



*Annual Review of Law and Social Science*

# Healthy Development as a Human Right: Insights from Developmental Neuroscience for Youth Justice

B.J. Casey,<sup>1</sup> Kim Taylor-Thompson,<sup>2</sup>  
Estée Rubien-Thomas,<sup>1</sup> Maria Robbins,<sup>3</sup>  
and Arielle Baskin-Sommers<sup>1</sup>

<sup>1</sup>Department of Psychology, Yale University, New Haven, Connecticut 06520, USA;  
email: bj.casey@yale.edu, estee.rubien-thomas@yale.edu, arielle.baskin-sommers@yale.edu

<sup>2</sup>School of Law, New York University, New York, New York 10012, USA;  
email: kim.taylor.thompson@nyu.edu

<sup>3</sup>The Elisabeth Haub School of Law, Pace University, White Plains, New York 10603, USA;  
email: mrobbins@law.pace.edu

Annu. Rev. Law Soc. Sci. 2020. 16:9.1–9.20

The *Annual Review of Law and Social Science* is online  
at [lawsocsci.annualreviews.org](https://lawsocsci.annualreviews.org)

<https://doi.org/10.1146/annurev-lawsocsci-101317-031101>

Copyright © 2020 by Annual Reviews.  
All rights reserved

## Keywords

adolescence, brain, cognition, development, law, rights

## Abstract

Healthy development is a fundamental right of the individual, regardless of race, ethnicity, or social class. Youth require special protections of their rights, in part owing to vulnerabilities related to psychological and brain immaturity. These rights include not only protection against harm but opportunities for building the cognitive, emotional, and social skills necessary for becoming a contributing member of society. They apply to all youth, including those within the adult criminal justice system, which raises the legal question of when adult capacity and responsibility begin and special protections are no longer warranted. This article highlights (a) empirical findings from developmental science on when psychological and neurobiological development reaches maturity; (b) the extent to which this scientific knowledge guides current policies and practices in the treatment of youth in the United States; and (c) emerging policies in the treatment of young people in the justice system based on developmental science.

## INTRODUCTION

At the young age of 16, Kalief Browder was accused of stealing a backpack and was sent to the notorious Rikers Island correctional facility in New York City. At that time, New York automatically treated 16-year-olds as adults in the justice system. Browder was held at Rikers not because he was found guilty of any crime but because his family could not afford to pay his \$3,000 bail. Browder maintained his innocence, refusing to take a plea bargain that would have resulted in his release. Eventually prosecutors dropped his charges, but not before he had spent three years of his youth behind bars, two of those years in solitary confinement. At the age of 22, two years after his release, Kalief Browder took his own life (Casey 2019, Gonnerman 2015).

On any given day, the US juvenile justice system incarcerates approximately 53,000 youth (Sawyer 2018, US Dep. Justice et al. 2013). On any given night, adult facilities house more than 5,000 youth, many for nonviolent crimes (Sickmund et al. 2017). These young people lose much more than their freedom when incarcerated; they lose the opportunity to develop in a healthy environment rich in educational, psychological, medical, and social benefits. As a result, these youth experience lifelong challenges associated with less education, increased mental health problems, higher rates of suicide, and greater financial instability (Visher & Travis 2003).

## THE FUNDAMENTAL RIGHTS OF THE CHILD

The premise of this article is that healthy psychological and brain development is a human right for all, not a privilege for a select few. Unfortunately, this right is not applied equally to all. As the Browder case highlights, it is not applied equally to children in the criminal justice system, and especially not to children of color, who disproportionately come into more contact with the justice system. Even in the justice system, an individual deserves an environment, opportunities, and treatment that allow for optimal development. The right to healthy development continues to be honored in the breach in the United States, where the government transfers, prosecutes, and punishes children as adults in our courts (Taylor-Thompson 2014); puts them in solitary confinement or incarcerates them when they cannot make bail (Clark 2017); and, more recently, detains or separates them indefinitely from their immigrant parents at US borders (Am. Bar Assoc. 2019).

Opportunities for personal growth and prosocial interactions are essential for the health and well-being of the youth (Steinberg 2015) and the health of society. These opportunities include a nurturing environment; formation of healthy bonds with peers; access to health care and education; and experiences to develop individual judgment, a sense of moral and social responsibility, and competencies for a career (i.e., an environment in which the child's best interests serve as the guiding principle). These experiences are necessary for the emergence of social, emotional, and cognitive abilities to become an adult and a contributing citizen of society. Exactly when a young person achieves these milestones, however, remains an open question and appears to vary by the individual, the situation, and societal norms. This article provides an overview of what developmental science has taught us about when an individual reaches psychological and neurobiological maturity and to what extent laws, policies, and practices in the United States operate consistently with these findings. We focus specifically on the needs of young people within the criminal justice system and describe emerging policies and programs that facilitate opportunities for healthy development and successful reentry into society for these youth.

### **The United States as an Outlier in Recognizing the Human Rights of the Child**

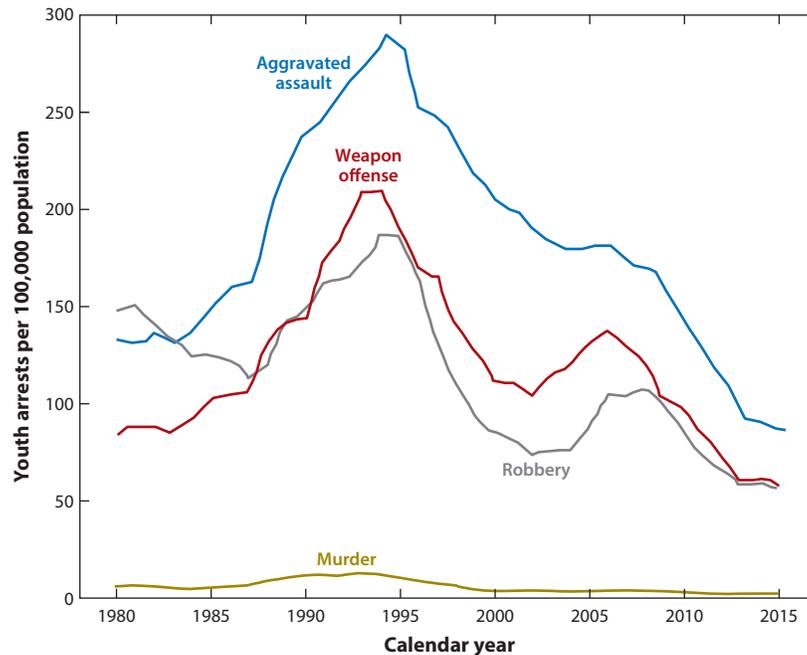
A basic premise of the Declaration of the Rights of the Child adopted by the League of Nations (1920–1946) after World War I is that healthy development is a human right (Buck 2014, Mulley

2010). The declaration recognizes that the child deserves special protections and opportunities to develop in a healthy manner without discrimination. Underlying these basic rights are the entitlement to an education and opportunities to develop the abilities, individual judgment, and social responsibility necessary to becoming a contributing member of society. The UN General Assembly adopted these rights in an expanded form in 1959, affirming that these rights apply to all youth regardless of nationality, religion, race, ethnicity, socioeconomic status, and gender (UN Comm. Hum. Rights 1959). Although US governmental officials helped to draft this treaty and ultimately signed it, the United States stands alone among the 193 members of the United Nations in its decision not to ratify it. Even today, the United States is not bound by its terms, and in reality, the UN position on the rights of the child literally has no direct impact on policy and practice in the US legal system.

### **The Rights of the Juvenile Offender in the United States**

To discern how the United States perceives and in turn treats children, particularly when they engage in delinquent or criminal behavior, we must turn to policies, laws, and practices from the past two centuries. During this time, the United States has experienced three distinct phases of policy change regarding the treatment of youthful offenders (Bonnie & Scott 2013; Cohen et al. 2016a; Henning 2013; Taylor-Thompson 2003, 2014). The first phase emerged in the early 1900s as the country embarked on a path that mandated special protection and treatment of juvenile offenders. This phase lasted nearly 100 years. Prior to the turn of the twentieth century, children faced prosecution and punishment as adults. But Progressive reformers in the Industrial Age questioned both the wisdom and utility of exposing young children to adult treatment. Instead, they insisted that the state should guide the behavior of wayward children through remedial approaches taken in the best interest of the child. Institutions were established that separated juvenile and adult offenders and focused on the young person's rehabilitation with the goal of preventing a lifetime of crime (N.Y. State Arch. 1989, Taylor-Thompson 2003). In 1899, Progressive reformers in Illinois secured legislation that enabled the establishment of the first juvenile court (Am. Bar Assoc. 2007, Mack 1909), separating the justice treatment of youthful offenders from that of adults. Other states soon followed. Justice reformers insisted that young offenders deserved special protections because of their greater potential for rehabilitation as compared with adult offenders. But these policy changes did not occur owing to a better understanding of the adolescent brain or behavior. Rather, they reflected changes in the political and social climate of the time (Bonnie & Scott 2013, Taylor-Thompson 2003).

By the end of the twentieth century, the political winds shifted, and a second policy phase emerged. Pundits, academics, and the media promoted a new image of children as dangerous, hardened, and remorseless (Taylor-Thompson 2014). Academics predicted a tidal wave of violence by a new type of young offender and stoked fears that these "superpredators" would get away with murder in the juvenile system (Regnery 1985). The media increased public fear by depicting individual incidents of violence, such as school shootings, as evidence of a new norm of juvenile violence rather than as exceptional circumstances (Taylor-Thompson 2014). And the media reserved its most explosive images for children of color, stigmatizing them as offenders who were not delinquent but instead were criminal. This recasting of the child as more sinister enabled a dramatic shift in treatment from the protective environs of the juvenile court to the more punitive approaches in the adult criminal justice system. The slogan "adult time for adult crime" became both a rallying cry and a policy prescriptive (Myers 2003). By the late 1990s, nearly every state and the District of Columbia had extended the right to transfer juvenile offenders to adult courts at younger ages (Cauffman et al. 2018, Griffin et al. 2011). Ironically, the prediction of a



**Figure 1**

National arrests of violent offenses involving youth aged 10–17 since 1980. Figure adapted with permission from Butts (2016).

new breed of young superpredators never manifested. To the contrary, juvenile crime has significantly decreased (Butts 2016, Myers 2003) (**Figure 1**). Despite this decline, the United States still has the highest rate of youth confinement of any developed country (Annie E. Casey Found. 2011, Casey 2019).

In 2005, the United States entered a third phase of policy change in the treatment of youthful offenders. The pendulum has shifted from a purely punitive approach to one that expects developmental perspectives to guide assessments of culpability and punishment. This phase of policy change reflects scientific advances in our understanding of the adolescent brain and behavior and promotes a neurodevelopmentally informed juvenile justice system (Natl. Acad. Sci. Eng. Med. 2019). Once again, as in the early phases of juvenile justice policy, young offenders are generally viewed as distinct from adult offenders, requiring special protections and treatment.

One of the principal voices championing the third phase has been the US Supreme Court, in five key opinions. The first of these decisions, *Roper v. Simmons* (2005) abolished the death penalty for juvenile offenders, ruling it unconstitutional under the Eighth Amendment as a violation of the prohibition against cruel and unusual punishment. Five years later, in *Grubam v. Florida* (2010), the court built on the foundations of *Roper* and established a categorical ban on life-without-parole sentences for juvenile offenders convicted of a nonhomicide offense. Then, two years later, in *Miller v. Alabama* (2012) and *Jackson v. Hobbs* (2012), the court outlawed the mandatory imposition of a life-without-parole sentence for homicide. To be clear, a youthful offender can still receive a life sentence without parole, but the sentence cannot be mandatorily implemented for any given crime. These opinions impacted only a few hundred individuals, but each of these opinions reflected acknowledgment by the US justice system that young people differ from adults in important ways. They are (*a*) less mature in their ability to consider the future

consequences of their decisions and actions (Steinberg et al. 2009), (b) more susceptible to peer influences (Chein et al. 2011, Steinberg & Monahan 2007), and (c) more malleable than adults (Cauffman & Steinberg 2000, Steinberg 2015).

The fifth opinion, *Montgomery v. Louisiana* (2016), has the potential to affect thousands of lives. There, the court held that its decision in *Miller v. Alabama* (2012) applied retroactively, meaning that more than 2,000 youth serving life-without-parole sentences for homicide were now entitled to resentencing.

These changes in the treatment of young offenders are promising, but juveniles within the US justice system continue to be detained for extended periods of time pretrial, transferred to adult courts, sentenced to life without parole, and confined to solitary isolation in different forms. Moreover, treatment is not equally applied to all children within the United States. That is, not all children in the United States are given the same special protections for healthy development.

### **The Role of Social Class, Race, and Ethnicity in the Protection of the Child's Rights**

No child fares well in the criminal justice system, but children of color and lower socioeconomic status are disproportionately affected. The US criminal justice system reflects deep-rooted issues related to enduring economic, social, political, and racial/ethnic inequality. These inequities have resulted in the marginalization of particular segments of society, with especially tragic consequences for young people who are incarcerated. These youth tend to be disproportionately poor, undereducated, and of color. Compared with their counterparts who are not involved in the justice system, incarcerated youth are far less likely to complete high school, are more likely to suffer from physical and mental health problems, more frequently enter into unstable relationships, and more often will experience chronic unemployment. Notably, their offender status enmeshes them in a trajectory that reinforces their marginalization, fueling a larger cultural bias that equates criminality with being poor or a member of a racial or ethnic group (Mears & Travis 2004, Moore et al. 2016, Natl. Acad. Sci. Eng. Med. 2001).

Socioeconomic status affects the treatment of young people who come into contact with the US justice system (Thornberry 1973). Our system of law enforcement focuses on low-income communities where crime is often more visible. Police departments designate and deploy resources to “high-crime” areas, encouraging more widespread surveillance and more intrusive tactics in those marginalized areas than in wealthier communities (Moore 2015). Consequently, high numbers of arrests occur in low-income communities, and the majority of youth with criminal justice system involvement either are on public assistance or come from families with low household incomes. Once youth from these communities are arrested, their poverty means they are less likely to be able to afford bail. As the case of Kalief Browder highlights, conditioning pretrial freedom on financial wherewithal raises fundamental human rights concerns (Human Rights Watch 2010).

We not only criminalize poverty but compound that economic injustice with racial and ethnic injustice. Youth of color are more than twice as likely to be impoverished as their White counterparts. For example, Blacks in the United States are overrepresented in economically disadvantaged communities, with 66% of Black children growing up in disadvantage as compared with 6% of Whites (Sharkey 2009) and 19% of Hispanics (Annie E. Casey Found. 2011). Youth of color are more likely than Whites to be arrested and incarcerated. Moreover, children of color are almost 20 times more likely than White children to be sentenced as adults for crimes. Although they represent a minority of the US population, youth of color comprise nearly 60% of youth sentenced to adult facilities (Poe-Yamagata & Jones 2000). As was poignantly portrayed in

the dramatic reenactment *When They See Us* (DuVerney 2019) and detailed in the documentary *The Central Park Five* (Burns 2012), juveniles transferred to adult court endure harsher treatment than those committed in juvenile court. Adult facilities have a higher risk of sexual and physical assaults and a tenfold increase in suicides relative to juvenile facilities (Gainsborough & Young 2000, Goff et al. 2014, Poe-Yamagata & Jones 2000). Once convicted, and even after successful completion of a sentence, young people will carry the burden of an adult criminal record, which can affect future education, diminish employment opportunities, and may lead to the loss of many of their rights, including the right to vote.

What are the root causes of the disproportionate percentage of incarcerated youth of color? Seminal experiments by Goff et al. (2014) set out to examine that question. They asked whether perceptions of age and innocence differ by race and severity of crimes. Both undergraduate and police officer volunteers served as participants. Each participant rated the innocence and age of White, Black, and Latino child suspects for either a misdemeanor or a felony. Goff's research revealed that participants perceived Black male children as both older than their true age and less innocent than their non-Black peers when accused of felony crimes. Perhaps the most sobering results from this study were those collected from police officers. Despite their experience dealing with young people suspected of crimes, police participants overestimated the age of Black males by 4.5 years. To put this point differently, participants misperceived 13-year-old Black boys as 17-year-olds. Similarly striking, the older the officer rated the child, the more culpable the child seemed: The officers rated Black felony suspects as older and White felony suspects as younger than their true age and more culpable for more severe crimes (Figure 2a,b). These findings suggest that Black children may be perceived as adults and may be held more accountable for a crime even by age 13. However, police perceived White children as younger than their actual age and, thus, as less accountable for their crimes. The phenomenon of adultification prematurely removes young Black males from a developmental category that benefits White males. The perception of young Black males as older and less innocent was also associated with police officers' self-reported use

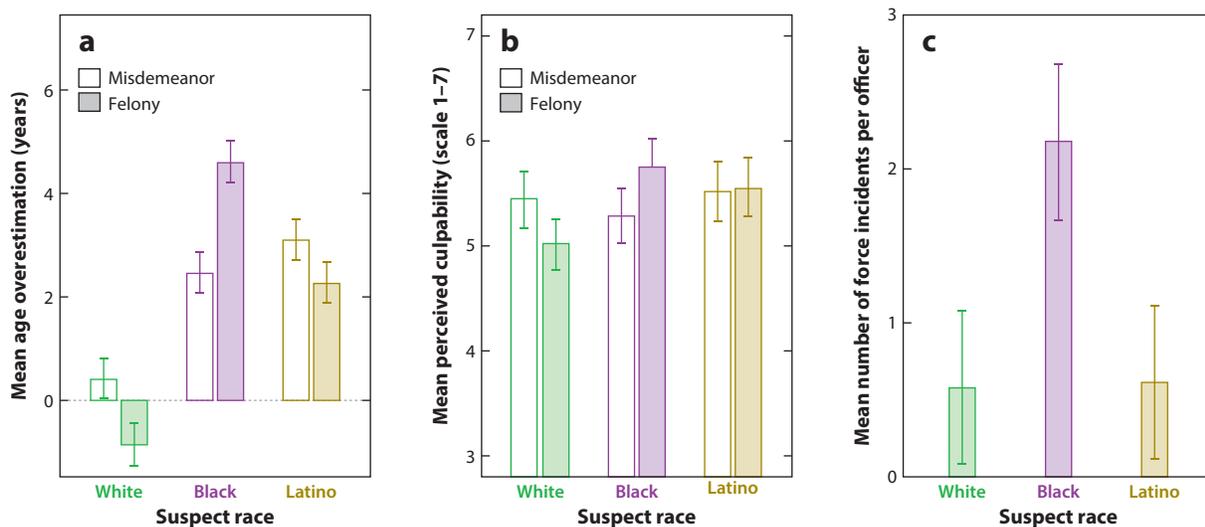


Figure 2

Effects of suspect race on police perceptions of age, innocence, and use of force. (a) Officers' average age estimation accuracy for youth suspects of different races. (b) Officers' average culpability ratings for youth suspects of different races. (c) Officers' average use of force against youth suspects. Error bars represent standard errors. Figure adapted from Goff et al. (2014).

of force. Average ratings of force were nearly four times higher for Black youth than for White youth (**Figure 2c**).

Together, this research suggests that the United States seems more open to the idea of healthy development with respect to some but not all children. Special protections afforded to young people by the law, such as consideration of diminished responsibility for criminal behavior and assignment to facilities that are more rehabilitative than punitive, are not applied equally to all youth. Factors such as socioeconomic status and race impinge on these protections for some (Cauffman et al. 2018, Taylor-Thompson 2014). Thus, despite youth being granted special protections in the eyes of the law, who is considered a young person deserving of these protections appears different based on various individual and social structural factors.

## **WHEN DOES A CHILD OBTAIN ADULT CAPACITY AND RESPONSIBILITY?**

### **Adolescence: The Transition from Childhood to Adulthood**

Upholding and defending special protections for youth raises a key legal question: At what age does the young person reach the point when adult capacities and responsibilities remove the need for special protections? Exactly when the milestone of adulthood is achieved varies depending on the perspective. From a developmental perspective, adolescence serves the function of the child developing into an adult. During this developmental phase, the adolescent learns to be relatively independent of the caregiver in preparation for the future role of being a contributing adult within society. The adolescent must meet the many challenges of this developmental time period, including negotiating new intellectual, emotional, social, physical, and sexual demands and conflicts without the buffer of the caregiver.

From a societal perspective, an individual achieves adulthood once he or she is financially independent, has completed formal education or vocational training, or has formed a family. Interestingly, the societal perspective on the milestone of adulthood is far from constant and, instead, changes from generation to generation and culture to culture. Take, for example, societal views on marriage as one measure. In the 1950s, the median age of marriage was 22. Today, the median age has risen to 28 (US Census Bur. 2016). The point at which the child is ready to take on these social responsibilities has varied throughout history and is dependent on educational, financial, or social achievements. So, the bar for adulthood may shift based on differing practices and expectations.

From a legal perspective, adulthood is even more difficult to define in the United States given the variability in policies and laws from one state to the next and even within states. The age of majority—or the age at which an individual is granted the rights and responsibilities of an adult by law—tends to be 18 years. Eighteen-year-olds can sign legal documents, vote, marry, and serve in the military without parental permission. In many states, the age at which individuals can purchase cigarettes or vaping products has been raised from 18 to 21. But the age boundaries for the prosecution of youth in the justice system are not as high or as solid. Every state sets a maximum age of juvenile court jurisdiction. For most states, the age is 17 years old, although North Carolina sets its maximum age at 15. However, more than half of US states have no statute that specifies a minimum age for charging a child as an adult for a violent crime (Cohen et al. 2016b, Griffin et al. 2011, Taylor-Thompson 2014). Consequently, children as young as 10 have been prosecuted as adults.

These different perspectives on the onset of adulthood raise the important question of whether age boundaries drawn by society and laws reflect or contradict what we know about psychological and human brain development. Is there a clear demarcation in age for the point at which a

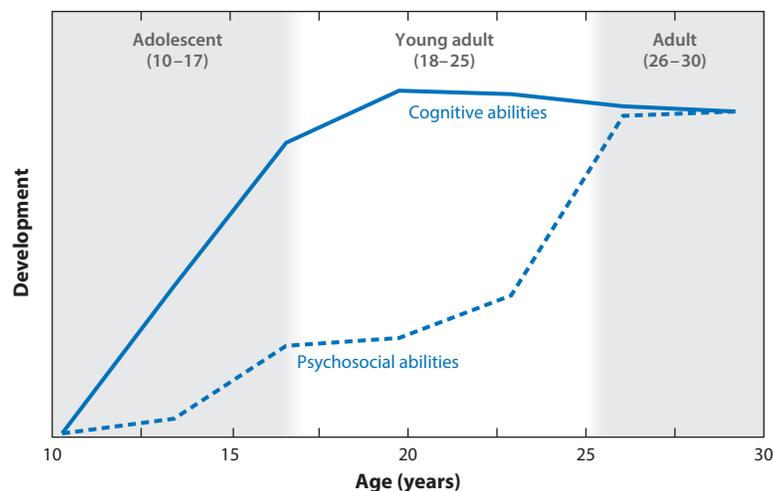
young person gains adult capacity and responsibility and no longer warrants special protections and treatment?

### When Does the Child Reach Psychological Maturity?

The age-of-majority model is based on the premise that an individual reaches full adult capacity by 18 years of age. This premise suggests that mental or psychological capacity is a unitary process. Yet, human behavior is complex and the result of a multitude of behavioral, cognitive, emotional, and social competencies (Casey et al. 2014). Do all of these competencies mature at once? In other words, is there a single age at which we all reach adult capacity, or does capacity vary by domain? Are we equally able to engage in controlled and flexible behavior to manage our thoughts, desires, fears, and rage at the same age, or do these processes develop at different time points?

A series of experiments performed by Steinberg et al. (2009) elegantly demonstrated that cognitive and psychosocial abilities develop at different rates. In that study of more than 900 individuals ages 10 to 30 years, they administered two different batteries of assessments: a cognitive task battery and a psychosocial task battery. The cognitive battery assessed verbal fluency, digit span, and resistance of memory against interference. The psychosocial battery assessed risk perception, sensation seeking, and peer influences on decision making. Composite scores were then separately computed for each of these sets of abilities, and difference scores were calculated in performance for the younger ages relative to performance by the 26- to 30-year-olds. The findings show that developmental asymptote in cognitive performance was reached by 16 to 17 years, whereas socioemotional abilities did not plateau until the early twenties. This gap in the development of cognitive versus psychosocial abilities has been shown to hold for young people across cultures and countries (Duell et al. 2018, Icenogle et al. 2019) (**Figure 3**). Together, these studies suggest that there is no magical age when all psychological capacities mature. Rather, different psychological abilities mature at different ages, and this maturity can extend into the early twenties.

Moreover, research focused on another aspect of cognitive capacity, cognitive control [the ability to override competing information and actions in favor of goal directed actions (Casey et al. 2001)], provides similar evidence for a gap between cognitive abilities and the ability to balance



**Figure 3**

Age gap in psychological abilities (figure adapted from Icenogle et al. 2019).

cognitive and emotive processes. Much like the work of Steinberg and colleagues, this research has shown that inhibition of irrelevant information in favor of task-relevant information becomes more efficient throughout childhood and adolescence (Casey 2015). Performance on pure cognitive control tasks like the Stroop, Flanker, and Go/NoGo tasks, in which a competing stimulus or response must be overridden, shows near-asymptote performance by the early teen years (Casey & Caudle 2013, Durston et al. 2002, Ridderinkhof et al. 1997).

This developmental pattern changes in the context of regulating and integrating socioemotional information. Several lines of research have examined the psychological ability to process emotionally salient information in a regulated manner (e.g., Cohen et al. 2016b). Broadly speaking, adolescents show exaggerated responses to emotional information, both positive and negative (Dreyfuss et al. 2014, Somerville et al. 2011). More specifically, adolescents show heightened sensitivity to rewards (Crone & Konijn 2018, Galvan et al. 2006, Van Leijenhorst et al. 2010), threats (Dreyfuss et al. 2014, Hare et al. 2008, Monk et al. 2003), and peers (Breiner et al. 2018, Chein et al. 2011). On one hand, consistent with the work by Steinberg et al. (2009), when teens are asked to make decisions in these social situations, their performance is diminished relative to adults (Breiner et al. 2018, Chein et al. 2011). Likewise, when socioemotional information is used as a distractor, teens show diminished cognitive control compared with children and adults (Dreyfuss et al. 2014, Somerville et al. 2011). On the other hand, when rewards versus losses are used as incentives to perform well, rather than as distractors, adolescent performance improves relative to adults (Barkley-Levenson & Galván 2014, Davidow et al. 2016, Geier et al. 2010, Somerville & Casey 2010). Adolescents are more deliberate and cautious than adults when a large reward is at stake (Teslovich et al. 2014) and more risk averse than adults when the probabilities of outcomes and potential losses are known (Tymula et al. 2012).

Together, these studies reveal two key findings. The first is that as a group, adolescents show protracted development in psychological abilities over time and differ from adults in these abilities, which justifies special concern for and protection of youth. Thus, age matters. The second is that there is no one age at which the adolescent reaches maturity in all psychological capacities. Different psychological capacities (cognitive, emotional, social) mature at different ages, and this development extends into the early twenties. A consequence of this type of distinction in developmental trajectories of psychological capacities may be that in some contexts, young people appear to display controlled behavior, but in other contexts their behavior may look out of control, or that in some contexts young people can weigh the costs and benefits of their options, but in other contexts they lack the ability to engage in this type of matured decision making.

These inconsistencies in youth behavior across different cognitive and psychosocial contexts are difficult for the law to handle, particularly when a young person at one age is showing divergent tendencies that in one context make them seem like an adult and in another context make them seem psychologically immature. In fact, US Supreme Court Justice Antonin Scalia accused developmental scientists of spinning their findings whichever way they wanted to advocate for the special treatment of youth (Steinberg et al. 2009). This accusation targeted amicus briefs for two Supreme Court cases. The first was *Hodgson v. Minnesota* (1990), regarding whether to give minors the right to obtain an abortion without parental involvement. The second was *Roper v. Simmons* (2005), regarding whether to abolish the death penalty for juvenile offenders. Justice Scalia argued that the same scientific evidence that was used to show that youth could make deliberate decisions about abortions was then used to show precisely the opposite position in the case of abolishing the death penalty for juveniles.

Yet, the two Supreme Court cases to which Scalia referred reflected different types of decisions, and developmental scientists have consistently shown situations in which adolescents make suboptimal decisions [e.g., regulating and integrating socioemotional information (Breiner et al.

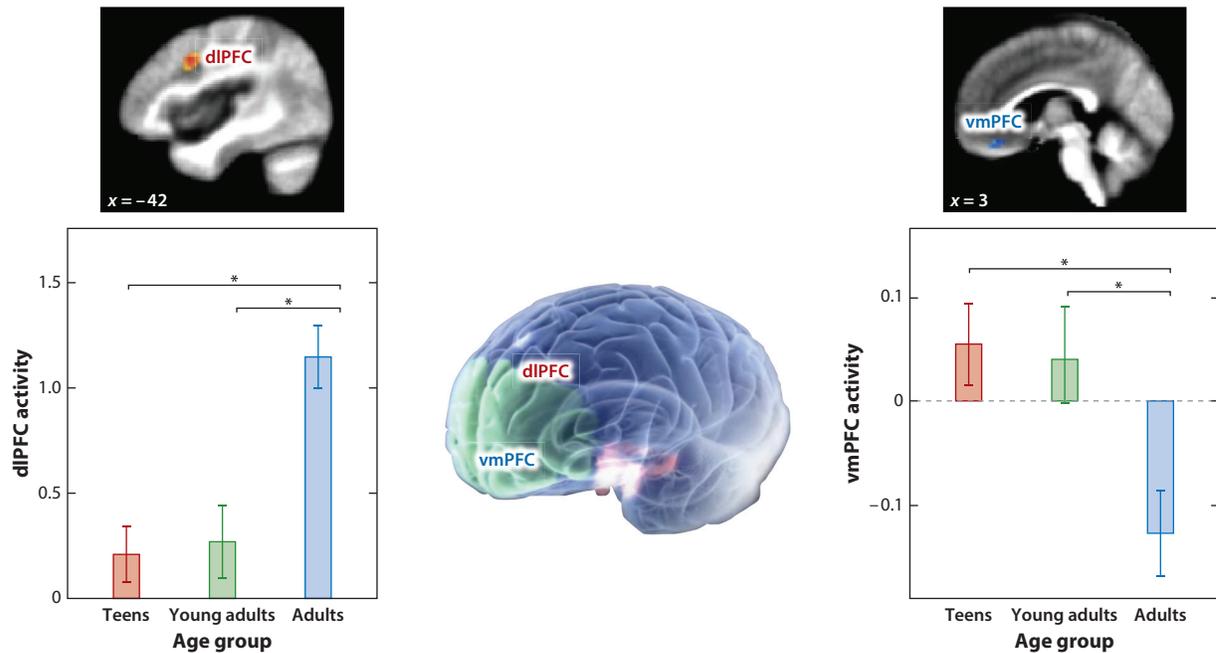
2018, Chein et al. 2011, Somerville et al. 2011, Steinberg et al. 2009)] and those in which they make optimal decisions [e.g., cognitive and incentive-based choices (Barkley-Levenson & Galván 2014, Davidow et al. 2016, Steinberg et al. 2009)]. Thus, distinguishing between complex contexts in which youth have capacity similar to adults, or not, is important for informing different legal policies to protect youth and their rights. Now, findings from brain science are emerging that provide additional insights into the possible basis of differential timing of distinct psychological processes in different social contexts to further inform policies.

### When Does the Brain Reach Maturity?

How has neuroscientific evidence informed the psychological literature on when we reach adult capacity and responsibility? Is there a neural signature of brain maturity? The field of neuroscience has shown that the brain has remarkable plasticity and can change and adapt to new situations and information throughout the life span (Somerville 2016). Thus, the suggestion of a single demarcation in time when the brain is mature or stable challenges neuroscientific evidence. Nonetheless, there have been exciting attempts to develop a human brain maturity index or growth curve from human structural and functional brain imaging data (Brown et al. 2012, Dosenbach et al. 2010, Kaufmann et al. 2017), much like the height and weight growth charts used in pediatrician offices today. Each of these brain imaging studies highlights significant brain changes into the twenties but varies depending on the brain region, measure, imaging modality, and sex of the individual. For example, Brown et al. (2012) used different MRI (magnetic resonance imaging)-based anatomical measures together with nonlinear modeling to predict true age in more than 800 3- to 20-year-olds. Their model could predict brain maturity and account for 92% of the variance, but the individual neuroanatomical components contributing to this prediction varied greatly in the degree to which they contributed to predictions at different ages. This work highlights the dynamic and complex developmental changes that occur in the brain from childhood to adulthood. However, even with this variability, there is a general pattern of prolonged development of prefrontal control and cortical circuitry into the twenties that is important for the regulation of emotions, desires, and actions.

To complicate this picture a bit further, recent studies suggest that functional brain maturation, as measured by correlated activity across the brain, is impacted by the emotional state of the brain (Rudolph et al. 2017). That is, a model designed to predict the true age of participants aged 10 to 25 years, from coactivated nodes within and across brain networks, was less able to predict the true age of individuals in emotionally charged mental states. Examining where the model was most and least accurate in predicting true age revealed an informative pattern. The model was less accurate in predicting the true age of adolescents in their mid-teens relative to younger and older participants during emotional arousal. In these conditions, their functional connectomes appeared less mature. This less-mature pattern of functional connectivity under emotional arousal was associated with greater self-reported risky behavioral tendencies and preferences for both adolescents and young adults up to the age 21.

To further discern the influence of emotional arousal on cognitive capacity and the brain during adolescence and young adulthood, Cohen et al. (2016b) examined the impact of positive (reward) and negative (threat) emotional states in teens aged 13 to 17, young adults aged 18 to 21, and adults over 21. Consistent with a vast developmental literature, teens performed worse relative to both young adults and adults over 21 in positively arousing conditions (positive social cues and in anticipation of reward; Breiner et al. 2018, Chein et al. 2011, Somerville et al. 2011). However, in conditions of potential threat, young adults, like teens, performed significantly worse than adults over 21. The developmental patterns in behavior in the threat conditions were paralleled

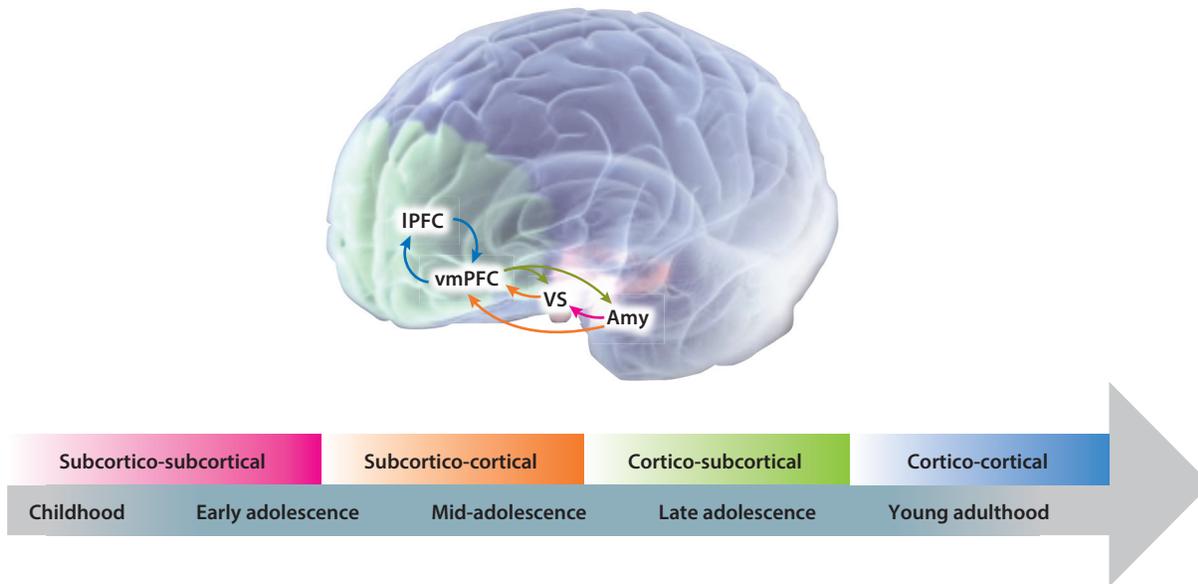


**Figure 4**

Young adults, like teens, show less activity in prefrontal cortical control circuitry and greater activity in limbic emotional cortical circuitry under threat, relative to adults. Abbreviations: dIPFC, dorsolateral prefrontal cortex; vmPFC, ventromedial prefrontal cortex. Figure adapted with permission from Cohen et al. (2016a).

by greater activity in limbic (emotional) cortical circuitry and less activity in prefrontal control circuitry in both teens and young adults relative to adults (**Figure 4**). Thus, the transition from young adulthood to adulthood reflects a shift in reliance on limbic circuitry to cognitive circuitry. The threatening contexts in the current experiment may best capture emotionally charged situations in which young people often come into contact with the law and end up making poor decisions. Together, these studies parallel the developmental behavioral findings and provide evidence of protracted development of brain circuitry into the early twenties that is associated with functionally significant behavior changes that vary by age as a function of the cognitive, emotional, or social context.

Currently, there is a growing shift in the description of the developing brain from simple dual-system models of cognitive and emotive brain systems to circuit-based accounts of development and function that may account for nuanced, yet significant, differences in the capacities of children relative to teens, teens relative to young adults, and young adults relative to adults (Casey et al. 2016, 2019). Accordingly, brain development involves a cascade of changes in progressively more complex circuits with age, from deep subcortical circuits implicated in emotive behavior; to subcortico-cortical circuits; and ultimately to changes in higher-level cortico-cortical circuits implicated in control of thoughts, actions, desires, and fears (Casey et al. 2016, 2019). This neurodevelopmental account suggests that the instantiation of a circuit is dependent on the maturation of preceding ones and is consistent with Thelen's notion of development as hierarchical (Casey et al. 2016, Thelen 2005). Studies supporting this account show early changes in deep subcortical regions of the brain (amygdala and ventral striatum; Geier et al. 2010, Hare et al. 2008, Monk et al. 2003, Van Leijenhorst et al. 2010) that correlate with impulsive reactions to positive



**Figure 5**

Illustration of hierarchical development of brain circuitry implicated in self-control (*top row of arrow*). Hierarchical changes in several brain circuits during adolescence (*bottom row of arrow*). Abbreviations: Amy, amygdala; IPFC, lateral prefrontal cortex; VS, ventral striatum; vmPFC, ventromedial prefrontal cortex. Figure adapted with permission from Casey et al. (2019).

and negative socioemotional cues (Dreyfuss et al. 2014, Heller et al. 2016, Somerville et al. 2011). Subsequent decreases in subcortical connectivity and diminished impulsivity to these cues with age parallel changes in medial prefrontal cortex–amygdala functional connectivity (i.e., cortico-subcortical changes, Heller et al. 2016), with a shift from positive to negative connectivity (Gee et al. 2013b). This shift in functional connectivity of cortico-subcortical circuits appears to be a prerequisite for later successful cognitive regulation of emotions via cortico-cortical projections during cognitive reappraisal of emotional information (Silvers et al. 2017). A simplified illustration of these hierarchical changes in circuits from subcortical to cortical is depicted in **Figure 5**. This diagram represents a shift from reliance on limbic emotional circuitry to more prefrontal control circuitry, with intervening phases of development within and between these circuits from early adolescence to adulthood. Accordingly, adolescence involves not simply one or even two changes in emotional and regulatory systems but a series of changes in multiple brain networks during adolescence.

Viewing adolescent brain development as consisting of a series of hierarchical changes may help to identify and explain differences in the capacities of young teens relative to older teens and of older teens relative to young adults. These changes may be critical for the development of regulatory processes across a variety of cognitive, social, and emotional situations and have important implications for the treatment of juvenile offenders of different ages in the justice system (i.e., not one age fits all). This view of brain and cognitive development contrasts sharply with the assumptions of the age-of-majority model that assumes young people are magically endowed with full adult capacity by their eighteenth birthday (Cohen et al. 2016a). Rather, it suggests hierarchical changes in brain and behavior that require us to rethink how we treat and meet the needs of

young people at different ages and phases of adolescence (early, late) and young adulthood as they transition into adulthood to take on independent roles in society.

## **DEVELOPMENTS IN THE TREATMENT OF YOUNG OFFENDERS IN THE UNITED STATES**

Although the United States still incarcerates more young people than any other industrialized country in the world, the youth confinement rate has been declining across races and ethnicities since the late 1990s (Sickmund et al. 2017). Even in this third phase of policy changes, where decision makers are encouraged to employ a less punitive approach to sentencing of youthful offenders, there has been no increase in the violent crime rate of juveniles (Butts 2016). The choice to shift more toward a developmental approach to youthful offending does not mean that youthful offenders should not be held to account for their actions. In contrast, that policy choice still means that youthful offenders should be held accountable, but it recognizes that the path toward changed behavior starts with giving the young offender the opportunities to learn so that he or she can earn the right to reenter society. This opportunity to learn and develop into a contributing member of society is a human right. Unfortunately, transfer laws; economic, racial, and ethnic injustices; and solitary confinement are inconsistent with this right. Below, we highlight how developmental science is informing justice policies and practice regarding the treatment of youthful offenders and how it can continue to do so.

### **Stopping Juvenile Transfer to Adult Court**

The decision to seek and grant transfer varies by state, age, and the type of crime committed. Over the past several decades, states have raised the age of juvenile jurisdiction to 17, with the state of Vermont even extending the age of juvenile court jurisdiction for nonviolent crimes from 17 to 21 by 2020. However, North Carolina still prosecutes 16-year-olds as adults, and some states have no minimum age limit for adult prosecution for violent crimes (i.e., a child of any age can be processed as an adult) (Griffin et al. 2011). Sentencing is harsher in adult courts, and adult facilities are more dangerous than juvenile ones (e.g., more sexual and physical assaults and suicides) (Goff et al. 2014, Poe-Yamagata & Jones 2000, Young & Gainsborough 2000). Paradoxically, transferring children into the adult justice system does not increase community safety. Data show that adult prosecution and incarceration of juveniles lead to higher recidivism rates after release (Fagan 1996, Hahn et al. 2007). Thus, transfer laws currently protect neither the youth nor society.

So how can developmental science inform transfer laws and policies to prevent children, especially children from disadvantaged communities, from being transferred to adult courts? It would seem reasonable to apply the same basic principles to transfer laws that the US Supreme Court acknowledged in its decisions to abolish the death penalty and to outlaw the mandatory imposition of life without parole for youthful offenders: Decision makers ought to consider the mitigating qualities of youth related to their immaturity and should consider their greater capacity for change given their developmental stage (Cauffman et al. 2018, Cauffman & Steinberg 2000, Steinberg 2015). Using developmental science as a lens might lead policy makers to ask whether juvenile offenders should remain in the juvenile system, with the special protections of care and rehabilitation that guide that system. At a minimum, states might consider mandating a minority rule against adult prosecution for offenders under at least 17 years of age (Taylor-Thompson 2014). A minority rule also would protect children of color from being treated more harshly in adult courts owing to decision makers perceiving them as older and less innocent than White

children. Yet, developmental science shows continued psychological and brain development into young adulthood, so would 21 be a more appropriate age limit? This question highlights the different needs, psychological abilities, and brain maturation of young adolescents relative to young adults. Age-specific reforms that avoid transfer of youth under 18 years to adult courts, and that create neurodevelopmentally attuned courts and correctional facilities geared toward remediation over punishment, may be more appropriate and attainable goals in the short term.

### **Treating Young Adulthood as a Special Developmental Stage in the Justice System**

Developmental science has begun to have a genuine impact in the justice system. In support of justice policy reforms, legislators are referencing developmental science. A growing number of prosecutors have sought and won election as district attorneys on a progressive platform calling for criminal justice reform. One plank of the platform has been to reduce their reliance on the tool that allows them to seek adult charges against children. As a result, we are beginning to see promising evidence of a downturn in the frequency with which prosecutors certify children for adult court treatment in some states. Some scholars and state officials have called for a complete cessation of adult charging for anyone under 21. California voters recently made the decision to remove that choice from prosecutors, and other states have approved reverse-transfer mechanisms, allowing a young person to be placed back in juvenile court if the adult charges do not result in a conviction.

In the legal system, litigants are looking to extend the rulings in *Roper*, *Miller*, and *Graham* to individuals who were between 18 and 20 at the time of their offense. Many of those representing individuals sentenced as young adults and serving life-without-parole or time on death row are using emerging research showing significant psychological and brain development into young adulthood to suggest that courts consider extending the application of those decisions to a slightly older cohort. Court personnel—judges, prosecutors, defenders, and probation officials—are undergoing training in developmental science to enable more informed treatment, charging, and sentencing decisions. The end result is a growing recognition of young adulthood as a distinct and special developmental phase of life that may require differential treatment in the justice system.

Consistent with this view is the emergence of young adult courts and correctional programs. Young adult courts first emerged in California but have begun to appear across the country. These courts represent a move toward restorative justice that balances the needs of the victim, the offender, and the community in an effort to repair the harm done by delinquent actions. Specialized young adult units also are emerging within correctional facilities. In Connecticut, Cheshire Correctional Institution is piloting a special unit for 18- to 25-year-olds called Truthfulness, Respectfulness, Understanding, and Elevating (TRUE). This unit supports incarcerated young adults with mentors and programs to prepare them for reentry into society. A recent study examining the effect of the TRUE unit on attitudes of and impressions toward those incarcerated by corrections officers found that this rehabilitative focus created a fairer and more just environment, promoting more positive interactions between officers and those incarcerated (D.E. Peterman, E. Rubien-Thomas, T. O'Brien, et al., manuscript under revision). Although 18- to 25-year-olds are not juveniles by US law, the findings from developmental science suggest that they are similar in some ways to teens in their brain maturation and psychological abilities. As such, opportunities for personal growth and prosocial interactions are fundamental to their development, health, and ability to contribute to society.

### **Eliminating the Use of Bail for Youth**

The justice system's reliance on money bail as a mechanism to ensure an individual's return to court has come under increasing scrutiny and attack. Kalief Browder's incarceration at Rikers Island occurred because he was deemed an adult in the justice system, where he was subject to adult court practices. And when the court set bail at \$3,000, his family could not afford to pay. Browder put a face on an economic justice problem that had long plagued the criminal justice system: Justice and freedom should not be dependent on a child's access to money or family resources.

Developmental science has offered new insights into the damage that pretrial incarceration can cause. As in Browder's case, such detentions can lead to prolonged separation of youth from their families, which has long-lasting effects on brain and psychological development and health (Cohen et al. 2013; Gee et al. 2013a; Tottenham et al. 2010, 2011), making reform efforts all the more important. Initiatives are now underway across the country for bail reform. California was one of the first states to abolish bail for those awaiting trial, declaring the state's bail system unconstitutional. Yet the bail laws that led to Browder's incarceration are basically still in effect in New York. National organizations are stepping into the policy debate and endorsing elimination of money bail. In 2017, the American Bar Association submitted a resolution and report against the use of bail with children (Am. Bar Assoc. 2017). This resolution urges federal, state, and local governments to prohibit the use of monetary or other goods for the release of a juvenile pretrial. They also recommend the use of nondiscriminatory practices and least-restrictive conditions of release for all juveniles. This resolution recognizes the importance of a nurturing environment for the healthy developing mind and brain, regardless of race, ethnicity, or social class, and is consistent with a neurodevelopmentally informed juvenile justice system (Natl. Acad. Sci. Eng. Med. 2019).

### **Banning Solitary Confinement for Youth**

Finally, there is growing documentation of the harm that isolation and solitary confinement have on the individual, including higher rates of self-harm and suicide (Holt-Lunstad et al. 2015, Kaba et al. 2014). Confining youth in dark and dirty cells with no social contact for days, weeks, or longer seems particularly cruel and violates international treaties protecting human rights and the special rights of the child. Yet, this practice continues in the United States today (Cauffman et al. 2018, Vasiliades 2005).

The publicity surrounding Browder's case served as a catalyst for reform. Browder spent two of his three years at Rikers Island in solitary confinement. That extended period of isolation was not protective of the special rights of the child and did not provide the rights to opportunities for growth and health. Following his death, the New York City Department of Correction announced a ban on involuntary solitary confinement for 16- and 17-year-olds at Rikers Island. The next year, the Department of Correction extended restrictions of involuntary confinement to 18- to 21-year-olds, making Rikers Island the first jail in the country to end solitary confinement for adolescents and young adults. That same year, the federal government under President Obama banned solitary confinement for juvenile offenders in federal prisons. Several, but unfortunately not all, states have since followed suit.

Solitary confinement stifles growth during a sensitive period of massive cognitive, emotional, and social development. The brain does not mature in isolation but rather depends on learning from experiences that help to shape psychological development. Opportunities to learn from individuals, social experiences, and prosocial role models are essential for the healthy development and socialization of youth. These opportunities are not afforded to youth placed in solitary confinement. So, applying the same basic principles that influenced the US Supreme Court to champion

the third phase of youth justice treatment, states should consider the vulnerabilities related to brain and psychological immaturity and a young person's potential for change in making the choice to end solitary confinement of juveniles.

## CONCLUSIONS: OPPORTUNITIES AND OBLIGATIONS

The premise of this article is that healthy development is a right for all. This premise is contradictory to current US policies and practices that transfer, prosecute, and punish juveniles as adults and is not applied equally to all youth, with the disproportionate contact of children of color with the justice system and detainment of youth who cannot make bail or illegally cross US borders. Yet opportunities for personal and social growth are essential for the health and well-being of the individual and for the emergence of psychological and social abilities necessary for becoming an adult and a contributing member of society. An overview of empirical findings from developmental science suggests that these needs extend well into young adulthood, when regulatory abilities in cognitive, social, and emotional processes and underlying brain circuits are still maturing. Further, different cognitive and psychosocial abilities and brain circuits mature at different time points in development in a hierarchical manner. This pattern of developmental changes has important implications for the treatment of juveniles of different ages in the justice system and argues against a one-age-fits-all approach. Rather, it requires us to rethink how we treat and meet the needs of young people at different ages (e.g., early versus late adolescence, late adolescence versus young adulthood) to provide the special protections and opportunities necessary for healthy development at each of these developmental phases of life.

The Kalief Browder case stands as a tragic failure of the US justice system to provide any special protection of his rights as a child or to ensure any opportunities for healthy development. Efforts by developmental scientists, psychologists, neuroscientists, and lawyers to inform and reform the treatment of youthful offenders are obviously too late for him. But his death can be more than a harrowing headline or a cautionary tale. It can serve as a call to action to adopt a more developmentally informed set of policies and practices for young people in our justice system. The past two decades have witnessed many positive changes, but there is more to do. Recognition and education about changes in psychological and brain functioning throughout adolescence and young adulthood may help us better target and direct interventions and policies for young people of different ages. The recent creation of young adult courts and correctional units reflects a move in this direction. With the goal of protecting our young people's rights to healthy development and making it a priority for society, we will build a healthier society in which they can contribute in positive and significant ways. In the end, these are the steps toward making healthy development a human right for all children.

## DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

## LITERATURE CITED

- Am. Bar Assoc. 2007. *Dialogue on Youth and Justice*. Washington, DC: Am. Bar Assoc. <https://perma.cc/Z5E9-7P6H>
- Am. Bar Assoc. 2017. *Resolution to the criminal justice section*. Rep., House Deleg., Washington, DC
- Am. Bar Assoc. 2019. *Family Separation and Detention*. Washington, DC: Am. Bar Assoc. <https://perma.cc/Q522-WYU2>

- Annie E. Casey Found. 2011. *Youth Incarceration in the United States*. Baltimore: Annie E. Casey Found. <https://perma.cc/6FDK-6SFJ>
- Barkley-Levenson E, Galván A. 2014. Neural representation of expected value in the adolescent brain. *PNAS* 111:1646–51
- Bonnie RJ, Scott ES. 2013. The teenage brain: adolescent brain research and the law. *Curr. Dir. Psychol. Sci.* 22:158–61
- Breiner K, Li A, Cohen AO, Steinberg L, Bonnie RJ, et al. 2018. Combined effects of peer presence, social cues, and rewards on cognitive control in adolescents. *Dev. Psychobiol.* 60:292–302
- Brown TT, Kuperman JM, Chung Y, Erhart M, McCabe C, et al. 2012. Neuroanatomical assessment of biological maturity. *Curr. Biol.* 22:1693–98
- Buck T. 2014. *International Child Law*. London, UK: Routledge. 3rd ed.
- Burns K, dir. 2012. *The Central Park Five*. Arlington, VA: PBS
- Butts JA. 2016. Total youth arrests for violent crime still falling nationwide. *DataBits*, Sept. 27. <https://perma.cc/6A67-E8WX>
- Casey BJ. 2015. Beyond simple models of self-control to circuit-based accounts of adolescent behavior. *Annu. Rev. Psychol.* 66:295–319
- Casey BJ. 2019. Healthy development as a human right: lessons from developmental science. *Neuron* 102:724–27
- Casey BJ, Caudle K. 2013. The teenage brain: self control. *Curr. Dir. Psychol. Sci.* 22:82–87
- Casey BJ, Durston S, Fossella JA. 2001. Evidence for a mechanistic model of cognitive control. *Clin. Neurosci. Res.* 1:267–82
- Casey BJ, Galván A, Somerville LH. 2016. Beyond simple models of adolescence to an integrated circuit-based account: a commentary. *Dev. Cogn. Neurosci.* 17:128–30
- Casey BJ, Heller A, Gee D, Cohen A. 2019. Development of the emotional brain. *Neurosci. Lett.* 693:29–34
- Casey BJ, Oliveri ME, Insel T. 2014. A neurodevelopmental perspective on the research domain criteria (RDoC) framework. *Biol. Psychiatry* 76:350–53
- Cauffman E, Fine A, Mahler A, Simmons C. 2018. How developmental science influences juvenile justice reform. *UC Irvine Law Rev.* 8:101–20
- Cauffman E, Steinberg L. 2000. (Im)maturity of judgment in adolescence: why adolescents may be less culpable than adults. *Behav. Sci. Law* 18:741–60
- Chein JM, Albert D, O'Brien L, Uckert K, Steinberg L. 2011. Peers increase adolescent risk taking by enhancing activity in the brain's reward circuitry. *Dev. Sci.* 14:F1–F10
- Clark AB. 2017. Juvenile solitary confinement as a form of child abuse. *J. Am. Acad. Psychiatry Law* 45:350–357
- Cohen A, Bonnie RJ, Taylor-Thompson K, Casey BJ. 2016a. When does a juvenile become an adult? Implications for law and policy. *Temple Law Rev.* 88:769–88
- Cohen A, Breiner K, Steinberg L, Bonnie RJ, Scott ES, et al. 2016b. When is an adolescent an adult? Assessing cognitive control in emotional and nonemotional contexts. *Psychol. Sci.* 27:549–62
- Cohen MM, Jing D, Yang RR, Tottenham N, Lee FS, Casey BJ. 2013. Early-life stress has persistent effects on amygdala function and development in mice and humans. *PNAS* 110:18274–78
- Crone EA, Konijn EA. 2018. Media use and brain development during adolescence. *Nat. Commun.* 9:588–98
- Davidow JY, Foerde K, Galván A, Shohamy D. 2016. An upside to reward sensitivity: The hippocampus supports enhanced reinforcement learning in adolescence. *Neuron* 92:93–99
- Dosenbach N, Nardos B, Cohen AL, Fair DA, Power JD, et al. 2010. Prediction of individual brain maturity using fMRI. *Science* 329:1358–61
- Dreyfuss M, Caudle K, Drysdale AT, Johnston NE, Cohen AO, et al. 2014. Teens impulsively react rather than retreat from threat. *Dev. Neurosci.* 36:220–27
- Duell N, Steinberg L, Icenogle G, Chein J, Chaudhary N, et al. 2018. Age patterns in risk taking across the world. *J. Youth Adolesc.* 47:1052–72
- Durston S, Thomas KM, Yang Y, Ulug AM, Zimmerman RD, Casey BJ. 2002. A neural basis for the development of inhibitory control. *Dev. Sci.* 5:F9–F16
- DuVernay A, dir. 2019. *When They See Us*. Los Gatos, CA: Netflix
- Fagan J. 1996. The comparative advantage of juvenile versus criminal court sanctions on recidivism among adolescent felony offenders. *Law Policy* 18:77–114

- Gainsborough J, Young MC. 2000. *Prosecuting juveniles in adult court: an assessment of trends and consequences*. Washington, DC: Sentencing Proj. <https://perma.cc/EET5-K48K>
- Galvan A, Hare TA, Parra CE, Penn J, Voss H, et al. 2006. Earlier development of the accumbens relative to orbitofrontal cortex might underlie risk-taking behavior in adolescents. *J. Neurosci.* 26:6885–92
- Gee DG, Gabard-Durnam LJ, Flannery J, Goff B, Humphreys KL, et al. 2013a. Early developmental emergence of human amygdala-prefrontal connectivity after maternal deprivation. *PNAS* 110:15638–43
- Gee DG, Humphreys KL, Flannery J, Goff B, Telzer EH, et al. 2013b. A developmental shift from positive to negative connectivity in human amygdala-prefrontal circuitry. *J. Neurosci.* 33:4584–93
- Geier CF, Terwilliger R, Teslovich T, Velanova K, Luna B. 2010. Immaturities in reward processing and its influence on inhibitory control in adolescence. *Cereb. Cortex* 20:1613–29
- Goff PA, Jackson MC, Di Leone BAL, Culotta CM, DiTomasso NA. 2014. The essence of innocence: consequences of dehumanizing black children. *J. Personal. Soc. Psychol.* 106:526–45
- Gonnerman J. 2015. Kalief Browder and a change at Rikers. *New Yorker*, April 14. <https://perma.cc/2EFD-7QPU>
- Graham v. Florida*, 560 U.S. 48, 08–7412 (2010)
- Griffin P, Addie S, Adams B, Firestone K. 2011. Trying juveniles as adults: an analysis of state transfer laws and reporting. In *Youth in the Adult Criminal Justice System*. Washington, DC: Off. Juv. Justice Delinq. Prev.
- Hahn R, McGowan A, Liberman A, Crosby A, Fullilove M, et al. 2007. Effects on violence of laws and policies facilitating the transfer of youth from the juvenile to the adult justice system. *MMWR* 56:1–11
- Hare TA, Tottenham N, Galván A, Voss HU, Glover GH, Casey BJ. 2008. Biological substrates of emotional reactivity and regulation in adolescence during an emotional go-nogo task. *Biol. Psychiatry* 63:927–34
- Heller AS, Cohen AO, Dreyfuss MFW, Casey BJ. 2016. Changes in cortico-subcortical and subcortico-subcortical connectivity impact cognitive control to emotional cues across development. *Soc. Cogn. Affect. Neurosci.* 11:1910–18
- Henning K. 2013. Criminalizing normal adolescent behavior in communities of color: the role of prosecutors in juvenile justice reform. *Cornell Law Rev.* 98:383–462
- Hodgson v. Minnesota*, 497 U.S. 417 (1990)
- Holt-Lunstad J, Smith TB, Baker M, Harris T, Stephenson D. 2015. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. *Perspect. Psychol. Sci.* 10:227–37
- Human Rights Watch. 2010. The price of freedom: bail and pretrial detention of low income nonfelony defendants in New York City. *Human Rights Watch*, Dec. 2. <https://perma.cc/Y4WC-UKJT>
- Icenogle G, Steinberg L, Duell N, Chein J, Chang L, et al. 2019. Adolescents' cognitive capacity reaches adult levels prior to their psychosocial maturity: evidence for a "maturity gap" in a multinational, cross-sectional sample. *Law Hum. Behav.* 43:69–85
- Jackson v. Hobbs*, 567 U.S. 460, 10–9647 (2012)
- Kaba F, Lewis A, Glowa-Kollisch S, Hadler J, Lee D, et al. 2014. Solitary confinement and risk of self-harm among jail inmates. *Am. J. Public Health* 104:442–47
- Kaufmann T, Alnæs D, Doan NT, Brandt CL, Andreassen OA, Westlye LT. 2017. Delayed stabilization and individualization in connectome development are related to psychiatric disorders. *Nat. Neurosci.* 20:513–15
- Mack JW. 1909. The juvenile court. *Harvard Law Rev.* 23:104–22
- Mears DP, Travis J. 2004. Youth development and reentry. *Youth Violence Juv. Justice* 2:3–20
- Miller v. Alabama*, 567 U.S. 460, 10–9646 (2012)
- Monk CS, McClure EB, Nelson EE, Zarahn E, Bilder RM, et al. 2003. Adolescent immaturity in attention-related brain engagement to emotional facial expressions. *Neuroimage* 20:420–28
- Montgomery v. Louisiana*, 577 U.S. \_\_\_, 14–280 (2016)
- Moore KE, Stuewig JB, Tangney JP. 2016. The effect of stigma on criminal offenders' functioning: a longitudinal mediational model. *Deviant Behav.* 37:196–218
- Moore NM. 2015. *The Political Roots of Racial Tracking in American Criminal Justice*. New York: Cambridge Univ. Press
- Mulley C. 2010. *The Woman Who Saved the Children: A Biography of Eglantyne Jebb: Founder of Save the Children*. Oxford, UK: Oneworld Publ.

- Myers DL. 2003. Adult crime, adult time: punishing violent youth in the adult criminal justice system. *Youth Violence Juv. Justice* 1:173–97
- Natl. Acad. Sci. Eng. Med. 2001. *Juvenile Crime, Juvenile Justice*. Washington, DC: Natl. Acad. Press. <https://perma.cc/W9NA-NXDA>
- Natl. Acad. Sci. Eng. Med. 2019. *The Promise of Adolescence: Realizing Opportunity for All Youth*. Washington, DC: Natl. Acad. Press. <https://perma.cc/4Z8L-ZAUF>
- N.Y. State Arch. 1989. *The greatest reform school in the world: a guide to the records of the New York House of Refuge*. Publ. No. FA10, N.Y. State Arch., Albany, NY
- Poe-Yamagata E, Jones MA. 2000. *And Justice for Some: Differential Treatment of Youth of Color in the Justice System*. Oakland: Natl. Counc. Crime Delinq. <https://perma.cc/77TU-WNRT>
- Regnery A. 1985. Getting away with murder: why the juvenile justice system needs an overhaul. *Policy Rev.* 34:65–68
- Ridderinkhof KR, Van Der Molen MW, Band GPH, Bashore TR. 1997. Sources of interference from irrelevant information: a developmental study. *J. Exp. Child Psychol.* 65:315–41
- Roper v. Simmons*, 543 U.S. 551, 03–633 (2005)
- Rudolph MD, Miranda-Domínguez O, Cohen AO, Breiner K, Steinberg L, et al. 2017. At risk of being risky: the relationship between “brain age” under emotional states and risk preference. *Dev. Cogn. Neurosci.* 24:93–106
- Sawyer W. 2018. *Youth confinement: the whole pie*. Press Rel., Prison Policy Initiat., Northampton, MA. <https://perma.cc/TZY3-BMBQ>
- Sharkey P. 2009. *Neighborhoods and the Black-White Mobility Gap*. Philadelphia: Pew Charit. Trust. <https://perma.cc/N9V3-Q6VY>
- Sickmund M, Sladky T, Kang W, Puzanchera C. 2017. *Easy Access to the Census of Juveniles in Residential Placement*. Washington, DC: Off. Juv. Justice Delinq. Prev. <https://perma.cc/5C9V-UDFN>
- Silvers JA, Insel C, Powers A, Franz P, Helion C, et al. 2017. The transition from childhood to adolescence is marked by a general decrease in amygdala reactivity and an affect-specific ventral-to-dorsal shift in medial prefrontal recruitment. *Dev. Cogn. Neurosci.* 25:128–37
- Somerville LH. 2016. Searching for signatures of brain maturity: What are we searching for? *Neuron* 92:1164–67
- Somerville LH, Casey BJ. 2010. Developmental neurobiology of cognitive control and motivational systems. *Curr. Opin. Neurobiol.* 20:236–41
- Somerville LH, Hare TA, Casey BJ. 2011. Frontostriatal maturation predicts cognitive control failure to appetitive cues in adolescents. *J. Cogn. Neurosci.* 23:2123–34
- Steinberg L. 2015. *Age of Opportunity: Lessons from the New Science of Adolescence*. New York: Houghton Mifflin Harcourt
- Steinberg L, Cauffman E, Woolard J, Graham S, Banich M. 2009. Are adolescents less mature than adults? Minors’ access to abortion, the juvenile death penalty, and the alleged APA “flip-flop.” *Am. Psychol.* 64:739–50
- Steinberg L, Graham S, O’Brien L, Woolard J, Cauffman E, Banich M. 2009. Age differences in future orientation and delay discounting. *Child Dev.* 80:28–44
- Steinberg L, Monahan KC. 2007. Age differences in resistance to peer influence. *Dev. Psychol.* 43:1531–43
- Taylor-Thompson K. 2003. States of mind/states of development. *Stanford Law Policy Rev.* 14:143–73
- Taylor-Thompson K. 2014. Minority rule: redefining the age of criminality. *N.Y. Univ. Rev. Law Soc. Change* 38:143–200
- Teslovich T, Mulder M, Franklin NT, Ruberry EJ, Millner A, et al. 2014. Adolescents let sufficient evidence accumulate before making a decision when large incentives are at stake. *Dev. Sci.* 17:59–70
- Thelen E. 2005. Dynamic systems theory and the complexity of change. *Psychoanal. Dialogues* 15:255–80
- Thornberry TP. 1973. Race, socioeconomic status and sentencing in the juvenile justice system. *J. Crim. Law Criminol.* 64:90–98
- Tottenham N, Hare TA, Millner A, Gilhooly T, Zevin JD, Casey BJ. 2011. Elevated amygdala response to faces following early deprivation. *Dev. Sci.* 14:190–204
- Tottenham N, Hare TA, Quinn BT, McCarty TW, Nurse M, et al. 2010. Prolonged institutional rearing is associated with atypically large amygdala volume and difficulties in emotion regulation. *Dev. Sci.* 13:46–61

- Tymula A, Rosenberg Belmaker LA, Roy AK, Ruderman L, Manson K, et al. 2012. Adolescents' risk-taking behavior is driven by tolerance to ambiguity. *PNAS* 109:17135–40
- US Census Bur. 2016. *Historical Marital Status Tables*. Washington, DC: US Census Bur. <https://perma.cc/Y3AS-ASHR>
- UN Comm. Hum. Rights. 1959. *Declaration of the Rights of the Child*. New York: UN Gen. Assem. <https://perma.cc/F49W-K56Q>
- US Dep. Justice, Off. Justice Programs, Off. Juvenile Justice Delinq. Prev. 2013. *Census of Juveniles in Residential Placement*. Ann Arbor, MI: Inter-Univ. Consort. Political Soc. Res. <https://perma.cc/6BQS-4BEM>
- Van Leijenhorst L, Zanolie K, Van Meel CS, Westenberg PM, Rombouts S, Crone EA. 2010. What motivates the adolescent? Brain regions mediating reward sensitivity across adolescence. *Cereb. Cortex* 20:61–69
- Vasiliades E. 2005. Solitary confinement and international human rights: why the U.S. prison system fails global standards. *Am. Univ. Int. Law Rev.* 21:71–99
- Visher CA, Travis J. 2003. Transitions from prison to community: understanding individual pathways. *Annu. Rev. Sociol.* 29:89–113
- Young MC, Gainsborough J. 2000. *Prosecuting Juveniles in Adult Court: An Assessment of Trends and Consequences*. Washington, DC: Sentencing Proj. <https://perma.cc/T9CZ-HCKQ>