

CRIMINAL CULPABILITY TRANSFER AND THE TEEN BRAIN

Virginia State Crime Commission

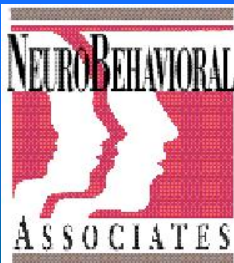


Vincent P. Culotta Ph.D. ABN

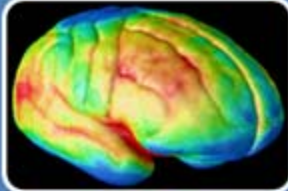
NeuroBehavioral Associates

www.nbatests.com

Columbia, MD



Contemporary Brain-Behavior Assumptions



Neurodevelopmental Maturation underlies and Drives Behavior and Cognition

Prefrontal Cortex is the Seat of Reasoning and Last Region to Reach Structural Maturity



Skills most closely related to criminal behavioral, Moral Reasoning, Judgment, Impulse Control, are directly subject to the Biological Maturation of the Prefrontal Cortex-Executive Control Center



Adolescent Brain is not Structurally Comparable to the Competent Adult Brain

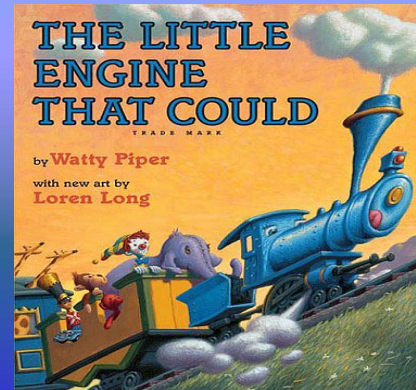


Recent Technological Advances in Neuroimaging have been critical in unlocking the relationship between Brain and Behavior

Disorders of Cognition Mood & Behavior

Misunderstandings & Misassumptions

- Problems of the “Mind”
not the “Body”
- Problems of “Motivation”
- Engenders Moralistic
Judgments rather than a
Readiness to Help



Adolescent Cognition and Behavior



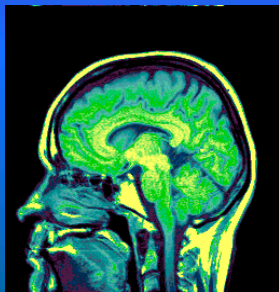
Driven by Rapid Development in Prefrontal Cortex



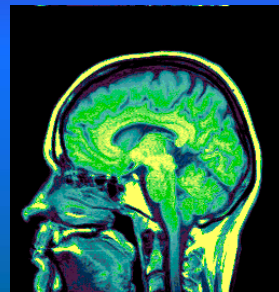
Executive Functions



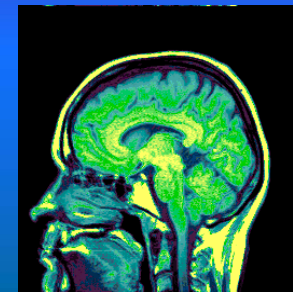
Self-Control
Inhibition
Flexibility
Initiation



Planning
Organize
Reasoning
Judgment



Self-Monitor
Delay Gratification
Assess Consequences
Perspective-Taking

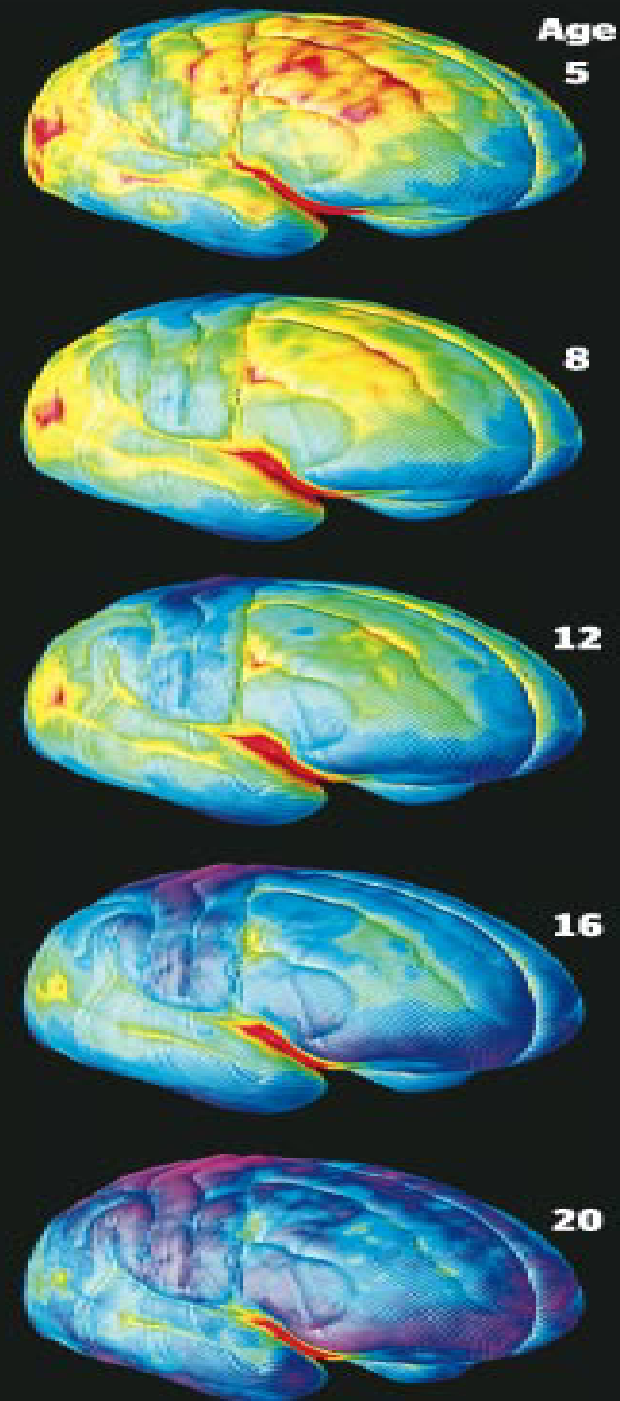


Executive Functions Cortical Maturation

The shades of blue symbolize maturing brain functions.

Maturation culminates in the prefrontal cortex, the area just behind the brow. This is the seat of Executive Functions the area that controls judgment and the weighing of risks and consequences.

Previously this area was thought to be mature by 16 but studies suggest this area is not fully developed until 25 or later .

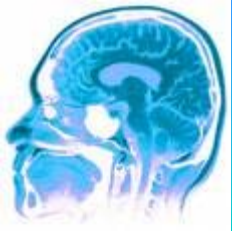




Brain Development



- Two waves of over production of gray matter.
 - Approximately 18 months with pruning back starting at age three.
 - Just prior to puberty with pruning back in adolescence, with a loss of gray matter of about 1% a year (between ages 13 and 18).
- Peak thickening of gray matter occurs at 11 for girls and 12 for boys; peak possibly related to the influence of surging sex hormones.
- Progressive thickening or myelination through the final phase of development



Executive Functions Brain Development

UCLA study: Comparison of MRI's

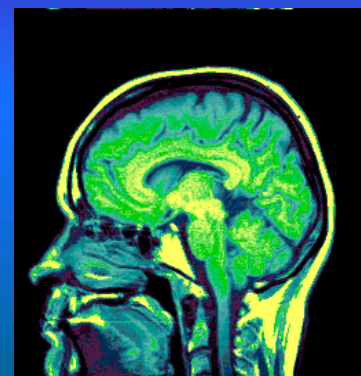
Young adults (23-30) v. Teens (12-16)

- Areas of the frontal lobe showed the largest difference between young adults and teens.
- Parietal and temporal areas appeared largely mature in the teen brain.
- The increased myelination in the adult frontal cortex supports the maturation of cognitive processing and other executive functions.



Early EF Risk Factors

- Early mother-infant interaction is important for the development of the orbitofrontal cortex during the first months of life.
- Early life stressful experiences may permanently damage the orbitofrontal cortex, predisposing the individual to later life neurobehavioral deficits
- Severe early stress induced by deprivation and abuse induces changes in the developing brain.





Environmental Stress Alters Biological Development

- Corticotrophin – releasing factor (CRF) hypersecretion throughout life as a consequence of severe abuse in childhood and may underlie the psychopathology that follows abuse (Heim et al, 2000).
- Abuse leads to a state of chronic hyper-arousal (Kendall – Tackett, 2000) and specific neurochemical changes which occur in the brains of abused children.
- The memory loss of disassociative amnesia induced by psychological stress may be the result of the toxic action of high, prolonged levels of glucocorticoids on the hippocampus (Joseph, 1999).



Risk Factors for Executive Dysfunction

- Pregnancy complications
- Intrauterine Substance Exposure
- Prematurity- Low birth weight
- Toxin exposure
- Post-natal injury – TBI (prefrontal)
- Neglect-Deprivation
- Abuse







Puberty and the Brain

- Hormone-brain relationship contributes to the appetite for thrills, strong sensations, and excitement which may promote ***exploration and independence*** (Ronald Dahl, 2004).
- The parts of the brain responsible for sensation seeking are getting turned on at the onset of puberty while the ***parts for exercising judgment are still maturing throughout adolescence***. (Ronald Dahl, 2004).
- There is a time-gap between the impulse toward risk-taking and when the brain allows teenagers to ***think before they act***.

Analogy:

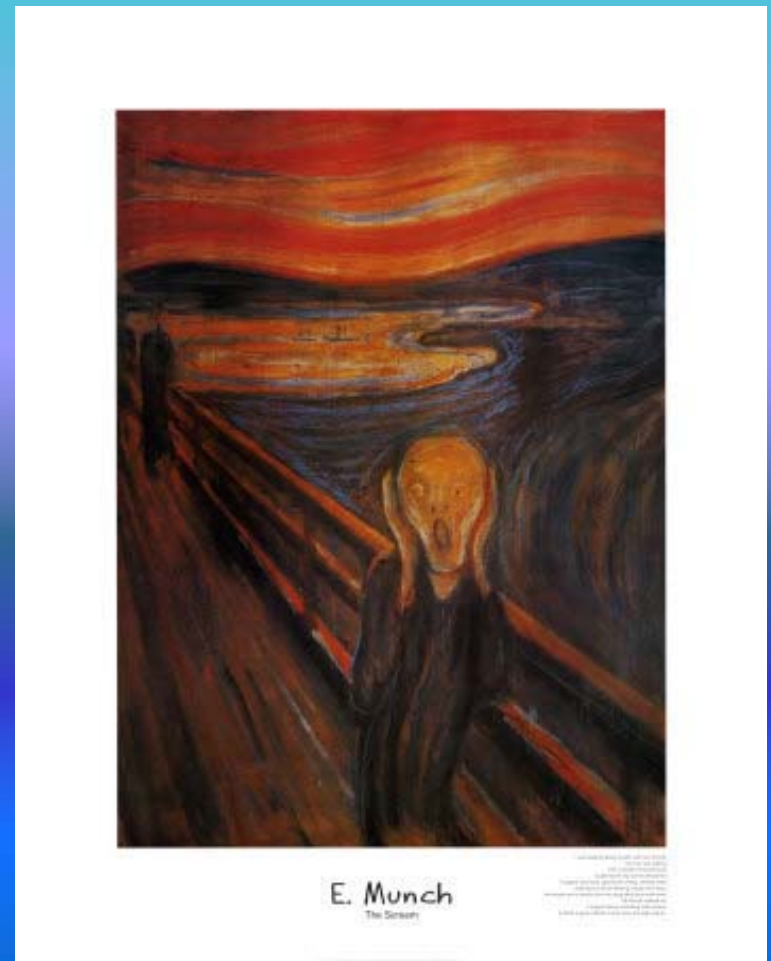
“Teens are unskilled drivers trying to maneuver a car turbo-charged by puberty”



Brain Development

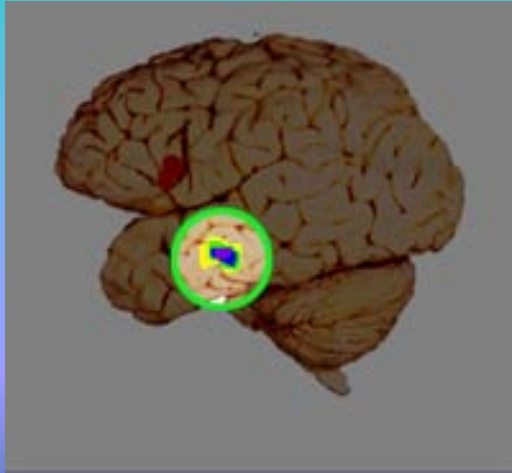
- Harvard Study: After undergoing pruning: Teenagers ages 11 to 17 had brain scans while identifying emotions on pictures of faces.
- Teens often misread facial expressions seeing sadness, anger, and confusion instead of fear.
- Adolescents tend to use the amygdala when responding to others emotions
- Results in a more reactionary, less reasoned, perception of situations than adults

Deborah Yurgelun-Todd PhD

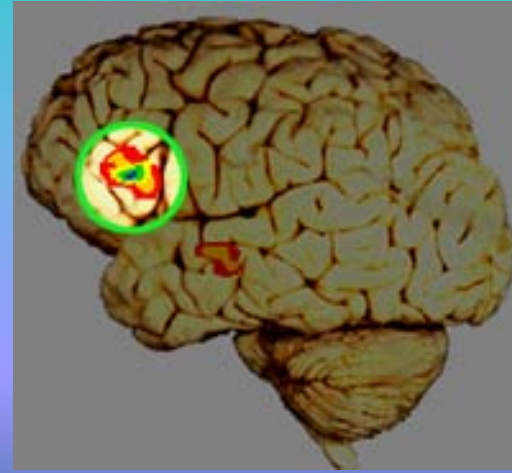


Brain Development

Reading Emotions



Teens

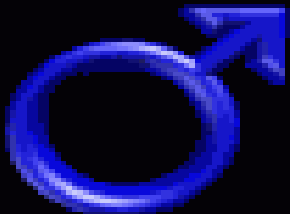
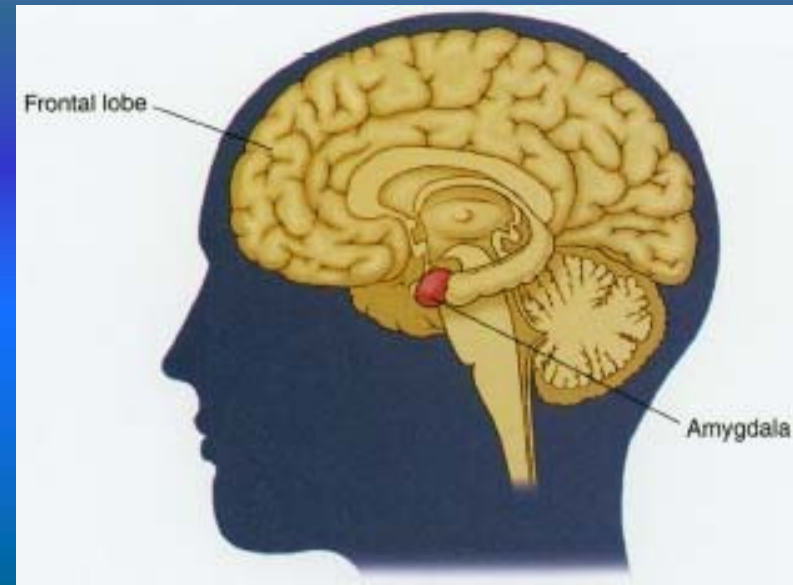


Adults

- In the adolescent brain the emotional region is activated more .
- In contrast, in adults the reasoning and judgment centers are more activated

Biology of Emotion and Cognition

- Older Boys: Locus of Control – Amygdala.
 - Phylogenetically ancient region
 - No direct connection to cerebral cortex
 - Disconnect between center for emotion and center for reasoning
 - Diminished empathy
 - Permits unfettered action





Implications



- Teenagers respond to emotions more strongly with a gut response than they do with *evaluating* the *consequences* of what they're doing.
- In terms of behavior adolescents are *more spontaneous and less inhibited*.
- *“Just because they're physically mature, they may not appreciate the consequences or weigh information the same way as adults do. So we may be mistaken if we think that although somebody looks physically mature, their brain may in fact not be mature.*
- - Deborah Yerglund Todd, Frontline

Consequences of Poor Executive Functions in Adolescence

Emotional Difficulties

- Aggression
- Mood Swings
- Depression & Anxiety

Compulsive Behaviors

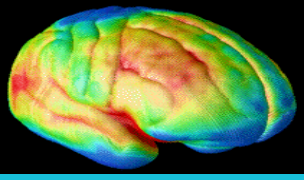
- Alcohol and Drug Abuse
- Preoccupation with Appearance
- Self Mutilation

Risk Taking Behavior

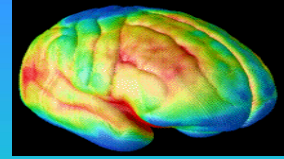
- Alcohol and Drug Abuse
- Unprotected Sex
- Conduct Problems

Inattention / Distractibility

- Poor Academic Performance
- Planning Difficulties
- Test-Taking Difficulties



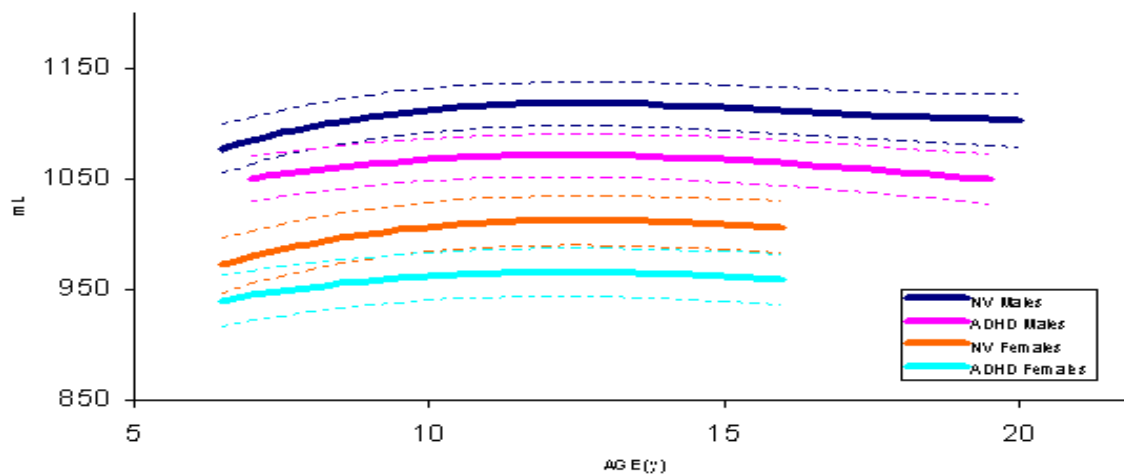
Disorders of Executive Function: ADHD



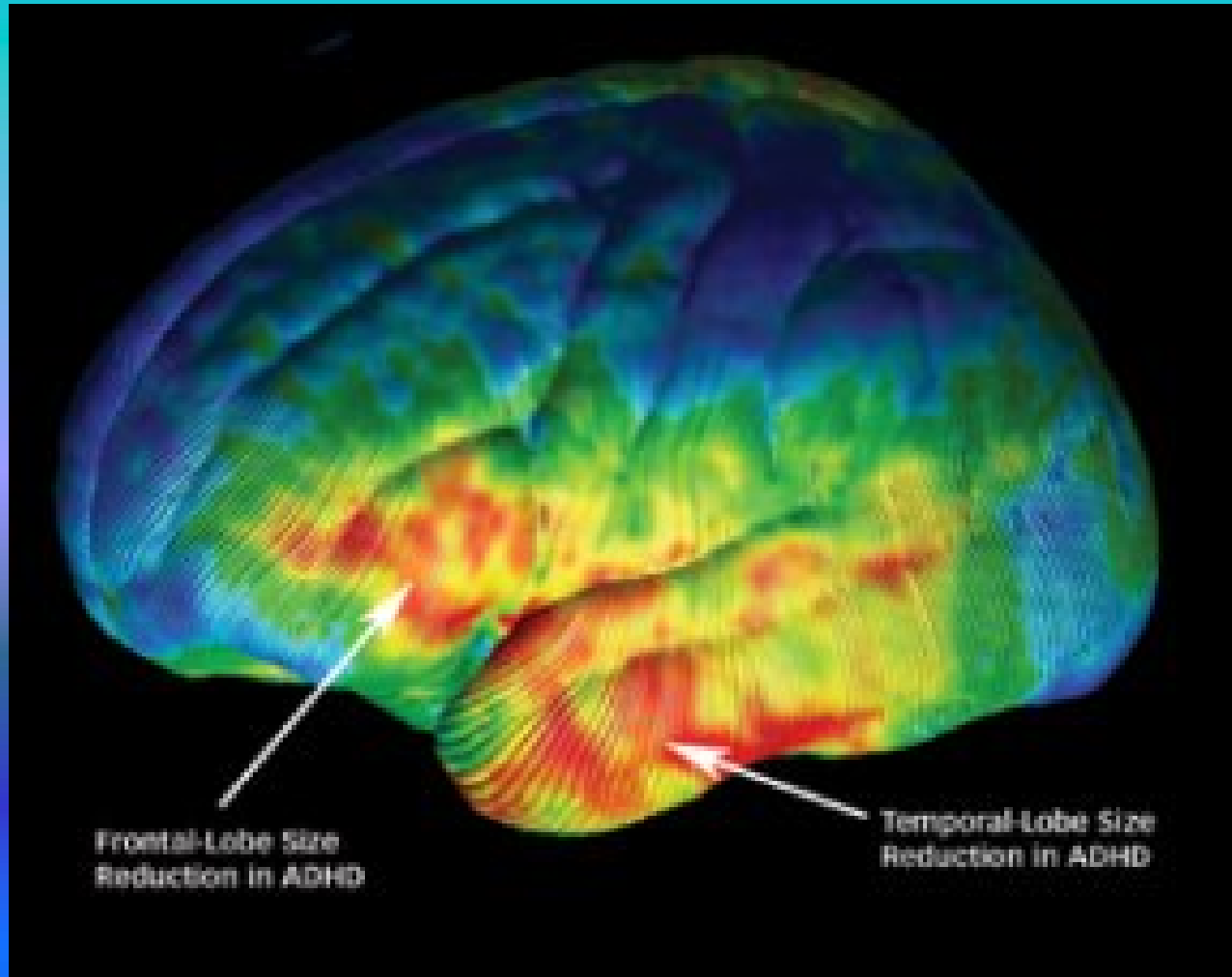
Delay in Cortical Maturation

2007 NIMH Study:

- Compared brain scans of 446 children with and without ADHD.
- Brains of children with ADHD develop normally but lagging behind approximately 3 years.
- Biological differences most evident in the cortex. Shaw et al., 2007



Brain Volume Differences in ADHD



ADHD children show 3-4 percent smaller brain volumes



Use it or Lose it



- Adolescence: A time of enormous opportunity and of enormous risk: a critical time for brain sculpting to take place.
- The pruning-down phase is : "Use it or lose it" principle.
- Those cells and connections that are used will survive and flourish. Those cells and connections that are not used will wither and die.

Giedd, Frontline - 2002

“Cells that fire together, wire together”



Violent Video Games

- 44 teen brains examined via fMRI after teens played violent video game
- Less activation of prefrontal portions of the brain.
- More activity in the amygdala.
- ***Lingering effects of heightened emotional arousal and suppressed self-control and concentration remained.***



"Teenagers' brains are not broken; they're just still under construction."

-Giedd

Why do most 16-year-olds
drive like they're
missing a part of their brain?



BECAUSE THEY ARE.



EVEN BRIGHT, MATURE TEENAGERS SOMETIMES DO THINGS THAT ARE "STUPID."

But when that happens, it's not really their fault. It's because their brain hasn't finished developing. The underdeveloped area is called the dorsal lateral prefrontal cortex. It plays a critical role in decision making, problem solving and understanding future consequences of today's actions. Problem is, it won't be fully mature until they're into their 20s.

It's one reason 16-year-old drivers have crash rates three times higher than 17-year-olds and five times higher than 18-year-olds. **Car crashes injure about 900,000 teens a year. And kill nearly 6,000.** Is there a way for teens to get their driving experience more safely—giving their brains time to mature as completely as their bodies? Allstate thinks so.

Graduated Driver Licensing (GDL) laws are one approach that's been proven effective at reducing teen

crashes. These laws restrict the more dangerous kinds of driving teens do, such as nighttime driving and driving with teen passengers. Since North Carolina implemented one of the most comprehensive GDL laws in the country, it has seen a 25% decline in crashes involving 16-year-olds.

To find out what the GDL laws are in your state, visit Allstate.com/teen. Help enforce them—and if they aren't strong enough, ask your legislator to strengthen them.

Let's help our teenagers not miss out on tomorrow just because they have something missing today.

*It's time to make the world a safer place to drive.
THAT'S ALLSTATE'S STAND*



Allstate
You're in good hands.

Auto
Home
Life
Retirement

ADHD and Driving

- Driving accidents leading cause of death in teenagers.
- Teens with ADHD two to four times more traffic accidents.
- Collisions 4 times more likely to occur at night.



"Next to creating a life, the finest thing a man can do is save one." - Abraham Lincoln

Plasticity

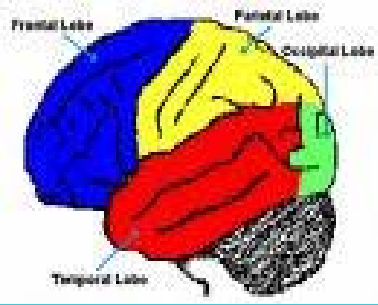


“Maturity is not simply a matter of slipping software (learning) into existing equipment. Instead, the hardware changes. Those changes partly reflect signals from the world outside, and seem to be a peculiarly human adaptation. Think of it as nature’s way of giving us a second chance.”

Giedd, 2002

Plasticity has Significant Implications for Rehabilitation

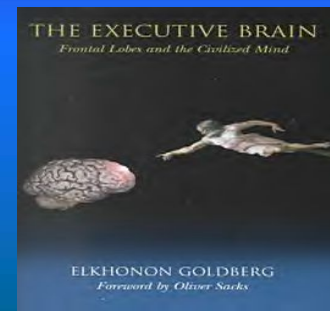




Responsibility & The Executive Brain

- Volitional control over one's actions is not innate; it emerges gradually through development.
- The capacity for volitional behavior depends on the functional integrity of the frontal lobes.
- The capacity for volitional control over one's actions is important, perhaps central ingredient of social maturity.
- The role of elders : Bearers of neurological, not just social maturity! ***Fully wired***

- Elkhonon Goldberg, 2001





A Work in Progress

“[They] frequently know the difference between right and wrong and are competent to stand trial. Because of their impairments, however, by definition, they have diminished capacities to understand and process mistakes and learn from experience, to engage in logical reasoning, to control impulses, and to understand the reaction of others ... their deficiencies do not warrant an exemption from criminal sanctions, but they do diminish their personal culpability.”

Atkins v. Virginia, 536 U.S. 304, 318, 122, S. CT. 2242, 2250 (2002).

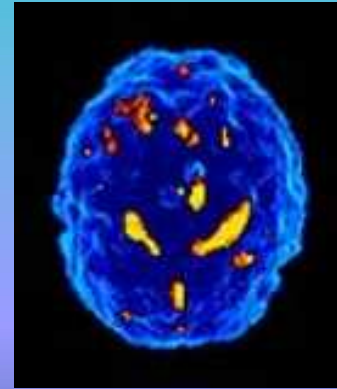
-American Bar Association-JJC-2003



Biological Maturation and the Adolescent Brain

Summary Points

- Substantial Individual Variability
- Vulnerable to Early Insult and Chronic Stressors
- Interaction of Genetics and Environment Shape Neural Networks-Plasticity
- Plasticity is a Two-Way Street
- Prefrontal Cortex or Executive Control Centers are Last to Mature
- Teens with Neurodevelopmental /Executive Dysfunction are Markedly Over-represented in the Justice System



Ontogeny Recapitulates Phylogeny

Embryonic Development of an Organism follows the same Path as the Evolutionary History of its Species



Effects on Violence of Laws and Policies Facilitating the Transfer of Youth from the Juvenile to the Adult Justice System

A Report on Recommendations of the CDC Task Force on Community Preventive Services*

Conducted a systematic review of published scientific evidence concerning the effectiveness of laws and policies that facilitate the transfer of juveniles to the adult criminal justice system to determine whether these transfers prevent or reduce violence among youth who have been transferred and among the juvenile population as a whole.

The findings in this report indicate that transfer policies have generally resulted in increased arrest for subsequent crimes, including violent crime, among juveniles who were transferred compared with those retained in the juvenile justice system.

To the extent that transfer policies are implemented to reduce violent or other criminal behavior, available evidence indicates that they do more harm than good.

CDC Task Force on Youth and the Criminal Justice System 2007

- Transferring juveniles is counterproductive for deterring subsequent violence
- Insufficient evidence that transferring juveniles prevents youth crime
- Strengthened transfer policies may be harmful for those juveniles who experience transfer



Neurodevelopmental Immaturity

Mitigates Criminal Culpability

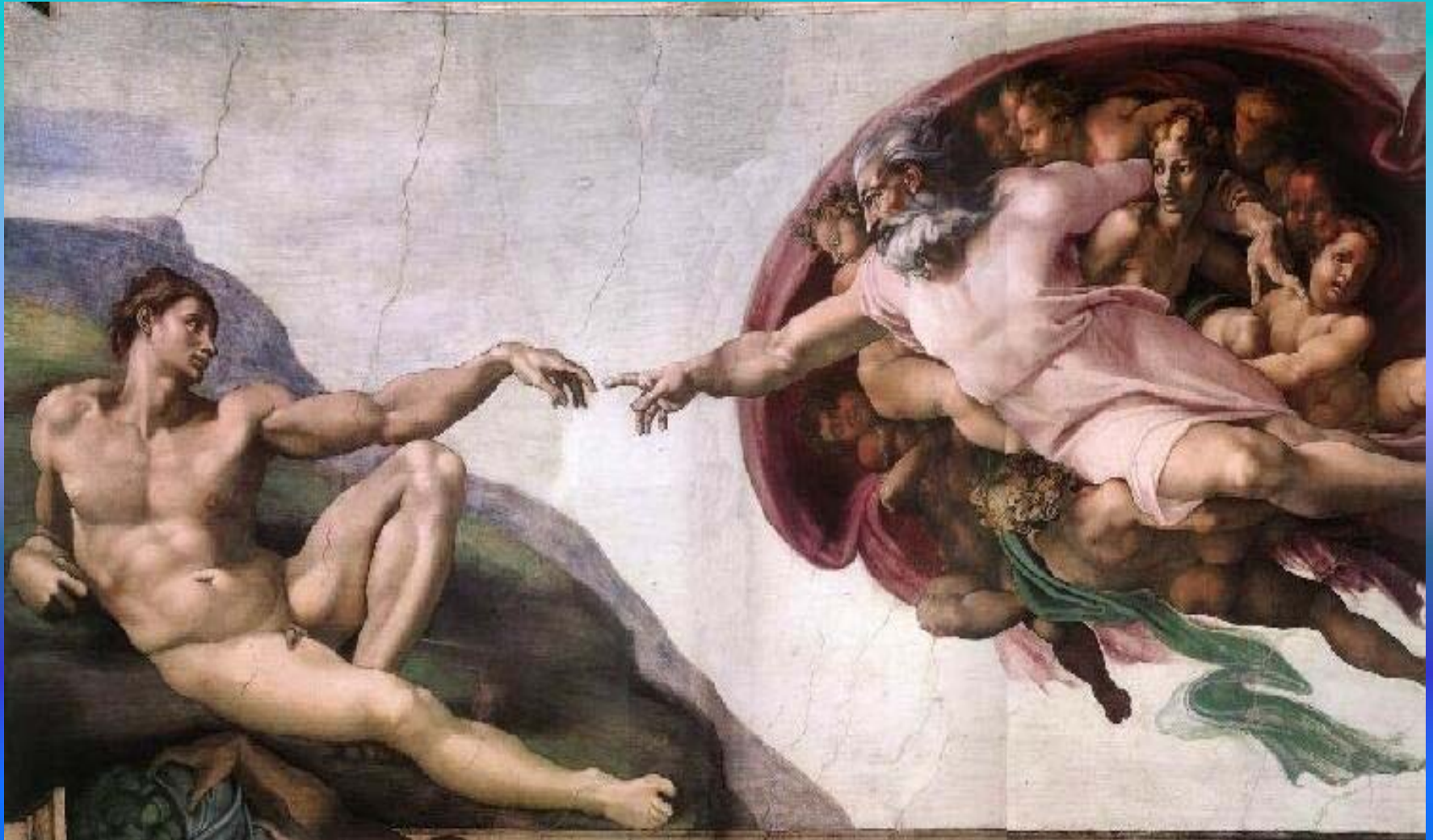
Merits a Separate System of Justice

Moderates the Severity of Punishment

Inform and Guide Transfer of Adolescents to the
Adult Court

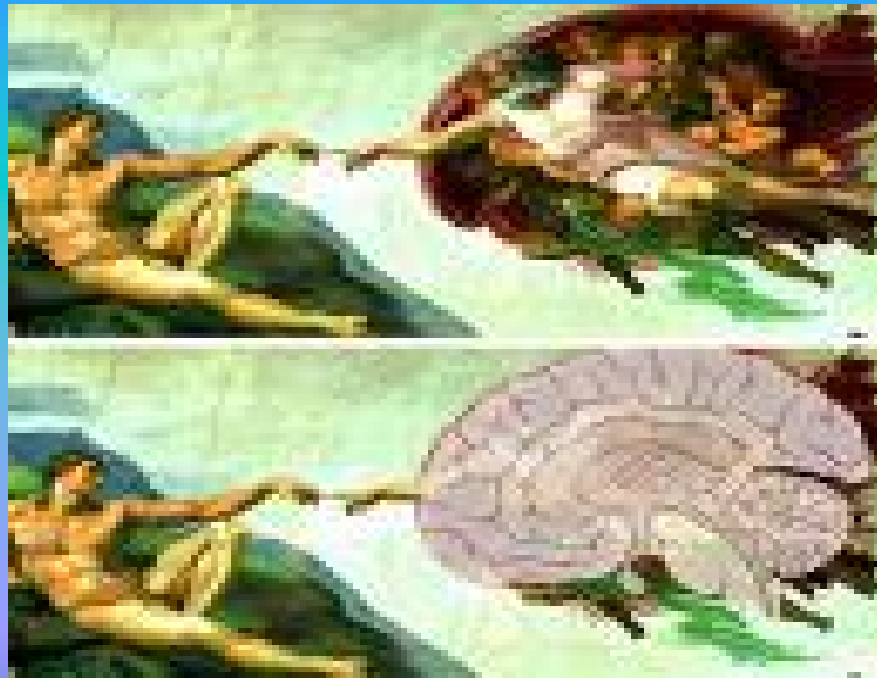


The Frontal Lobes: The Seat of Civilization



“An Interpretation of Michelangelo's Creation of Adam”

JAMA 1990



The Creation of Adam (1508-1512) Sistine Chapel. In 1990 (JAMA, 1990) Frank Lynn Meshberger, M.D. described an anatomically accurate image of the human brain portrayed behind God. Borders in the painting correlate with sulci in the inner and outer surface of the brain, the brain stem, the basilar artery, the pituitary gland and the optic chiasm. God's hand does not touch Adam, yet Adam is already alive as if the spark of life is being transmitted across a synaptic cleft. Below the right arm of God is a sad angel in an area of the brain activated on PET scans when someone experiences a sad thought. God is superimposed over the limbic system, the emotional center of the brain and possibly the anatomical counterpart of the human soul. God's right arm extends to the **prefrontal cortex, the most creative and most uniquely human region of the brain.**

Resources

ABA: *Adolescence, Brain Development and Legal Culpability*

<http://www.abanet.org/crimjust/juvjus/Adolescence.pdf>

American Psychologist: *Less Guilty by Reasons of Adolescence*

http://ccjr.policy.net/cjedfund/resourcekit/Psychology_Less_Guilty.pdf

National Institute of Mental Health: *Imaging Study Shows Brain Maturing*

<http://www.nimh.nih.gov/press/prbrainmaturing.cfm>

PBS Frontline: *Inside the Teenage Brain*

<http://www.pbs.org/wgbh/pages/frontline/shows/teenbrain/>

Roper v. Simmons: Amici Curiae Brief of the American Bar Association, et al.

<http://www.abanet.org/crimjust/juvjus/simmons/aba.pdf>

Roper v. Simmons: Amici Curiae Brief of the American Medical Association, et al.

<http://www.abanet.org/crimjust/juvjus/simmons/ama.pdf>

Roper v. Simmons: Amici Curiae Brief of the American Psychological Association, et al.

www.apa.org/psyclaw/roper-v-simmohhttp://ns.pdf

Science Magazine: *Crime, Culpability, and the Adolescent Brain*

<http://www.wpic.pitt.edu/research/Incd/papers/ScienceLunaOct2004.pdf>

Science News: *Teen Brains on Trial.*

<http://www.sciencenews.org/articles/20040508/bob9.asp>



Includes a new afterword

DESCARTES' ERROR

EMOTIONS, REASON, AND
THE HUMAN BRAIN

"A fascinating exploration of the biology of reason and its inseparable dependence
on emotion. . . . Damasio is a profound thinker and an elegant writer."

—OLIVER SACKS

Antonio Damasio

Author of *Looking for Spinoza*

THE EXECUTIVE BRAIN

Frontal Lobes and the Civilized Mind

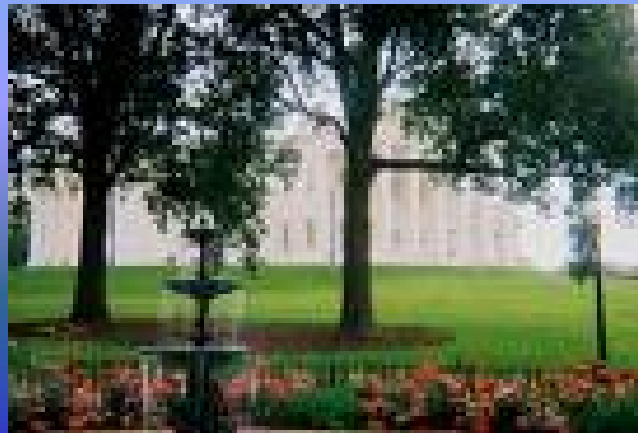


ELKHONON GOLDBERG

Foreword by Oliver Sacks

CRIMINAL CULPABILITY TRANSFER AND THE TEEN BRAIN

Virginia State Crime Commission



Vincent P. Culotta Ph.D. ABN

NeuroBehavioral Associates

www.nbatests.com

Columbia, MD

