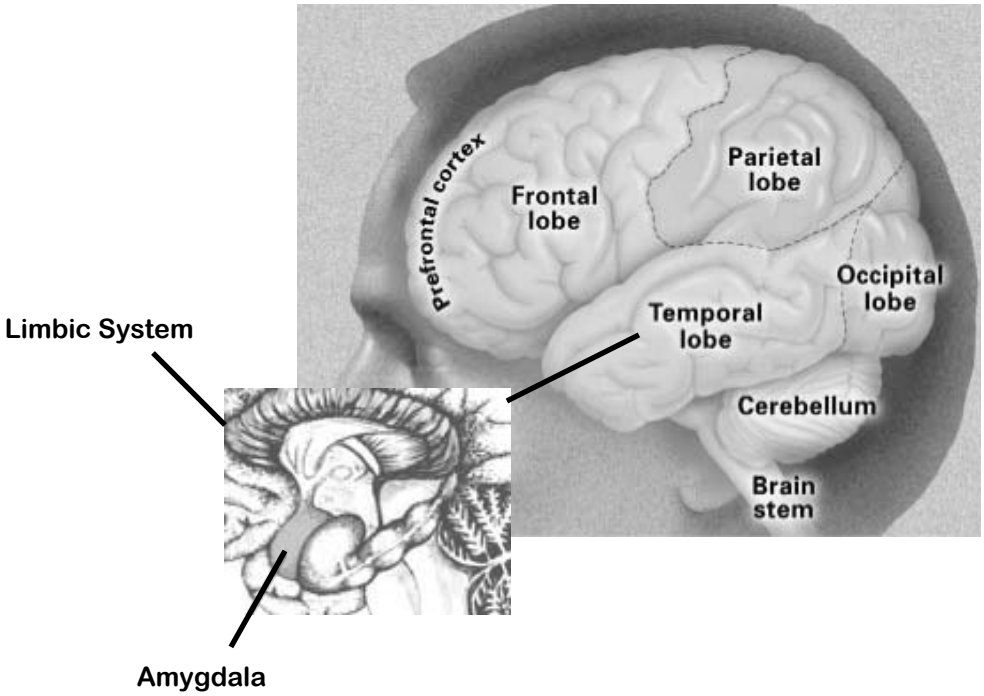
Adolescent Brain Development

Understanding the Parts of the Brain



The Adult Brain

The **Frontal Lobe**, often called the "command center" of the brain, is the part of the brain that controls the decision making process for adults, including long-term planning, risk-assessment, impulse control, and other behaviors associated with criminal culpability. It is also one of the last parts of the brain to fully mature (in the early 20s).[1] This late maturation process suggests that adolescents are not as capable as adults of weighing long-term consequences, and evaluating risk-assessment.

The **Prefrontal Cortex** is responsible for cognitive processing, problem solving, and emotional control in adults. There is a stark contrast in brain maturation (Myelination) between youth aged 12-16 and young adults (23-30), especially in the Frontal Lobe and Prefrontal Cortex.[2] This difference suggests that adults are more capable of controlling their emotions and making more rational decisions than adolescents.

The Adolescent Brain

The **Limbic System** regulates hormonal processing, which is overly active in adolescents,[3] and also is responsible for handling emotional reactions. Adolescents tend to use their Limbic System more often in the decision making process, since their Frontal Lobes are not fully developed, which results in adolescents making more decisions based on emotional reactions rather than reasoning, weighing of long term consequences, or planning.[4]

The **Amygdala,** part of the Limbic System, is responsible for impulse reactions, emotional reactions, fear, and is also used in the decision-making process of adolescents. Developing adolescents tend to use their Amygdala when responding to other people's emotions, yielding more reactionary, less reasoned perceptions of situations than adults.[5]

Footnotes:

1. Fagan, Jeffrey. “Adoescents, Maturity, and the Law.” *The American Prospect*. August, 2005.
2. National Institute of Mental Health (NIMH). *Teenage Brain: A Work in Progress*. 2001.
3. Adolescents going through puberty experience increased hormone levels. For example, the production of testosterone, a hormone closely associated with aggression, increases approximately tenfold in boys. National Institute on Alcohol Abuse and Alcoholism (NIAAA). *Adolescent Brains Show Reduced Reward Anticipation*. 2004.
4. McNamee, Rebecca. *An Overview of the Science of Brain Development.* Presented at the Coalition for Juvenile Justice Annual Conference. 2006.
5. NIMH. *Id.*

Images Adapted From:

1. PBS: The Secret Life of the Brain: http://www.pbs.org/wnet/brain/
2. Amygdala/Limbic System: http://www.memorylossonline.com/glossary/amygdala.html

Online Resources:

1. ABA: *Adolescence, Brain Development and Legal Culpability*
   http://www.abanet.org/crimjust/juvjus/Adolescence.pdf
2. American Psychologist: *Less Guilty by Reasons of Adolescence*
   http://ccjr.policy.net/cjedfund/resourcekit/Psychology_Less_Guilty.pdf
3. National Institute on Alcohol Abuse and Alcoholism: *Adolescent Brains Show Reduced Reward Anticipation.*
   http://www.nih.gov/news/pr/feb2004/niaaa-25.htm
4. National Institute of Mental Health: *Imaging Study Shows Brain Maturing.*
   http://www.nimh.nih.gov/press/prbrainmaturing.cfm
5. PBS Frontline: *Inside the Teenage Brain*
   http://www.pbs.org/wgbh/pages/frontline/shows/teenbrain/
6. *Roper v. Simmons: Amici Curiae* Brief of the American Bar Association, et al.
   http://www.abanet.org/crimjust/juvjus/simmons/aba.pdf
7. *Roper v. Simmons: Amici Curiae* Brief of the American Medical Association, et al.
   http://www.abanet.org/crimjust/juvjus/simmons/ama.pdf
8. *Roper v. Simmons: Amici Curiae* Brief of the American Psychological Association, et al.
   http://www.apa.org/psyclaw/roper-v-simmons.pdf
9. Science Magazine: *Crime, Culpability, and the Adolescent Brain*
   http://www.wpic.pitt.edu/research/lncd/papers/ScienceLunaOct2004.pdf
10. Science News: *Teen Brains on Trial.*
    http://www.sciencenews.org/articles/20040508/bob9.asp
11. Juvenile Defense Network: *Roper v. Simmons and ways to incorporate it into your practice.*
    http://www.youthadvocacyproject.org/pdfs/Roper%20fact%20sheet.pdf

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Implications in the Courtroom

Adolescence has long been known as a time of significant psychosocial development. Recent advances in fMRI (functional MRI) technology have been critical in understanding adolescence as a crucial period of brain development.[1] Since the science is relatively new, we do not know how it will affect juvenile justice jurisprudence; a system focused on behavior not anatomy. Science supports the notion that anatomy affects behavior, and as juvenile defenders we need to educate the court in this area and use the research to advocate for our clients.

Below are some suggestions on how to use this new brain information in your practice. There are many ways to utilize the research, from pre-trial issues to jury instructions. However, counsel should be aware that there is no case law in Massachusetts addressing the admissibility of brain science testimony and, therefore, be prepared for any objections. We also suggest counsel submit a separate jury instruction on adolescent brain development in every juvenile trial to highlight that kids are different.

Brain Development Facts & Implications in the Courtroom:

Adolescence is a time of significant neurobiological and psychosocial development, meaning that adolescent behaviors are less predictive than adult behavior of personality characteristics and future behavior.[2] This fact can be used in **disposition/sentencing** to argue that children can be rehabilitated and that long, and especially adult sentences, are not consistent with research that indicates adolescents behavior can change and prior behavior is not as predictive of future behavior. Additionally, the fact that their brains are not fully developed can also be used when seeking relief from the **sex offender registry**, a consequence which neglects to consider that youth can change their "criminal" behavior.

Adolescent brains undergo a second wave of significant development during the teen years, (primarily concentrated in the Frontal Lobe), meaning that their capacity to make decisions, use judgment, respond to others' emotions, and assess long-term consequences is immature, and still developing.[3] This fact can be used as a **trial issue** and as part of **jury instructions**. Since adolescents tend to respond to certain stimuli using their Amygdala, the youth, it can be argued, may not be able to form the requisite intent for the crime charged. If you have a client with a history of trauma the intent issue, especially in assault type cases, is even more compelling. Trauma during childhood can become biologically encoded in the brain, affecting brain development. This encoding can impair many functions of the brain including memory, reality testing, and emotional processing, and can cause increased feelings of anxiety, arousal, irritability, depression, and aggression. The more chronic the trauma, the stronger the impact.[4]

Even as their brains develop, and their cognitive abilities mature, adolescents continue to display psychosocial immaturity. Adolescents are more prone to peer pressure, tend to focus on reward over risk, act impulsively, and are present instead of future oriented.[5] While this is based on developmental research, it is consistent with adolescent brain research findings and is relevant in **joint venture** cases.

During adolescence, the brain undergoes significant maturation called Myelination, which streamlines the connections inside the brain, allowing for more reasoned responses. The maturation process is not completed until young adulthood (perhaps as late as age 25), making the brains of adolescents inherently less capable of balancing their emotions, and more likely to exhibit risk-taking behavior.[6] This fact is relevant in crafting **conditions of probation** that meet your client's developmental needs. The imposition of multiple conditions is counterintuitive to what we know about adolescents; they are generally poor decision makers and lack judgment in assessing long-term consequences.

The Frontal Lobe, often called the command center of the brain, is not fully developed in adolescents so their ability to make decisions, respond to other people, use reasoned judgment, and assess long-term consequences is immature and often spontaneous.[7] This is relevant in cases dealing with **police interrogation** and **waiver of Miranda.** Since their frontal lobes are less developed, adolescents are likely to be more vulnerable and susceptible to police pressure.

Footnotes:

1. American Bar Association (ABA): Juvenile Justice Center. *Adolescence, Brain Development, and Legal Culpability.* 2004. Prior to the advancements of fMRI technology in the 1990s, the only studies done on adolescent brains were performed on cadaver tissue, since X-rays and other means of testing were deemed potentially harmful to children.
2. Scott & Grisso. *The Evolution of Adolescence: A Developmental Perspective on Juvenile Justice Reform*. J. Crim L. & Criminology, 137. 1997. National Institue of Mental Health (NIMH). *Imaging Study Shows Brain Maturing.* 2004.
3. Kagan, J., Baird. "Brain and Behavioral Development During Childhood and Adolescence." *The New Cognitive Neurosciences III.* Gazzaniga (ed), MIT Press. Cambridge, MA. November, 2004.
4. Teicher, M. *Child Abuse Hurts the Brain.* http://www.news.harvard.edu/gazette/2003/05.22/01-brain.html.
5. Steinberg, L. & Scott. "Less Guilty by Reason of Adolescence: Developmental Immaturity, Diminished Responsibility, and the Juvenile Death Penalty." *American Psychologist*. 58(12): 2003. Grisso, *Id.*
6. Beckman, Mary. "Crime, Culpability, and the Adolescent Brain." *Science Magazine.* Vol. 305: 2004.
7. NIMH. *Teenage Brain: A Work in Progress.* 2001. Steinberg, *Id.*

Image Adapted From:

1. Franklin Institute: *The Human Brain*. http://www.fi.edu/brain/index.htm

Online Resources:

1. ABA: *Adolescence, Brain Development and Legal Culpability*
   http://www.abanet.org/crimjust/juvjus/Adolescence.pdf
2. American Psychologist: *Less Guilty by Reasons of Adolescence*
   http://ccjr.policy.net/cjedfund/resourcekit/Psychology_Less_Guilty.pdf
3. National Institute on Alcohol Abuse and Alcoholism: *Adolescent Brains Show Reduced Reward Anticipation.*
   http://www.nih.gov/news/pr/feb2004/niaaa-25.htm
4. National Institute of Mental Health: *Imaging Study Shows Brain Maturing.*
   http://www.nimh.nih.gov/press/prbrainmaturing.cfm
5. PBS Frontline: *Inside the Teenage Brain*
   http://www.pbs.org/wgbh/pages/frontline/shows/teenbrain/
6. *Roper v. Simmons: Amici Curiae* Brief of the American Bar Association, et al.
   http://www.abanet.org/crimjust/juvjus/simmons/aba.pdf
7. *Roper v. Simmons: Amici Curiae* Brief of the American Medical Association, et al.
   http://www.abanet.org/crimjust/juvjus/simmons/ama.pdf
8. *Roper v. Simmons: Amici Curiae* Brief of the American Psychological Association, et al.
   http://www.apa.org/psyclaw/roper-v-simmons.pdf
9. Science Magazine: *Crime, Culpability, and the Adolescent Brain*
   http://www.wpic.pitt.edu/research/lncd/papers/ScienceLunaOct2004.pdf
10. Science News: *Teen Brains on Trial.*
    http://www.sciencenews.org/articles/20040508/bob9.asp
11. Juvenile Defense Network: *Roper v. Simmons and ways to incorporate it into your practice.*
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