. The neurodevelopmental immaturity demonstrated by all adolescents and young adults can be exacerbated or augmented by developmental adversity. Such adversity may include neurodevelopmental and psychological disorders, trauma, and deprivations in the family system, and corruptive and violent communities. As these accrue, *particular* functional immaturity may be observed.

18. In spite of the robustness and broad applicability of the above scientific findings, a variety of faulty metrics have been asserted in individual cases in denying the role of brain immaturity in adolescent offending. Among the more routinely encountered examples are the following:

    a. *Planning vs. impulsivity:* There may be an assertion that an offense does not reflect the impetuosity of youth because planning was involved, and therefore, the actions do not appear impulsive. This reflects a misunderstanding of impulsivity. To explain, "spontaneous" and "impulsive" overlap but are not synonymous terms/concepts.

       There are two types of impulsivity. The first type is *reactive impulsivity*. Reactive impulsivity involves an immediate reaction without pause or reflection: e.g., you are shoved, and you shove the other person back. It is spontaneous in its immediacy. Reactive impulsivity is most often observed in pre-school-age children, persons who are intoxicated, persons in a crisis, and persons with dementia.

       The second type of impulsivity is *judgment impulsivity*. Judgment impulsivity is characterized by the press of internal forces, with inadequate consideration for consequences or alternative options. For example, you meet someone today and spend the next two days planning your wedding and life together. On the third day, you marry. This represents a profoundly impulsive action, even though two days were spent in planning. Judgment impulsivity is particularly characteristic of adolescents.[12]

       Further, planning is *not* inconsistent with immaturity. The capability to plan is a feature of human cognition that arises during the preschool years with progressive development in the complexity of plans that may be supported. Planning is a continuous and not dichotomous variable. For that reason, the presence of a plan does not contraindicate youthful vulnerabilities.

    b. *Features of the offense:* An assertion may be made that if features of the offense behavior are similar to behaviors enacted by adults, then the vulnerabilities of

[12] Cunningham, M. D. (2023). Miller evaluations. In R. Gurung and R. Roesch (Ed.), *Routledge encyclopedia of psychology in the real world: Psychology and law.* Routledge, Taylor & Francis Group.

youth are not applicable, e.g., motive of pecuniary gain, efforts to avoid detection, etc. However, the role of youthfulness is not demonstrated in the offense being completely distinct from that carried out by an adult. Certainly, some features are more commonly observed among youthful offenders. There are no features of adolescent offending, though, that are entirely distinctive for that group alone.

To illustrate, car accidents occur with both adult and adolescent drivers. These accidents may emanate from similar behavioral features, including excessive speed, inattention, and stimulation. However, teens exhibit these risky behaviors more frequently than adults. One can't differentiate the role of youthful immaturity by inspecting the accident itself. Rather, the role of immaturity is demonstrated by a marked reduction in such crash-risk behaviors among drivers older than 25.

c. *Wrongful awareness:* It is sometimes asserted that if a youth "knew" an act was wrong, then youthfulness immaturity is not implicated. However, moral awareness and reasoning are more complex than a recognition that behavior is "wrong." To illustrate, a typically situated 5-year-old knows that it is wrong to kill another person. However, that recognition is socially regarded as so primitive and superficial that a 5-year-old would never be held to the level of criminal responsibility or moral culpability applied to a 25-year-old for the same homicidal conduct. From psychological research, it is understood that moral reasoning is not an all-or-nothing phenomenon. Rather, it accretes to age 25, encompassing such varied constituents as a moral code, increased empathy, and sensitivity to the impacts of actions.

d. *No "homunculus":* It may be asserted that though a youthful defendant was immature in some respects, his offense behavior did not reflect such immaturity, thus rendering his age irrelevant as a sentencing consideration. This postulates a homunculus, i.e., miniature "person" of maturity, intact discernment, and moral clarity who somehow magically sits outside of youthful limitations and impairments, formulating offense conduct as if an adult. This homunculus is a fiction. The immature brain and associated limitations in decisional capabilities and moral reasoning are the only resources a youthful defendant possesses for understanding and acting on the world at the time of offense conduct.

19. The faculties of moral discernment and reasoning, facets of decisional and judgment capability, are products of increased brain development. Accordingly, the qualitative development of these capabilities is progressive through childhood and into the mid-20s and significantly accounts for the greater capacity of adults to desist from criminal conduct. Desistance from crime is also demonstrated by recidivism data, including the low recidivism rates in *Miller*[13] releases.[14]

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[13] *Miller v. Alabama*, 567 U.S. 460 (2012).

[14] Beckett, K., & Goldbert, A. (2024, January 12). *Sentencing reform in Washington State: Progress and Pitfalls*. Seattle Clemency Project/University of Washington; Daftary-Kapur, T., & Zottoli, T. (2020) *Resentencing of juvenile lifers: The Philadelphia experience*. Department of Justice Studies, Monclair State University; Samples, S.

20. Courts have already incorporated these findings in their sentencing decisions. For example, Washington State's *O'Dell* case[15] applied this developmental science in sentencing considerations, stating, "The science proves that youth reduces culpability and is therefore relevant to the sentence imposed upon an individual defendant." The Washington courts have further adopted and relied on this science, with the *Monschke*[16] court noting, "no clear line exists between childhood and adulthood" and "individual youthful characteristics may mitigate the sentences of these two young petitioners."

21. Taken as a whole, the body of neuroscientific evidence regarding adolescent brains is clear. By biological fact, adolescents wield a brain that, in its circuitry and anatomy, is tilted towards emotion, intensity, impulsivity, and poor self-regulation. However, these decisional and behavioral vulnerabilities recede with progressive brain development to age 25. Increased age and desistance from crime are well-known phenomenon that squares well with our neurodevelopmental evidence that executive function, emotional regulation, and increased quality of moral reasoning progressively establish themselves as the brain matures. Courts would be remiss to ignore this body of evidence in their sentencing procedures—to ignore the impact of brain development until the mid-20s, and to make negative predictions about future behavior in the face of overwhelming evidence in favor of desistance.

Respectfully submitted,

Christen A. Carson, PhD, ABPP

Date: September 18, 2025

(2021, August). Crime by "juvenile lifers" after prison "very rare," State says. *Target 8 News*. Grand Rapid, Michigan. https://www.woodtv.com/news/target-8/crime-by-juvenile-lifers-after-prison-very-rare-state-says/

[15] *State v. O'Dell*, 183 Wn.2d 680, 358 P.3d 359 (2015).

[16] *In re Monschke*, 197 Wn.2d 305, 482 P.3d 276 (2021).

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Psychologist, Washington (PY00002700, licensed since 2003)
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Ph.D. Clinical Psychology, Pacifica Graduate Institute, Santa Barbara, CA (2001)
M.A. Clinical Psychology, Duquesne University, Pittsburgh, PA (1995)
B.A. Psychology, Stetson University, DeLand, FL (1993)
B.A. Spanish, Stetson University, DeLand, Florida and *Universidad Complutense*, Madrid, Spain (1993)

MEMBERSHIP

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Washington State Psychological Association
APA Division 41, American Psychology-Law Society
APA Division 43, The Society for Couple and Family Psychology Member
APA Division 31, State, Provincial, and Territorial Psychological Association Affairs
National Academy of Neuropsychology

PROFESSIONAL PRACTICE

03/2000 - Current: Clinical and Forensic Psychologist, Seattle, WA
Forensic Practice: Criminal: Evaluations including Mitigation Evaluations, *Miller* Evaluations, Competency Evaluations, Mental State Evaluations. Specialization in adolescent brain development, trauma. Previously contracted psychological examiner for King County Superior Court, Juvenile Division. Family: Litigation Support in dissolution matters; Civil: Personal Injury Evaluations.

Clinical Practice phased out in 2022: Previously conducted individual, couple, child, adolescent, and family psychotherapy; Mental Health psycho-diagnostic evaluations with treatment recommendations; Cognitive evaluations of adults, adolescents, children, including learning disabilities, ADHD, and giftedness; Clinical supervision and consultation with doctoral students, post-doctoral students, and psychologists. Clinical Specializations: Broad range of psychiatric mental health conditions, Psycho-diagnostic assessment and differential diagnosis, relationship issues, attachment and loss, life transitions, behavior problems, mood disorders, developmental issues, chemical dependency and dual diagnosis, parenting, domestic violence, sexual abuse, LGBTQ issues.

10/1998-6/2001: Licensed Mental Health Counselor, Sound Mental Health, Seattle, WA
Therapist working with multi-problem families with chemical dependency, domestic violence, physical abuse, sexual abuse, and out of home placement; Specialized work in the areas of psychological trauma, crisis intervention and emergency response, and integration of clinical work in primary care settings; Supervision of interns, Provided trainings to staff and students.

04/1997-09/1998: Predoctoral Psychology Intern/Therapist/Case Manager, Westside Outpatient Mental Health and Crisis Clinic, San Francisco, CA
Psychology Intern providing diagnostic and risk assessments, treatment planning, and psychological mental health services to individuals, couples, and families, supervision of staff, and program development. Specializing in acute mental health and chemical dependency issues.

01/1996-03/1997: Social Work Specialist/Bilingual Instructor and Case Manager, Curtis and Associates, Santa Barbara, CA
Taught skill-building curriculum, including social skills and psychoeducational information. Specific focus on minority non-English and Spanish-speaking participants. Curtis & Associates Inc., contracted by the Santa Barbara Department of Social and Health Services, offered self-sufficiency skills and job training to individuals and welfare-to-work programs.

08/1994-08/1995: Graduate Student Counselor and Assessor, Duquesne University, Pittsburgh, PA Provided cognitive and psychological assessments, and outpatient therapy.

01/1993-03/1994: Neuroscience Laboratory Technician and Research Assistant, Florida State University, Tallahassee, FL. Conducted research culminating in poster presentation and publication: Contreras, R. J., Carson, C. A., & Pierce, C. E. (1995). A novel psychophysical procedure for bitter taste assessment in rats. *Chemical senses*, *20*(3), 305–312. https://doi.org/10.1093/chemse/20.3.305

RECENT PRESENTATIONS

Adapting to change: Forensic Resentencing Evaluations Post-Monschke, Mattis, and Other State Case Law. Co-presenting with Stephanie Tabashneck, Psy.D, J.D. (CLBB). American Academy of Forensic Psychology, Washington, D.C., August 28, 2025.

Neuroscience and the Law- A 21st Century Paradigm Reflected in Juvenile Capital Sentencing Jurisprudence. William James College Psychology Doctoral Program Guest Lecturer. April 7, 2025.

Adolescent and late adolescent brain science and recidivism, with co-speaker Dr. Daftary-Kapur, Nebraskans for Prison Reform, Lincoln, NE, October 21, 2024

Evaluating Family and Community Factors in Adolescent and Late Adolescent Forensic Criminal Psychological Evaluations, American Psychological Association, Seattle, WA. August 10, 2024

Science Informed Decision-Making (in sentencing), Federal Judicial Center and Center for Law, Brain and Behavior, Clinical consultant and panelist, Harvard Law School, Cambridge, MA. June 11-13, 2024

An Evidence-Informed Family Systems Decision Tree for Intervening in Parent-Child Contact Problems with Leslie M. Drozd, PhD, and Michael A. Saini, PhD, Association of Family and Conciliation Courts, Chicago, IL, May 12, 2022

Post-Divorce Issues and Parenting Plans that Stimulate Growth, American Academy of Forensic Psychology, Portland, OR, November 16, 2018, *Guest speaker* with Robin Deutsch, Ph.D., ABPP, and Marsha Kline Pruett, Ph.D., MSL, ABPP

Considerations in Developing Parenting Plans for Special Needs Children: Focus on Autism Spectrum and ADHD, Association of Family and Conciliation Courts, Seattle, WA, September 22, 2018

Child Custody Research & Issues with IPV & Child Abuse, 22nd International Summit on Violence, Abuse & Trauma, Speaker Plenary Panel, San Diego, CA, September 26, 2017

Comprehensive Parenting Evaluations: Steps with Emphasis on Abuse & Trauma Assessment, San Diego, CA, IVAT September 27, 2017

Assessing Trauma, Alienation, and Abuse in Parenting Evaluations, International Hawai'i Summit on Preventing, Assessing & Treating Trauma Across the Lifespan. March 29, 2017