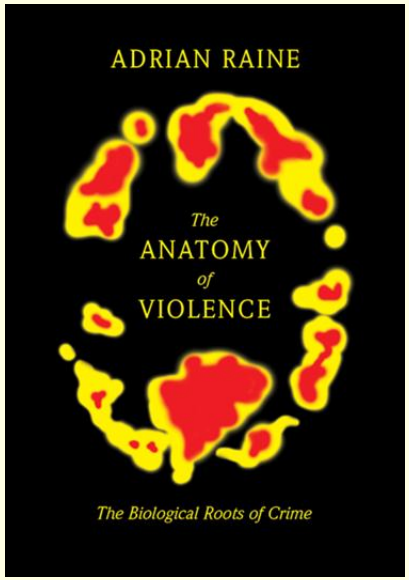
The Anatomy of Violence:

Implications for Prevention, Prediction, and Punishment



Adrian Raine

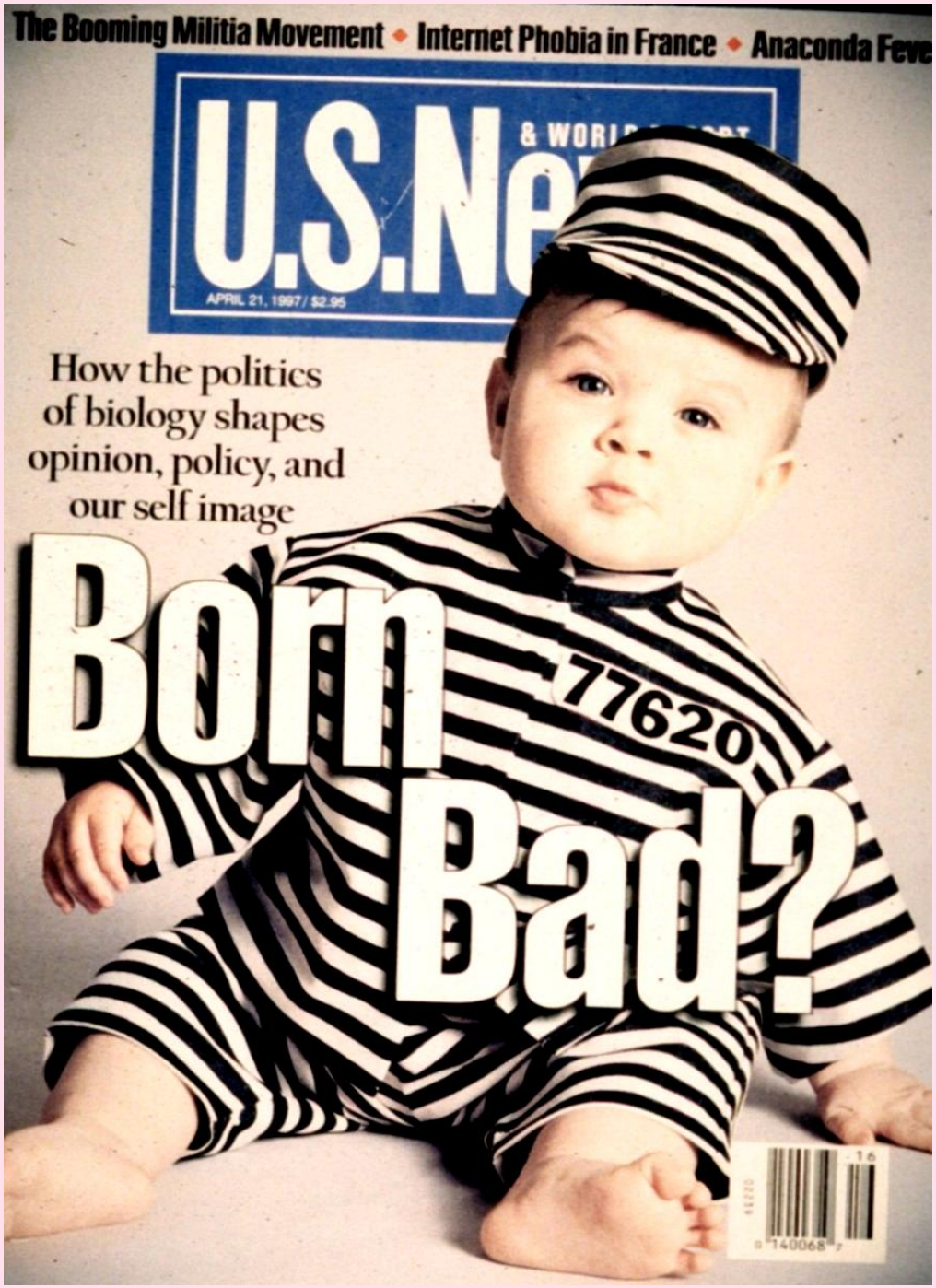
Departments of Criminology, Psychiatry, and Psychology, University Of Pennsylvania.

OUTLINE

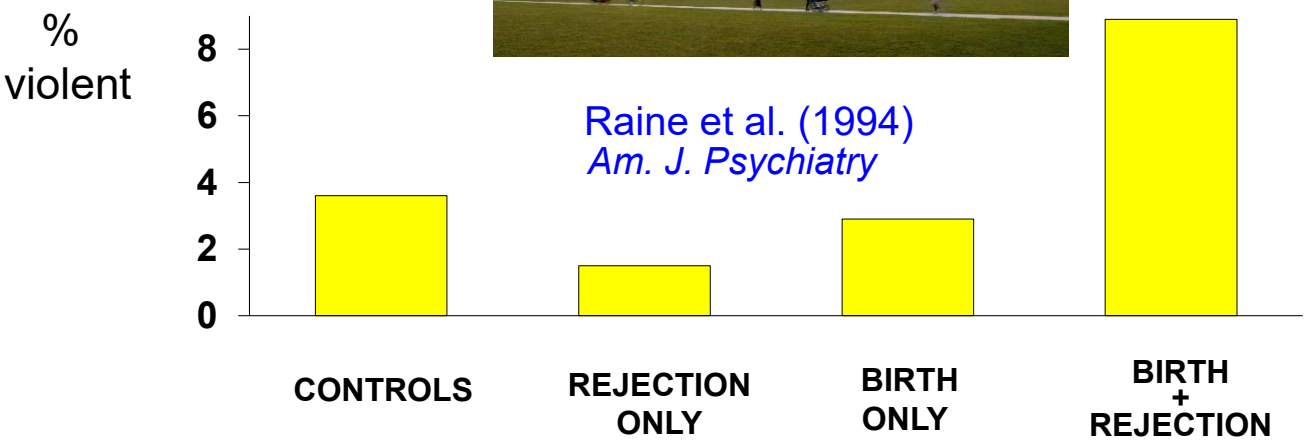
1. Early Biological Risk Factors

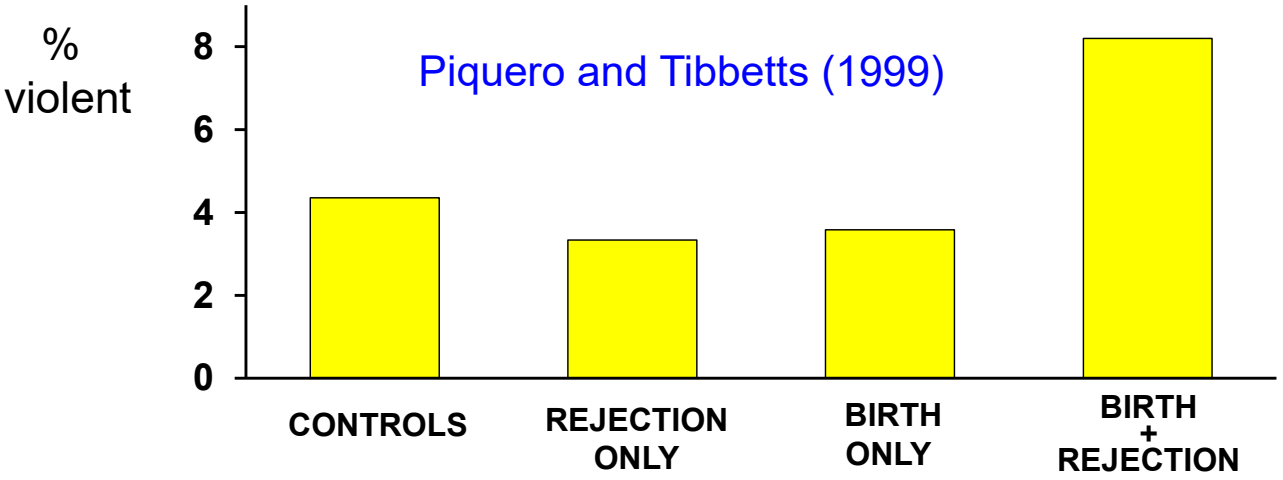
2. Brain Mechanisms
   - prefrontal cortex
   - amygdala

3. Legal and Societal Implications
   - prevention
   - prediction
   - punishment


The Booming Militia Movement ◆ Internet Phobia in France ◆ Anaconda Fever
U.S.News & World Report
APRIL 21, 1997 / $2.95
How the politics of biology shapes opinion, policy, and our self image
Born Bad?
77620

Birth Complications, Early Deprivation, and Violence





Prenatal Nutrition and Adult Antisocial Personality

Prenatal Exposure to Wartime Famine and Development of Antisocial Personality Disorder in Early Adulthood

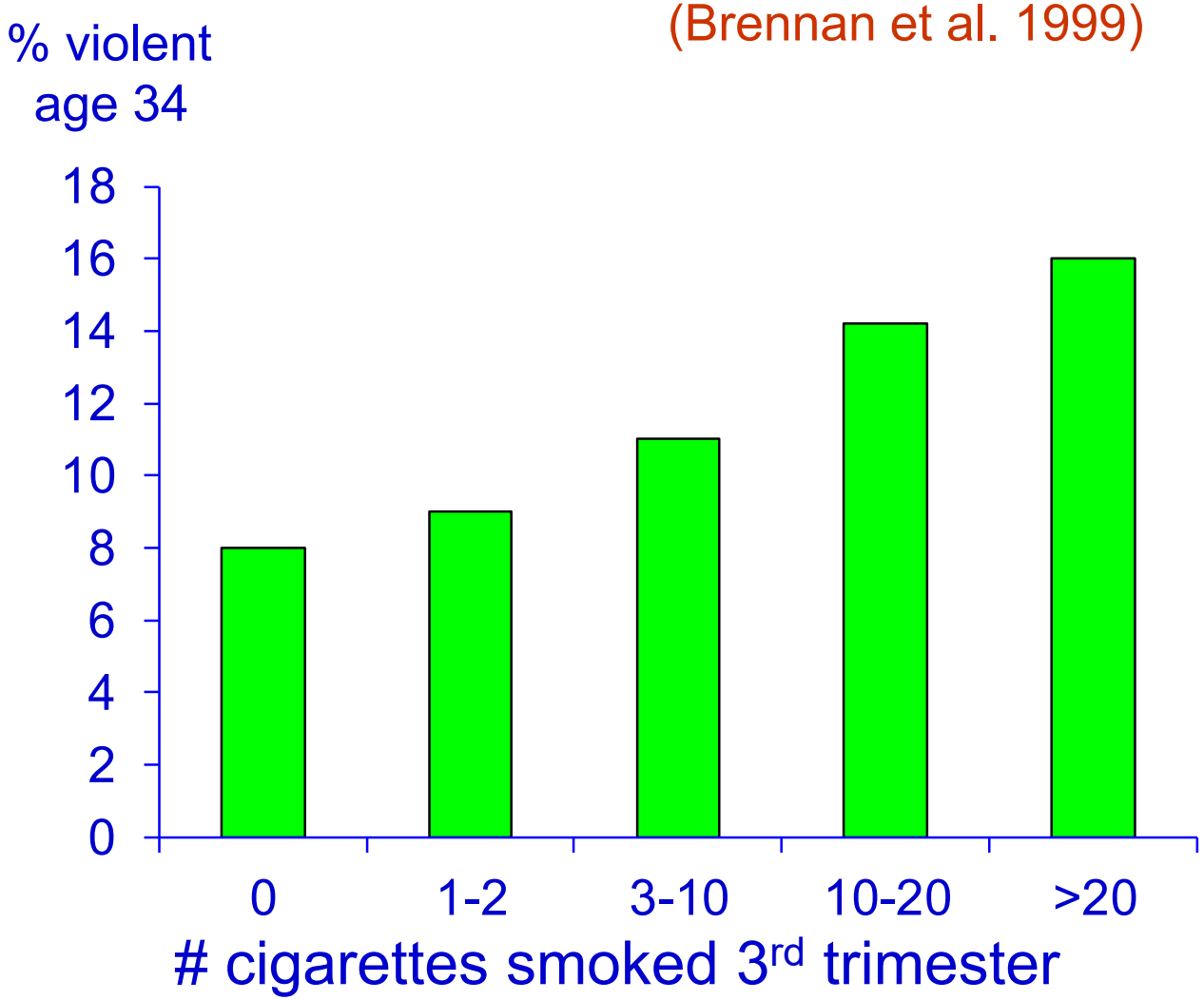
Richard Neugebauer, PhD, MPH
Hans Wijbrand Hoek, MD, PhD
Ezra Susser, MD, DrPH

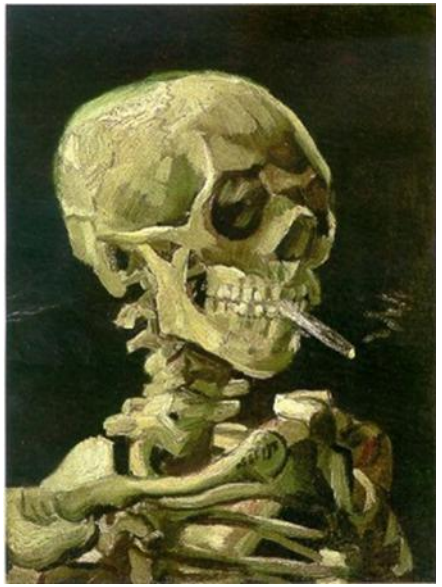
Context Several observational epidemiological studies report an association of pregnancy and obstetric complications with development of antisocial personality disorder (ASPD) in offspring. However, the precise nature and timing of the hypothesized biological insults are not known.

Smoking During Pregnancy

4,169 male births in Copenhagen

(Brennan et al. 1999)



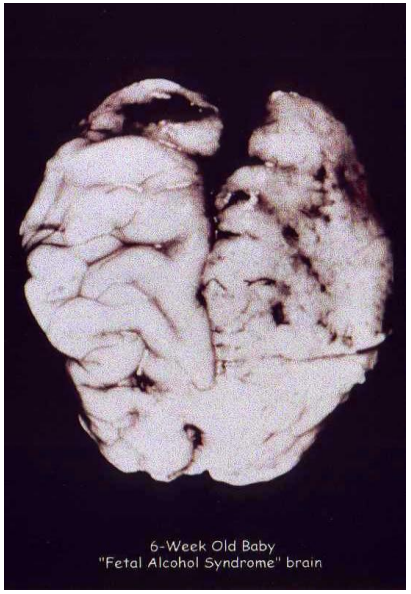


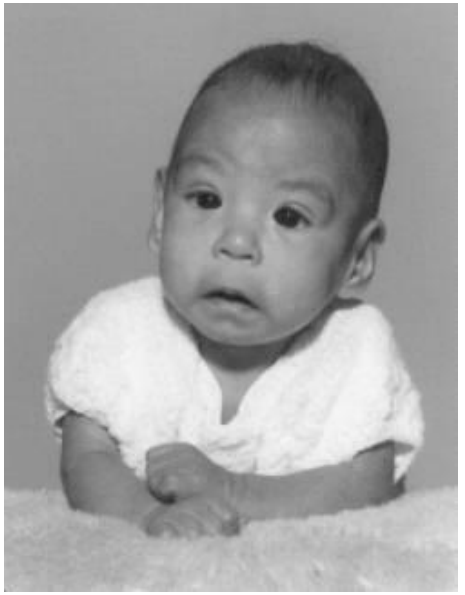
> 20 other studies find same effect for child antisocial behavior

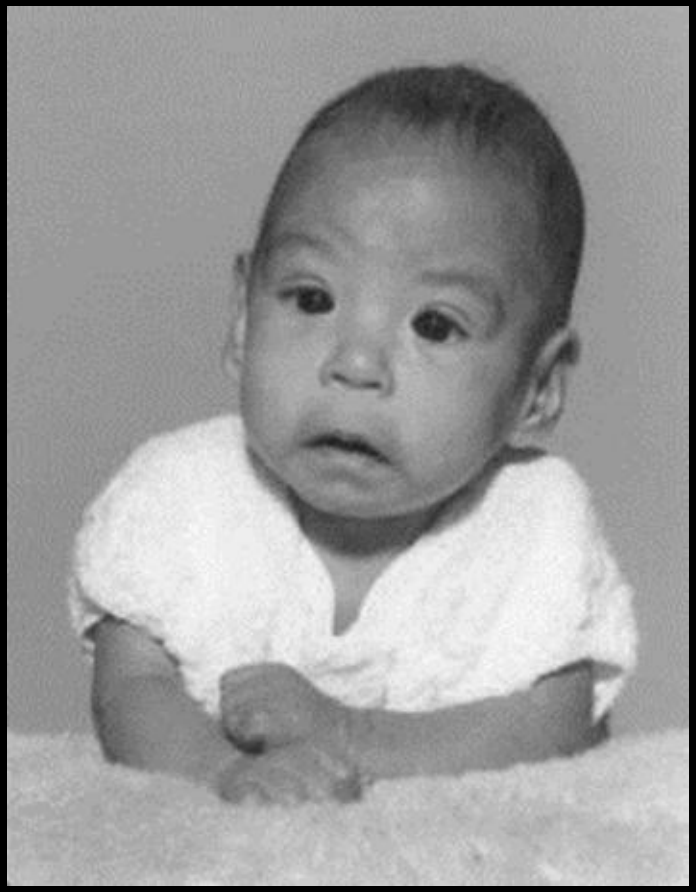
FETAL ALCOHOL SYNDROME (FAS)

Streissguth et al. (1996): 473 with FAS or FAE

- 61% rate of delinquency
- 58% police contacts in adulthood
- 54% males (33% females) arrested / convicted after age 12







Jennifer Crumbley

James Crumbley

Jamillah Falls, Memphis, TN

Baby girl born July 5, 2014
Baby tested positive for heroin & marijuana
Convicted of assault - 6 months in prison

PARENTAL RESPONSIBILTY
OR …
HELP, NOT HANDCUFFS

OUTLINE

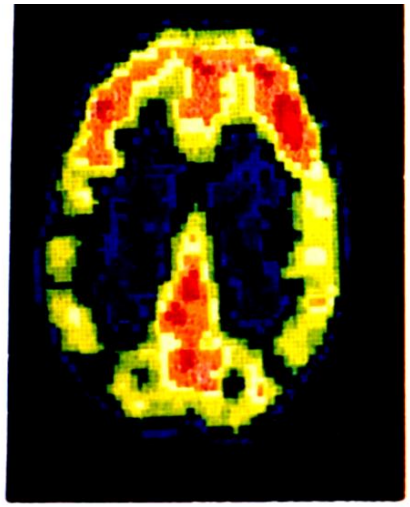
1. Early Biological Risk Factors

2. Brain Mechanisms

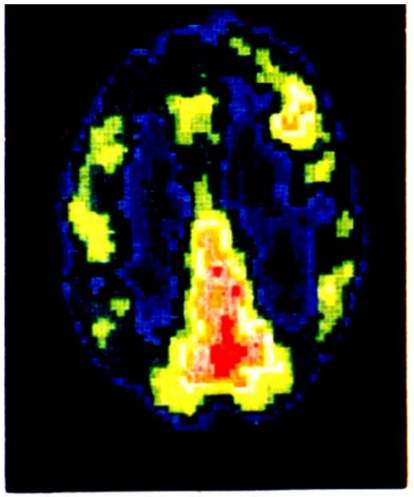
3. Legal and Societal Implications

Brain Abnormalities in Murderers Indicated by Positron Emission Tomography

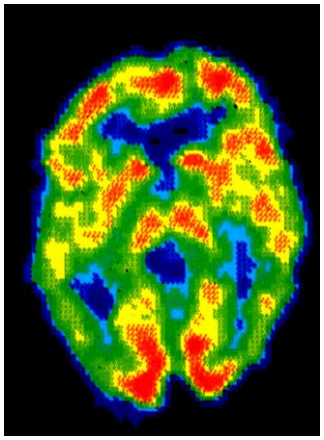
Raine et al., 1994, *Biological Psychiatry, 42*, 495-508



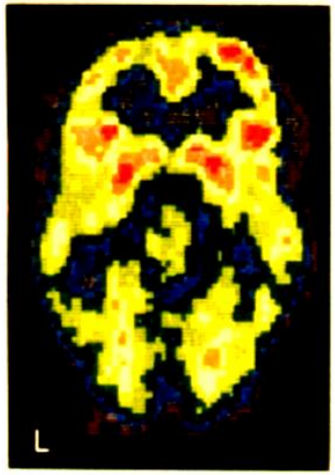
NORMAL



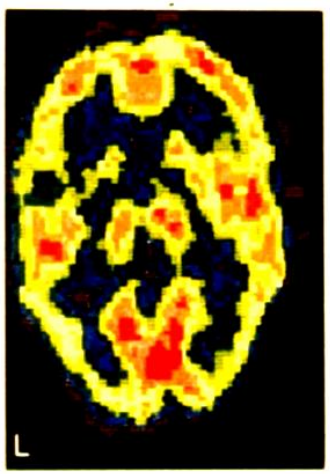
MURDERER



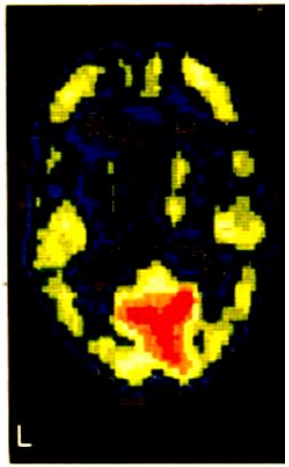
Raine



Normal



Multiple Murderer



Murderer

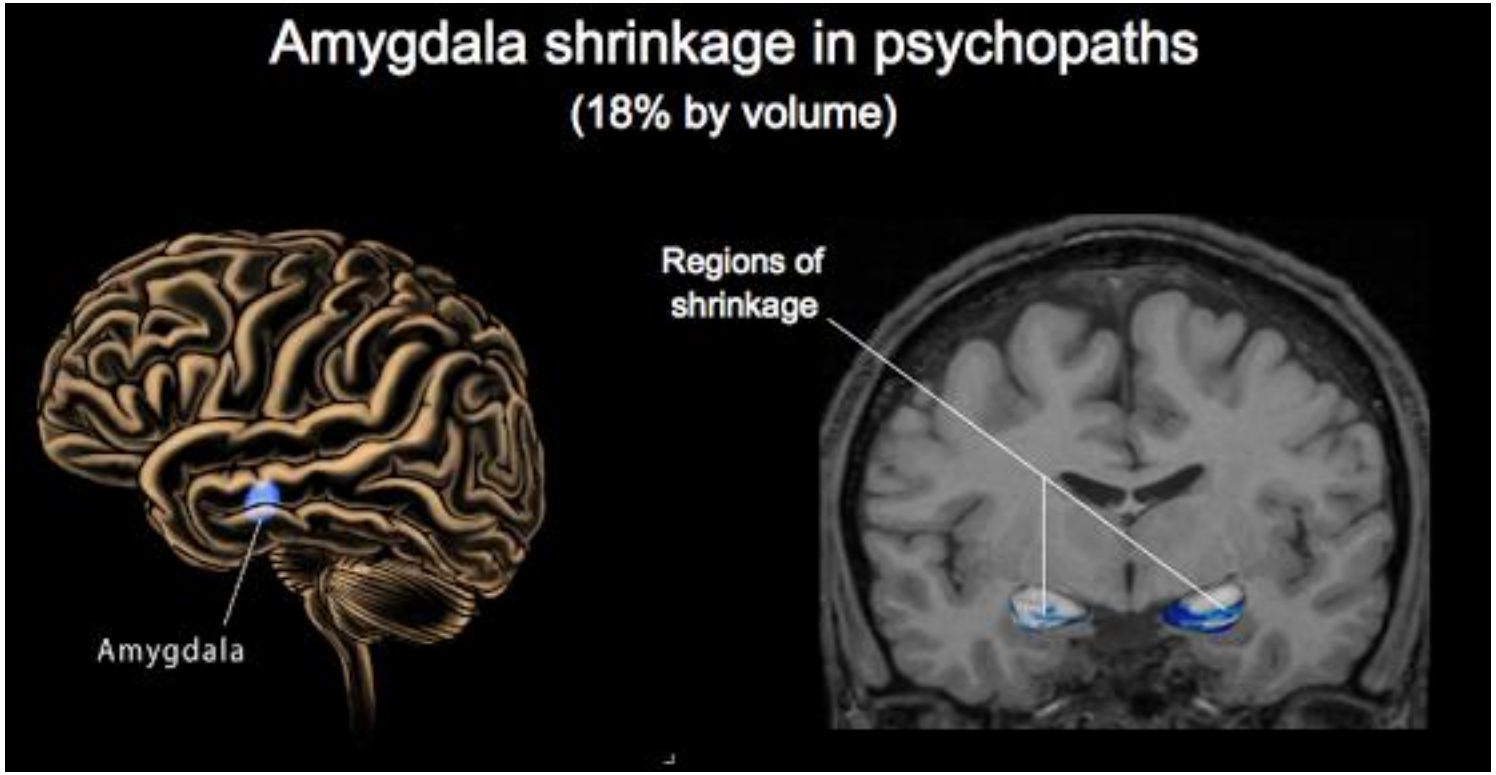
Reviews confirm prefrontal dysfunction in violence / antisociality / psychopathy:

Yang & Raine, (2009); Blair (20220); de Brito (2021)

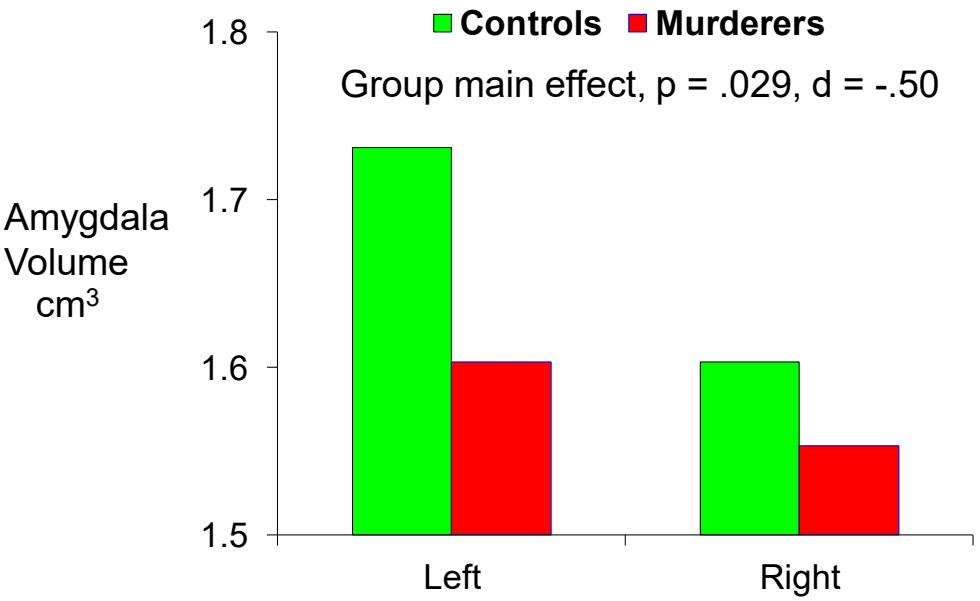
Structural Amygdala Deformations in Psychopaths

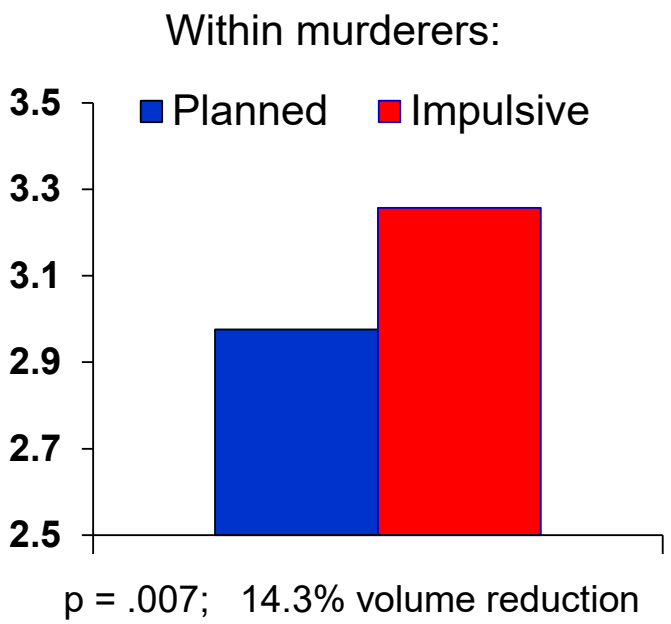
Yang et al., (2009) *Archives of General Psychiatry, 66, 986-994.*

27 psychopaths vs. 32 non-psychopaths



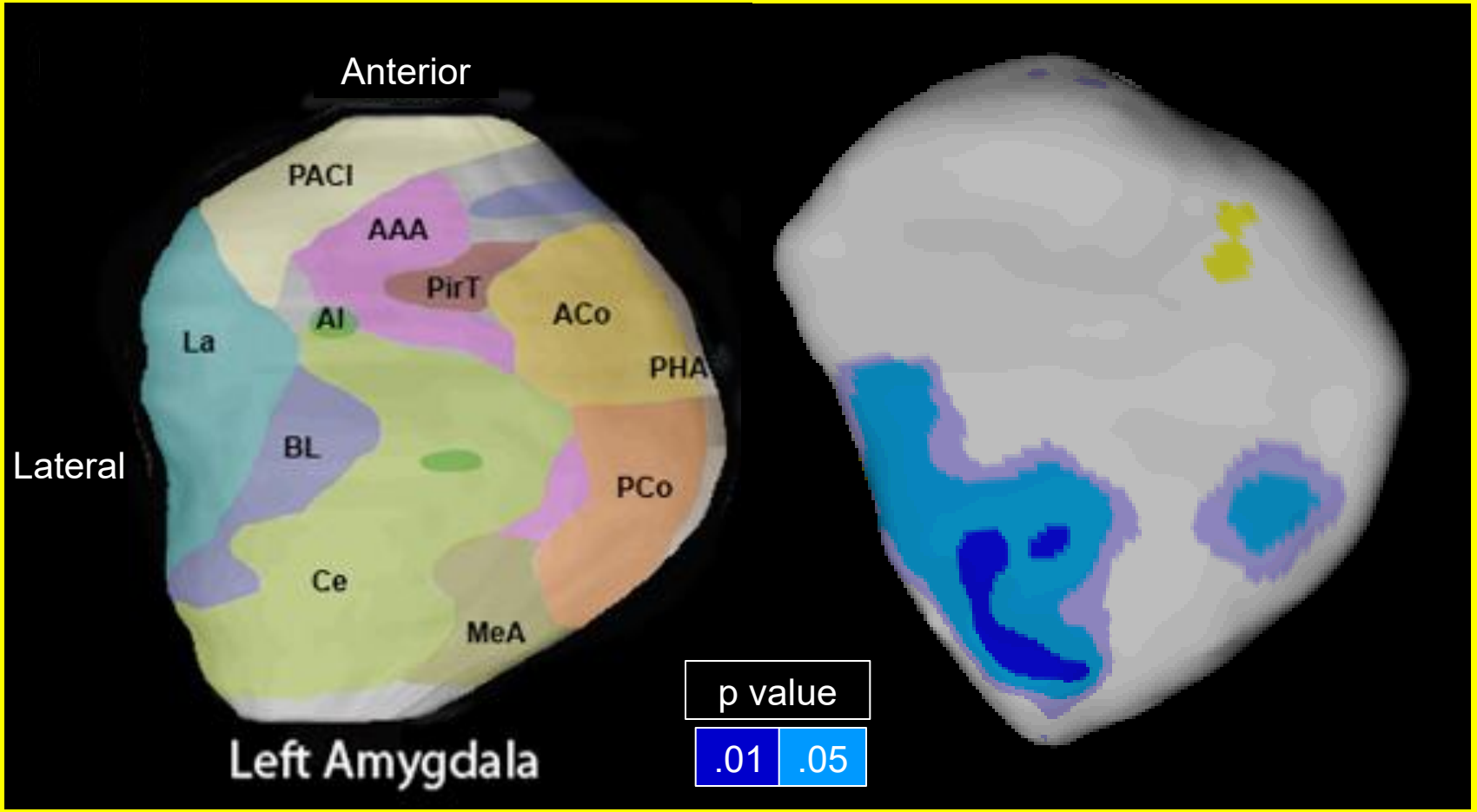
Amygdala Volumes in Murderers





Within murderers: amygdala – psychopathy correlation, r = -.67, p < .001

Localization of Deformations Within the Amygdala



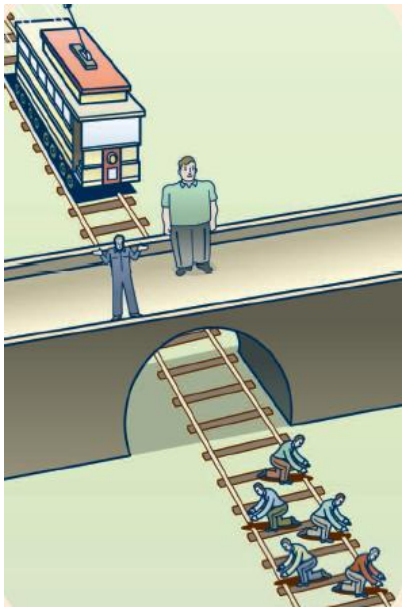
Schematic map of amygdala nuclei

Deformations in Murderers (vs Controls)

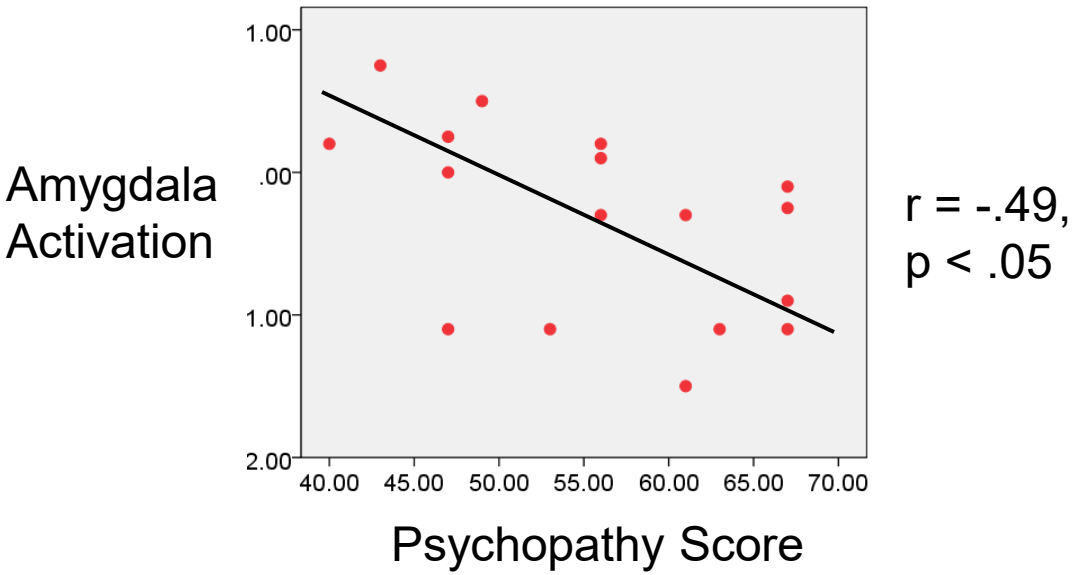
Moral Decision-Making, the Amygdala and Psychopathy

(Glenn et al. 2009)

Molecular Psychiatry, 14, 5–9



Increased psychopathy associated with reduced amygdala activation



Psychopaths may *know* right from wrong, but …

Do they having the *feeling* of what's right and wrong?

OUTLINE

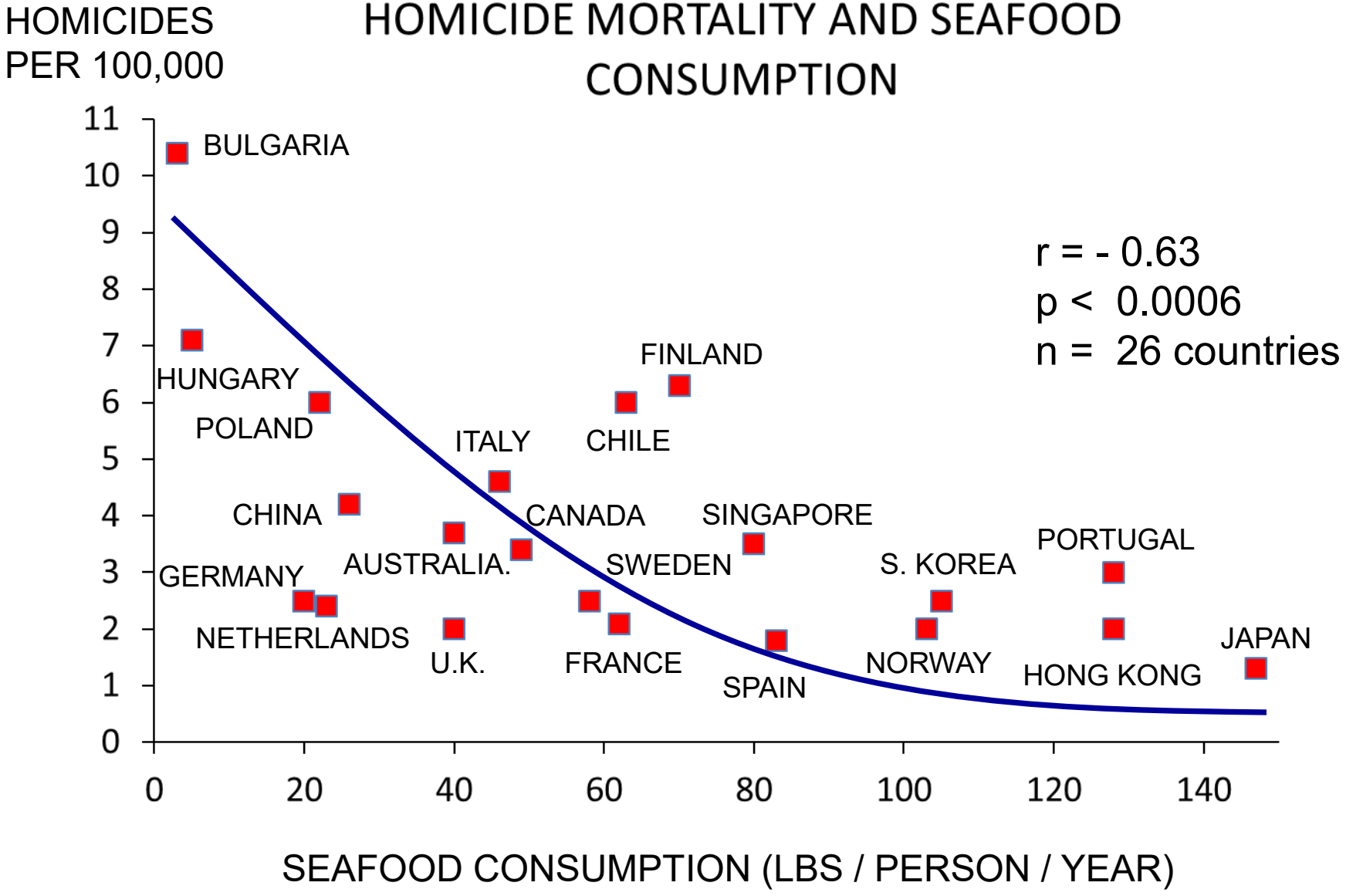
1. Early Biological Risk Factors

2. Brain Mechanisms

3. Neurolegal Implications

   - Prevention

HOMICIDE MORTALITY AND SEAFOOD CONSUMPTION

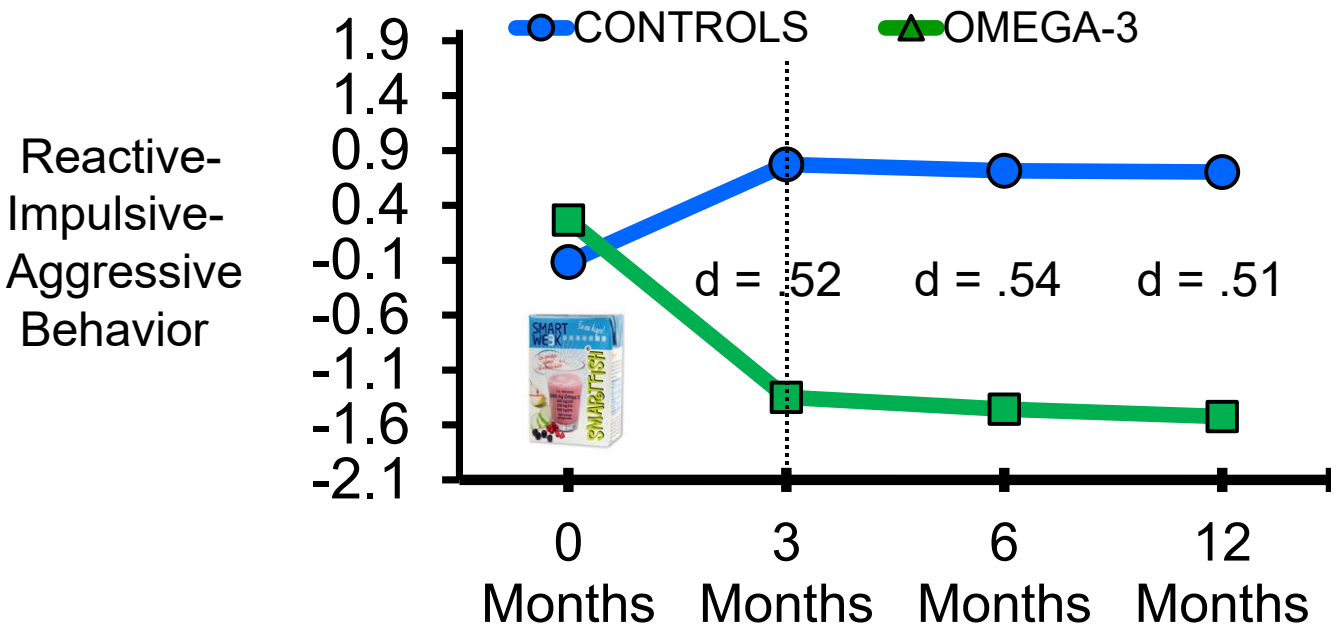


Hibbeln, JR (2001). World Rev Nutr Diet, 88; 41-46.

Omega-3 Supplementation for Young Offenders

Raine et al., (2020) *J. Experimental Criminology, 16, 389-405*

145 male young offenders, aged 19.2 years



Meta-Analysis: Omega-3 Reduces Aggression Raine & Brodrick (2024)

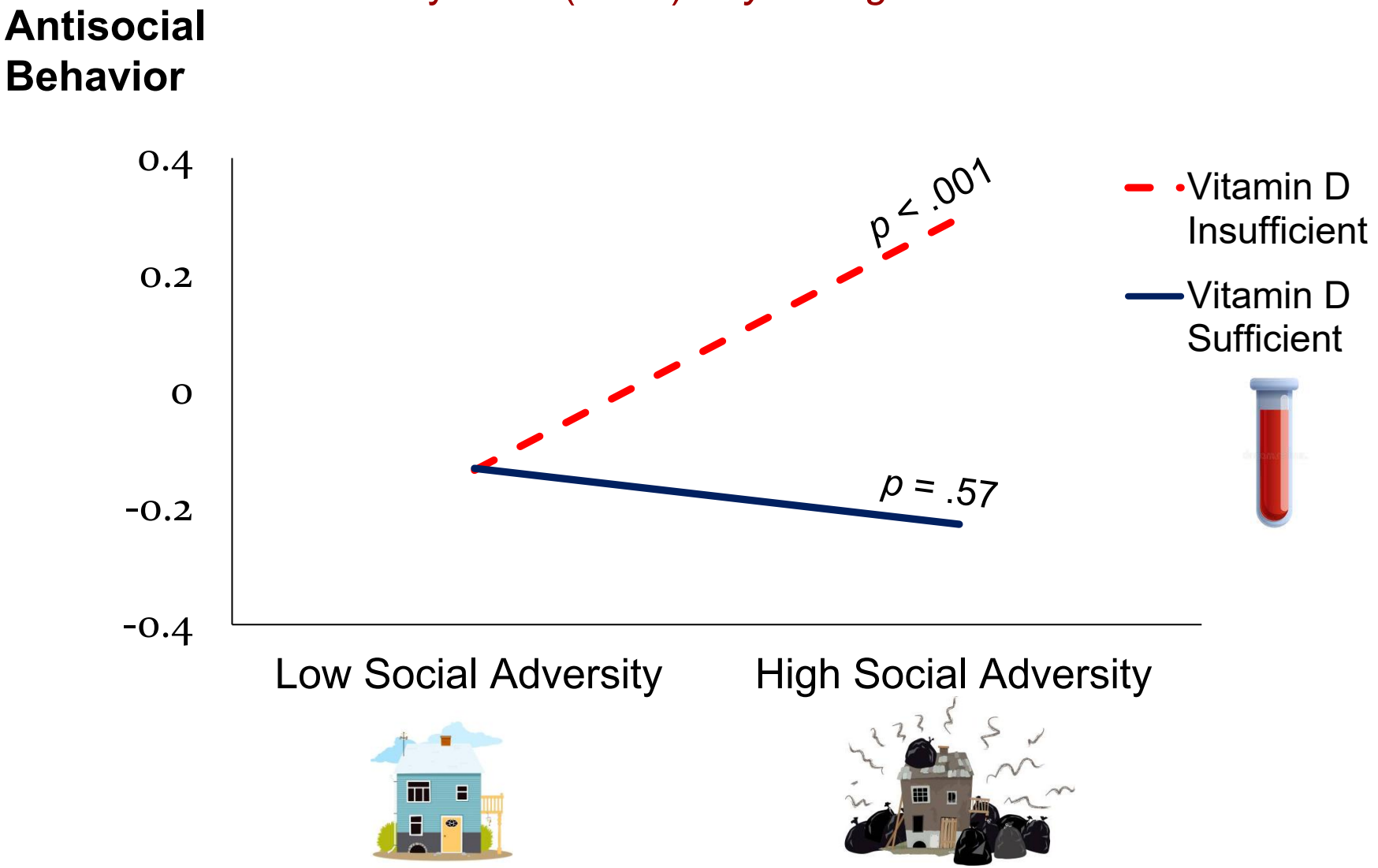
29 RCTs: d = .22 (32.9% reduction)

Meta-Analysis: Omega-3 Reduces Antisocial Behavior Raine & Saven (in press)

25 RCTs: antisocial behavior: d = .14 (22% reduction)
externalizing behavior: d = .22 (33% reduction)

Increased Vitamin D Intake Protects Against Antisocial Behavior in the Face of Adversity

Choy et al. (2021) *Psychological Medicine*



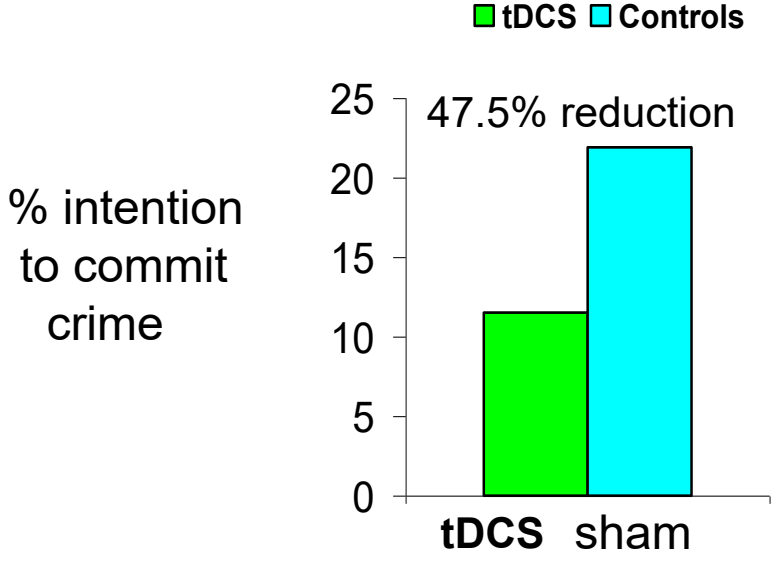
Transcranial Direct Current Stimulation (tDCS) and Criminal Intent

Choy et al. (2018) *J. Neuroscience, 38,* 6505-6512

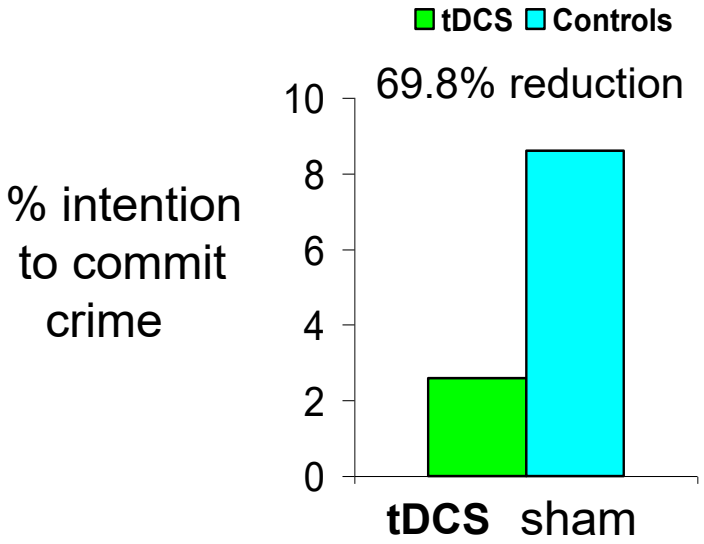
Double-blind, stratified, randomized controlled trial

39 tDCS stimulation

42 sham stimulation



Physical assault



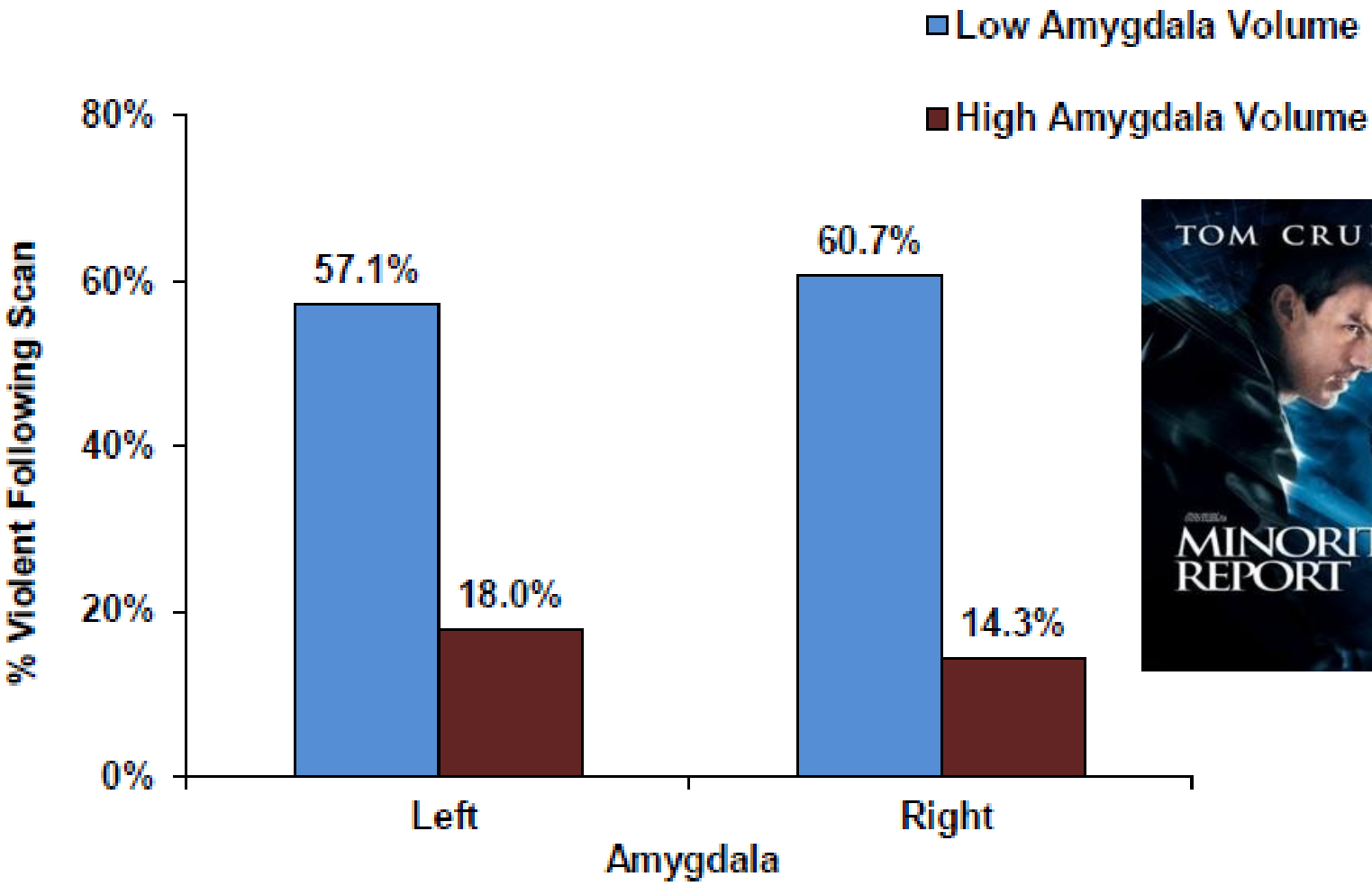
Sexual assault

OUTLINE

1. Early Biological Risk Factors
2. Brain Mechanisms
3. Neurolegal Implications
   - Prevention
   - Prediction

Amygdala Volume Predicts Later Violence

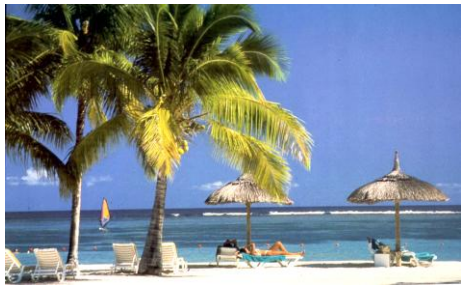
Pardini et al. (2013) *Biological Psychiatry*

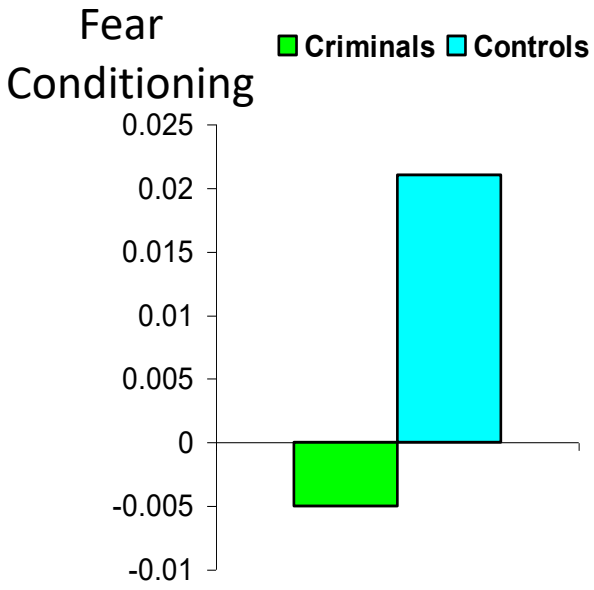


Controlling for prior aggression, violence, and psychopathy

Fear Conditioning at Age 3 and Crime at age 23

Gao et al. (2010) *Am. J. Psychiat., 167,* 156-160.





d = .35, p < .005

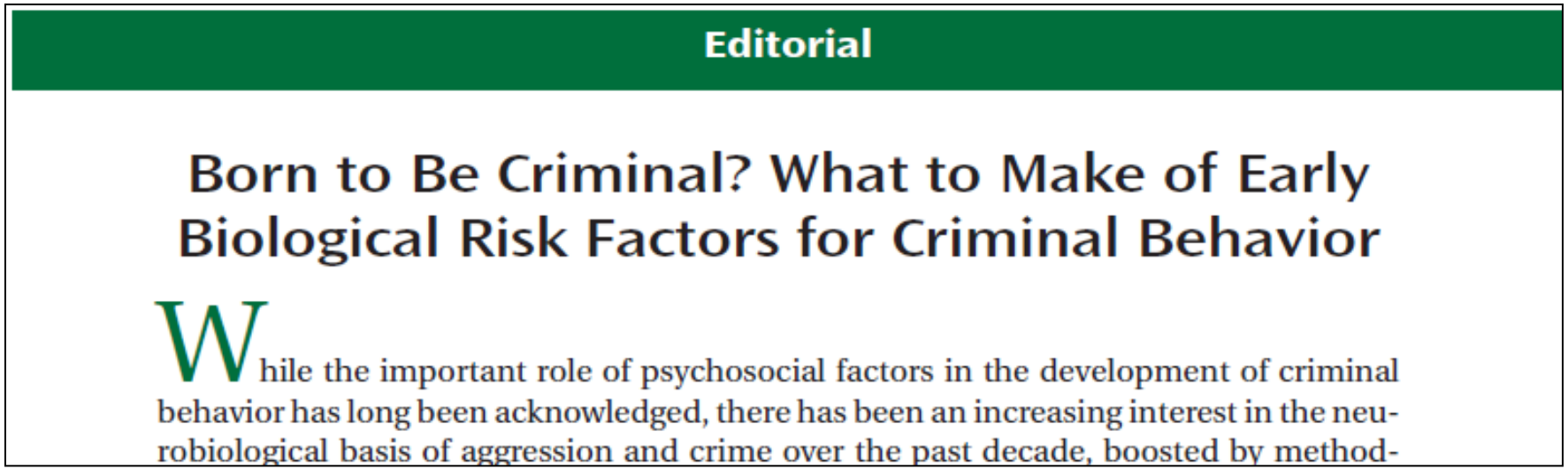
N = 1,795 3-year-olds

- fear conditioning at age 3
- criminal convictions at age 23

Criminal offenders N = 137
Matched controls N = 274

Match on:
sex, ethnicity, social adversity

Editorial: Philipp Sterzer (2010) *American Journal of Psychiatry*, 167, 1-3.



Editorial

Born to Be Criminal? What to Make of Early Biological Risk Factors for Criminal Behavior

While the important role of psychosocial factors in the development of criminal behavior has long been acknowledged, there has been an increasing interest in the neurobiological basis of aggression and crime over the past decade, boosted by method-

"If not handled with great caution, neurobiological markers can easily be misused to stigmatize individuals who are perceived as a potential threat to society."

"Neurobiological research offers a great chance to further our understanding of antisocial and criminal behavior.

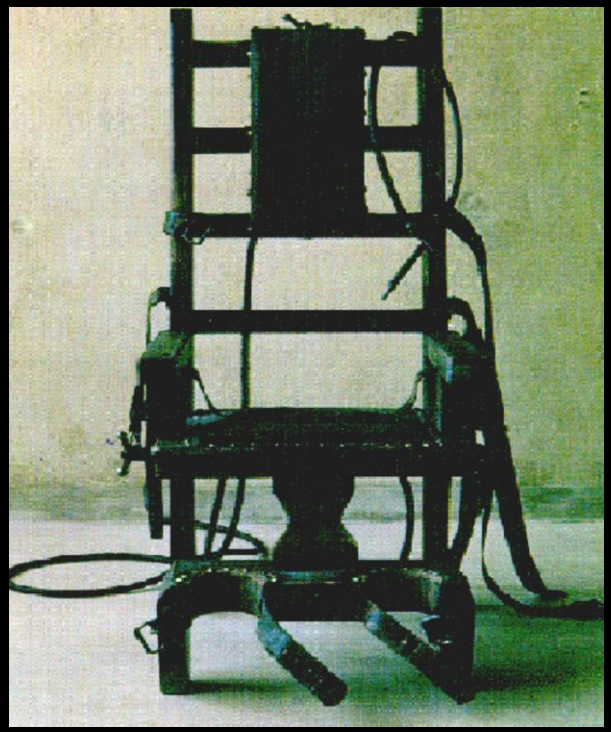
This understanding should be used to benefit those children who are at greatest risk for a criminal career and to design interventions that are tailored to their needs".

OUTLINE

1. Early Biological Risk Factors
2. Brain Mechanisms
3. Neurolegal Implications
   - Prevention
   - Prediction
   - Punishment

Neuroethics, Neurolaw, and Neurocriminology Interface

If neurobiological impairments predisposes to antisocial behavior, are criminals responsible?



THE CASE OF MICHAEL:
ACQUIRED PEDOPHILIA

Burns & Swerdlow (2003) *Arch. Neurol. 60*:437-440

- 40 years old, 2nd marriage (stable), schoolteacher
- no psychiatric history or sexually deviant behavior

Is Michael Responsible?

Michael *is* responsible: he has rational capacity:

1. he knew what he was doing
2. he knew act was illegal / immoral

"The fact is, I did what I did do. I am responsible for it, I am the one to blame."

- Is it *just* to blame Michael?

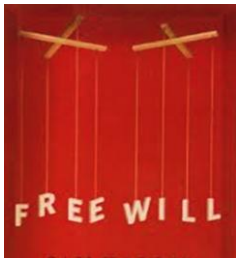
"Now, whether I should be held as accountable for it as someone without a tumor? No, I don't think so".

- Should we consider emotion alongside cognition in responsibility criteria?

- What about cases where there is no clear treatment?

SUMMARY

1. Early Biological Risk Factors
   - Place constraints on free will



2. Brain Mechanisms
   - Prefrontal cortex and amygdala

3. Legal and Societal Implications
   - Omega-3 can reduce aggression
   - Better crime prediction from biology?
   - Should mercy season justice?