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The Teenage Brain: Adolescent Brain Research and the Law

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Abstract

In this article, we explore the emerging and potential influence of adolescent brain science on law and public policy. The primary importance of this research is in policy domains that implicate adolescent risk taking; these include drug and alcohol use, driver licensing, and criminal justice. We describe the emerging importance of brain science in the Supreme Court and other policy arenas. Finally, we argue that current research cannot contribute usefully to legal decisions about individual adolescents and should not be used in criminal trials at the present time, except to provide general developmental information.

Keywords

adolescence, law, neuroscience, juvenile justice, risk taking

In recent years, policymakers, the media, and the public have shown a great deal of interest in the expanding body of knowledge on adolescent brain development—an interest that reflects an expectation that accumulating knowledge about the structure and functioning of the developing teenage brain can usefully inform law and public policy (Wallis, 2004). In this article, we examine the relevance of developmental neuroscience to legal policies dealing with adolescents and discuss several applications. Specifically, we explain how developmental understanding of teenage risk taking and criminal activity can contribute to legal policies that protect adolescents during this distinct developmental period and that also promote the public interest. We emphasize, however, that current knowledge does not provide a scientific basis for evaluating the "maturity" of adolescents on an individual basis for legal purposes.

Adolescence in American Law

Although adolescence is recognized by developmentalists as a distinct stage separate from childhood and adulthood, the law typically does not adopt rules applicable specifically to adolescents. Instead, on various issues, lawmakers have tended to draw binary age boundaries between "minors," who are presumed to be vulnerable, dependent, and incompetent to make decisions, and adults, who are viewed as autonomous, responsible, and entitled to exercise legal rights and privileges (Scott, 2000). Although adolescents become legal adults for most purposes at 18 years of age (the "age of majority"), the threshold for defining adult status is not uniform. For example, driving privileges are extended to adolescents in many states at 16 years of age and the right to purchase alcohol at 21 years of age; in most states, youths 14 years of age (or even younger) can be tried as adults when charged with serious crimes. The statutory age for making health decisions (especially reproductive decisions and treatment of behavioral health disorders) has been set at 14 years in many states. Policies setting these age boundaries are based on many considerations, depending on the issue—administrative convenience, parental rights, child welfare, economic impact, and the public interest—as well as assumptions, often rooted primarily in conventional wisdom, about whether youths at a given age are sufficiently mature, as a class, to be treated as adults for the particular statutory purpose.

On most issues, the threshold of adult status is relatively settled and is not highly controversial; this may explain why brain science has not played much of a role (Woolard & Scott, 2009). In general, research indicating that substantial structural and functional changes in the brain occur during adolescence has reinforced a background supposition favoring protective policies until teenagers reach 18 years of age. This approach has been generally satisfactory, except to some youth advocates who favor extending adult rights and

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privileges to younger adolescents and who, therefore, are generally hostile to neuroscience input in the policy arena (Steinberg, 2009).

Linking Neuroscience Evidence to Youthful Risk Taking

Developmental neuroscience research that can be linked to youthful risk taking and offending is in a relatively early stage, and currently its relevance to the key policy issues is indirect. Nonetheless, the existing research on the timing of developments in brain structure and function is consistent with and supplements the larger body of behavioral research; this new research provides the basis for understanding why many adolescents become involved in risky activity and desist as they mature into adulthood (Casey, Getz, & Galvan, 2008; Steinberg, 2009).

It seems likely that asymmetries in the timing of development of different brain regions contribute to risk taking and immature judgment in adolescence. The research indicates that the prefrontal cortex matures gradually; maturation extends over the course of adolescence and into early adulthood. This region controls the brain's executive functions—advanced cognitive processes employed in planning, controlling impulses, and weighing the consequences of decisions before acting. Maturation in the connections between the prefrontal cortex and other regions of the brain also occurs gradually, resulting in improvement over time in impulse control and emotional regulation. In contrast, changes in the limbic system around puberty result in increases in emotional arousal and in reward and sensation seeking (including sensitivity to social stimuli; Chein, Albert, O'Brien, Uckert, & Steinberg, 2011; Steinberg, Cauffman, Woolard, Graham, & Banich, 2009). This gap between early increases in sensation seeking and later development of emotional and behavioral controls has been described by one scientist as "starting the engines without a skilled driver" (Dahl, 2001, p. 8), and it may shed light on much teenage risk taking and criminal activity. In short, the hypothesis, which is based on neurobiological research, is that teenagers are attracted to novel and risky activities, including criminal activity, particularly with peers, at a time when they lack the judgment to exercise self-control and to consider the future consequences of their behavior.

Neuroscience, Teen Alcohol Use, Driving, and Public Policy

Developmental research, accompanied by pertinent brain research, is playing an increasingly important role in shaping policies relating to adolescent risk taking—drug and alcohol use, the extension of driving privileges, and juvenile justice. Adolescent tendencies to experiment with intoxicating substances (at increasingly younger ages) and to get high (typically in groups) are paradigmatic examples of sensation seeking and risk taking. Moreover, age of onset and intensity of adolescent drinking are strongly predictive of problem drinking and alcohol use disorders in adulthood, and this trajectory may be attributable in part to the vulnerability of the adolescent brain. Extensive use of alcohol in adolescence may also have effects that increase the risk of severe and long-lasting addiction (Wong, Mill, & Fernandes, 2011; Yucel, Lubman, Solowij, & Brewer, 2007). (Similar accounts have been given for teenage use of tobacco, marijuana, and other drugs.) These findings argue for maintaining the 21-year-old drinking age and for intensifying efforts to prevent early onset of alcohol use (Bonnie & O'Connell, 2007).

Policymakers have paid increasing attention in recent years to the lethal mixture of teen driving at night accompanied by peers and alcohol. The result has been developmentally informed "graduated licensing" legislation that lengthens the process of obtaining a license and controls the circumstances under which teens are permitted to drive, gradually increasing their exposure to higher risk conditions (such as nighttime driving and driving with teen passengers). A recent National Research Council (NRC) report (NRC, 2007) noted in support of graduated licensing that adolescent capacity to exercise executive functions is "still under construction" during the initial years of driving and can be "overwhelmed by strong emotion, multi-tasking, sleep deprivation, and substance abuse" (p. 18). The report explained that deficits in judgment, impulse control, planning, and attention are magnified by extra passengers, music, cell phones, and other sources of stimulation or distraction (NRC, 2007). Some policy analysts have suggested that graduated licensing restrictions should apply to all initial license applicants younger than 21 years of age (Masten, Foss, & Marshall, 2011).

Neuroscience and Juvenile Justice Policy

Neuroscience has played an increasingly prominent role in juvenile crime policy because questions about whether and when adolescent offenders should be punished as adults have been hotly contested. In this section, we offer a brief historical review that clarifies this emerging role, and then we identify specific questions on which this research potentially can inform legal policy.

During most of the 20th century, the law assumed that juvenile crime was a product of immaturity and that young offenders should be dealt with in a separate justice system with a primary goal of rehabilitation. However, in the 1980s and 1990s, partly in response to increasing rates of violent juvenile crime, a wave of punitive law reforms swept the country. Supporters of tougher policies rejected altogether the idea that juveniles were different from adults in any way that was relevant to criminal responsibility or punishment (Scott & Steinberg, 2008). Legislatures enacted harsh laws that greatly expanded the category of youths subject to criminal

court jurisdiction. Use of confinement also increased in the juvenile system.

In the past decade, enthusiasm for harsh punishment of juveniles has waned somewhat, and lawmakers once again appear to accept the relevance of developmental differences to justice policy. This change is attributable to declining crime rates, convincing evidence that incarcerating juveniles increases recidivism, and concerns that imposing harsh adult sentences on teenagers violates basic principles of fairness. Increasingly, lawmakers and the public accept the idea that juvenile offenders should usually be subject to developmentally appropriate dispositions within the juvenile justice system and that those who are transferred to criminal court should receive more lenient sentences than their adult counterparts. In a new wave of law reform, legislatures and courts have moderated the tough laws adopted in the 1990s, keeping more adolescents in juvenile court and reducing the emphasis on long incarceration. The contemporary view, however, is not simply a revival of the traditional rehabilitative model based on naïve characterizations of juvenile offenders as children. Increasingly, policymakers have turned to developmental science, particularly neuroscience, to inform justice policy through a more sophisticated understanding of how dimensions of adolescent development affect juveniles' criminal activity as well as their response to justice-system interventions (Scott, in press).

Adolescent brain research has the potential to influence juvenile crime policy in two important ways. First, to the extent that neuroscience research provides evidence that immature brain functioning influences decision making and risk taking implicated in criminal behavior, it is relevant to the question of whether adolescents are less culpable than adults and deserve less punishment for similar offenses. Behavioral research has found that adolescents differ from adults in their greater propensity for risk taking and susceptibility to peer influence and their reduced capacity for self-regulation and for attending to future consequences. These characteristics diminish adolescents' responsibility to the extent that their decisions to offend are likely to be rooted in transient developmental processes rather than antisocial values or deficiencies in character (Scott & Steinberg, 2003; Steinberg & Scott, 2003). This argument for diminished responsibility is reinforced and strengthened to the extent that these well-demonstrated developmental characteristics are explained by normal and predictable neurobiological processes. This research can offer a powerful challenge to laws that classify juveniles charged with crimes as adults. Second, studies of changing brain structure and function over the course of adolescence reinforce arguments based on behavioral research that most adolescent crime is a product of the developmental influences described earlier, and thus most teenagers will "mature out" of their criminal tendencies. Generally, this perspective supports policies that keep youths in the juvenile justice system, where interventions can be tailored to promote healthy development and to reduce reoffending.

The Persuasive Impact of Adolescent Brain Research

Adolescent brain research has captured the attention of lawmakers in recent years and has been cited by courts, legislatures, and other officials to justify support for laws and policies that deal more leniently with adolescent offenders than with adults. For reasons that are not clear, this research seems to carry greater weight as "hard science" than the large body of behavioral research that it largely confirms.

Three recent Supreme Court opinions invoked developmental research in finding harsh adult sentences for juveniles to be unconstitutional under the Eighth Amendment prohibition of "cruel and unusual punishment." In each of these opinions, the court emphasized the reduced culpability of juveniles because of their developmental immaturity, pointing to adolescents' diminished decision-making capacity, their vulnerability to external pressures (including peer pressure), and their unformed characters. In *Roper v. Simmons* (2005), the court rejected the death penalty as a disproportionate sentence for a crime, relying heavily on behavioral research. Both *Graham v. Florida* (2010) and *Miller v. Alabama* (2012) also pointed to brain science in striking down sentences of life without parole for juveniles. This research provided evidence of "fundamental differences between juvenile and adolescent minds" in "parts of the brain involved in behavioral control" (*Miller v. Alabama*, p. 2464).

This invocation of developmental neuroscience evidence by our nation's highest court is a powerful signal of the potential importance of this research for legal regulation of juvenile crime. Moreover, the message that immature brain functioning contributes to teenage offending, making young offenders less culpable than adults and more likely to reform, has resonated with politicians, the media, and the public in recent years. Across the country, neuroscience research indicating that teenage brains differ from those of adults has been offered in support of a broad range of policies dealing more leniently with young offenders. For example, the Washington State Legislature in 2005 cited developmental brain research in abolishing mandatory minimum sentences for juveniles, as did Governor Bill Owens of Colorado in explaining his support for abolishing the application of a harsh sentencing statute to juveniles. In combination, behavioral and neurobiological research on adolescence have played an important role in advancing policies that recognize the immaturity of young offenders in responding to juvenile crime.

The Limits of Neuroscience

A recent study published in *Science* suggests that neuroscience evidence that does no more than describe the biological

underpinning of a behavioral diagnosis (psychopathy in this study) can have an influence (whether legitimate or not) on judges making decisions in individual criminal cases (Aspinwall, Brown, & Tabery, 2012). Not surprisingly, prosecutors and attorneys for juveniles increasingly seek to introduce neuroscience evidence in criminal trials—to demonstrate that the brain functioning of a particular juvenile facing criminal charges was or was not sufficiently mature to hold the youth responsible for his or her offense. This has largely been unsuccessful, often because courts have found it to be irrelevant to the legal issue at hand—such as whether the youth lacked criminal intent (Maroney, 2009). However, the use of this research is also highly problematic on scientific grounds. So far, neuroscience research provides group data showing a developmental trajectory in brain structure and function during adolescence and into adulthood; however, the research does not currently allow us to move from that group data to measuring the neurobiological maturity of an individual adolescent because there is too much variability within age groups and across development (Dosenbach et al., 2010). Indeed, we do not currently have accurate behavioral measures of maturity. At some point, neuroscience and accompanying behavioral studies may provide age norms against which an individual adolescent's brain development and functioning can be measured. However, today an expert who offers an opinion that a particular 14-year-old defendant has a mature or immature brain as compared with other 14-year-olds (or "has the maturity of a 17-year-old") is exceeding the limits of science. Currently, the only legitimate use of adolescent brain research in individual cases is to provide decision makers with general descriptions of brain maturation.

It is difficult to predict the extent to which developmental neuroscience research will inform legal policy and practice in the future. Legal policy toward adolescents will always be based on many considerations, of which developmental maturity is only one. Currently, the research is important primarily in domains of public policy relating to adolescent risk taking, particularly in juvenile justice policy, where it is invoked to support rehabilitative programs in juvenile courts and to challenge policies that subject juvenile offenders to the same punishment as their adult counterparts.

Recommended Reading

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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