



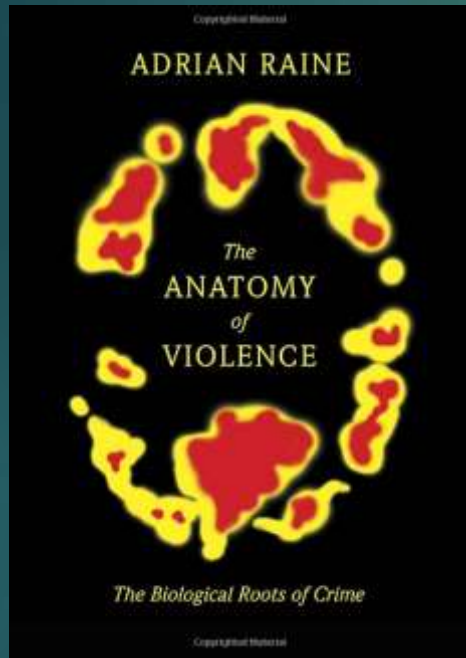
The Neurobiology of Violence: Neurocriminology

CHARLES J. VELLA, PHD

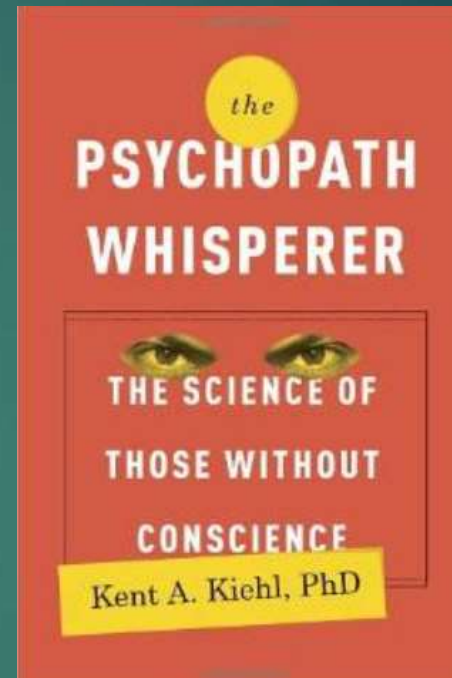
APRIL 9, 2015

THANKS TO ADRIAN RAINE, CHRISTOPHER M.
FILLEY, KENT KIEHL

This presentation is based on these books



- ▶ The Anatomy of Violence:
- ▶ The Biological Roots of Crime
- ▶ by Adrian Raine
- ▶ 2013



- The Psychopath
- Whisperer
- by Kent Kiehl
- 2015

Punishment of crime

- ▶ We should know the difference between who we are angry at and who we are afraid of.
- ▶ Protection for society: We need to segregate from society those of whom we are afraid
- ▶ Rehabilitation: We need to rehabilitate those with whom we are angry

Aspen Neurobehavioral Conference Consensus Statement

(Filley et al. Neuropsychiatry Neuropsychol Behav Neurol 2001; 14: 1-14)

- ▶ Working group representing neurology, psychiatry, neuropsychology, trauma surgery, nursing, evolutionary psychology, ethics, and law
- ▶ Aggression can be adaptive, but violence is a an aggressive act characterized by the unwarranted infliction of physical injury
- ▶ Violence can result from brain dysfunction, although social and evolutionary factors also contribute
- ▶ Study of neurobehavioral aspects – frontal lobe dysfunction, altered serotonin metabolism, and the influence of heredity – promises to lead to deeper understanding

NGRI: Not Guilty by reason of insanity

- ▶ Not guilty by reason of insanity (NGRI) is a verdict issued in criminal cases whereby the defendant, determined to be legally insane, is held not responsible for his or her criminal actions
- ▶ The legal test of insanity, the right and wrong test as stated in the M'Naghten case (1843): did not know that his act would be wrong
- ▶ This rule was applied in the case of United States vs. Durham. In the Durham case the court said, "The accused is not criminally responsible if his unlawful act was the product of mental disease or mental defect."



“Oh, Agent Starling, you think you can dissect me with this blunt little tool?”

Hannibal Lector in *Silence of the Lambs*

A biological perspective on the causation of crime

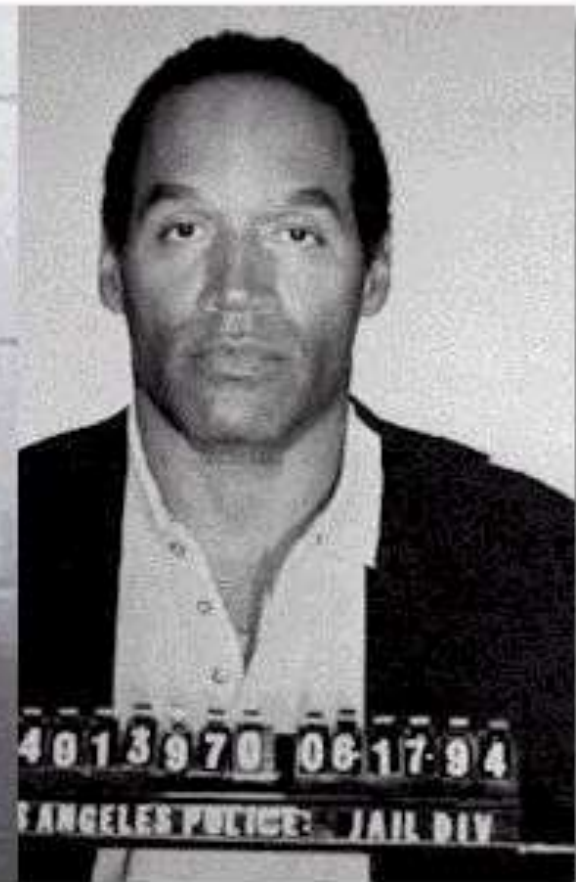
- ▶ Is there a significant biological contribution to the causes and cures of crime?
- ▶ Issues of free will, responsibility
- ▶ Neurolaw impact

NOT ALL CRIMINALS ARE THE SAME



MANSON, Charles Milles

CII 966 856

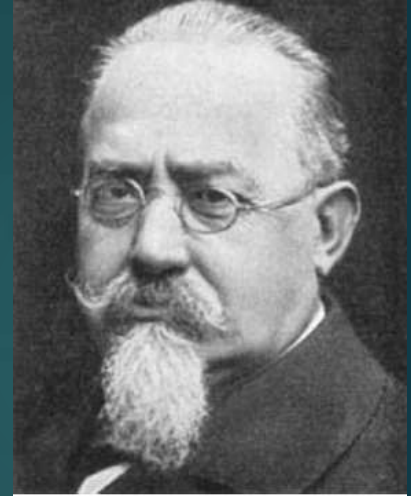


Some Historical Background

- ▶ The Italian physician Cesare Lombroso (1839-1909) was influenced by phrenology and promoted atavism, the idea that some people are “born criminals” in whom certain cranial features represent the re-emergence of regressed evolutionary traits
- ▶ This discredited approach may in part be responsible for an aversion to consider biological factors in criminal behavior

Cesare Lombroso (1835-1909)

- ▶ Author of 3 volume *The Criminal Man*, 1889
- ▶ There has never been anyone in history of criminology who has been more eulogized or condemned.
- ▶ Scientific study of biological criminology: 1871, Cesare Lombroso, psychiatrist at asylum for criminally insane in Pesaro, Italy
- ▶ Saw an indentation at base of skull of Giuseppe Villella; concluded that he had smaller cerebellum
- ▶ Became founding father of criminology



Lombroso's Theory

- ▶ His “born criminal” criminology theory:
 - ▶ Crime originated in the brain (phrenology)
 - ▶ Criminals were evolutionary throwbacks (Darwinism)
- ▶ Anthropometric method: Criminals could be identified by “atavistic stigmata”: physical characteristics from more primitive stage of evolution, i.e. single palmar crease
- ▶ Evolutionary hierarchy: Blonde northern Italians at top, poor darker southern Italians and blacks at the bottom (racial stereotyping)

Cesar Lombroso

- ▶ Famous case: hole in cerebellum
- ▶ Born bad individuals
- ▶ Physical characteristics, atavistic stigmata
- ▶ Fetal neural maldevelopment, between 1st and 2nd trimester
 - ▶ Single palmer crease
 - ▶ Big gap between 1st and 2nd toe

Lombroso vs. Goring

- ▶ Lombroso: Strong rehabilitation emphasis; abhorred retribution
- ▶ Despite being a Jewish scientific progressive, he contributed to both the eugenics movement and anti-Semitism
- ▶ Charles Goring, an English prison administrator, wrote *The British Convict* in 1913; 1st statistical disproof of Lombroso's anthropometric theory: no external differences in criminals

Usual Suspects

- ▶ Risk factors for criminal behavior and violence:
 - ▶ Genetics
 - ▶ Social disadvantages
 - ▶ Poor nutrition
 - ▶ Brain trauma in childhood
 - ▶ Different brain

History of Criminology: Sociological vs Biological Theories

- ▶ In the 1920s, Robert E. Park and Ernest Burgess presented their Chicago school of thought through the University of Chicago
- ▶ West Side Story - “Gee, Officer Krupke” and “I got a social disease.”
- ▶ Most of 20th century, social & sociological causation models of crime
- ▶ Biological research on violence was vilified in the 1970s and 1980s.

Evolutionary theory

- ▶ Violence as evolutionary adaptive strategy for gaining resources and passing on genes (Richard Dawkins, *The Selfish Gene*)
- ▶ Psychopathy as ultimate selfish gene; nomadic, cheating behavior
- ▶ Drive-by shootings as dominance displays

Evolutionary theory 2

- ▶ Cultural psychopathy:
 - ▶ Mundurucu as antisocial, male dominated, competitive society;
 - ▶ Yanomano tribe (Napoleon Chagnon) where 30% violent male death rate & 44% of males have killed someone (sexual jealousy); killers have more wives and more children
- ▶ Our fascination with violence: soldiers, boxing, football, kung fu movies, true crime novels, serial killers, women marrying serial killers in prison
- ▶ Stealing, rape, homicide, infanticide, spousal abuse & killing can be viewed from evolutionary perspective

Evolutionary theory: Killing your kids

- ▶ Most homicides of young children are committed by family members (71%; using hands or feet as weapon)
- ▶ 100 times more likely to be murdered on day you are born
- ▶ Murders of children are most likely to occur in 1st year of life
- ▶ 50 times more likely to be murdered by your stepfather; in England, 53% of all infant killings done by stepparent
- ▶ Stepparents are 6x more likely to abuse genetically unrelated child under age 2

Evolution of predation in the brain



Evolution favored male brains who hunted well

Men are warriors

- ▶ 9 male murders for every 1 female murderer
- ▶ In same sex homicides, 97% of perpetrators are male
- ▶ Men are overwhelmingly the victims of violence
- ▶ Men who murder are 2 x as likely to be unmarried
- ▶ Sex differences in aggression appear by 17 months
- ▶ Violence increases throughout adolescence and peaks at age 19 (aggression tied to sexual selection)

Murders are Intraracial: Blacks kill blacks; whites kill whites

Most Murders Are Intraracial



% of **black** victims
killed by **blacks**



94%



% of **black** victims
killed by **whites**



6%



% of **white** victims
killed by **whites**



86%



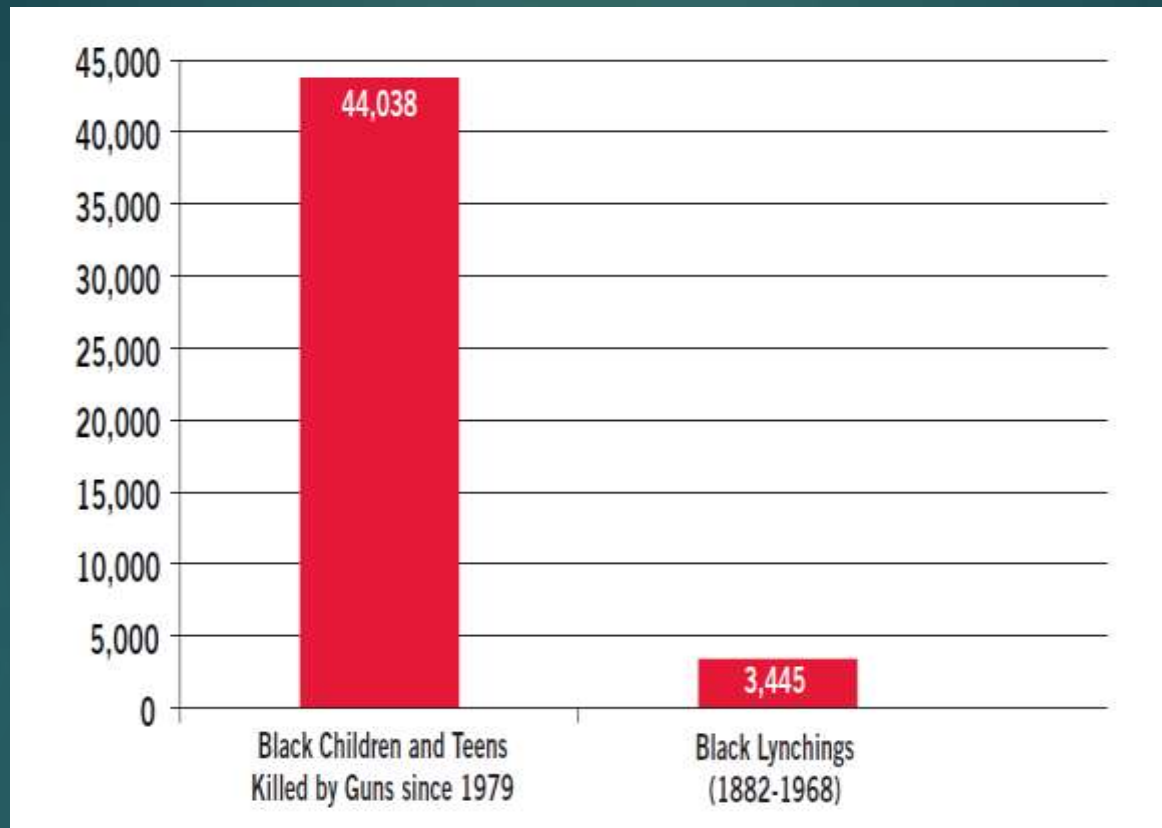
% of **white** victims
killed by **blacks**



14%

Source: Justice Department
Note: Homicides from 1976-2005
The Wall Street Journal

It is dangerous to be Black in USA



Firearm homicide is the leading cause of death for African Americans ages 1-44.

African Americans suffer 54% of all firearm homicides.

But remember: Gun suicides (61%) outnumber gun homicides (39%)

- ▶ For every year since 1920, guns in U.S. are used more often for suicide than for homicides or home defense
- ▶ In 2011:
 - ▶ 31,672 Americans died by guns
 - ▶ 11,000 were homicides (39%) (72% by handguns)
 - ▶ 19,392 were suicides (61%)
- ▶ 200,000 nonfatal gunshot injuries;
- ▶ 1382 murder-suicides in 2011 (27 per week)
- ▶ 62 mass killings in US since 1982 (2 per year)

Environment & Biology

- ▶ How environment and biology interact to produce violence
- ▶ Brain mechanisms are different in violent offenders
- ▶ Question of determinism and responsibility in violence ?
- ▶ Factors that predispose to violence
- ▶ Ultimately how to stop violence.

Normal criminal impulses

- ▶ In Adults: (if no childhood punishments, no conditioned fear response or conscience)
- ▶ 66% have a fantasy of killing someone
- ▶ 67% of undergraduates have plagiarized essay
- ▶ 88% have bought a pirated software or DVD
- ▶ 94% have illegally downloaded music or movie
- ▶ Most conscience is based on early fear conditioning

Seeds of Sin: Genetic Basis of Crime

- ▶ There is a genetic predisposition to violence:
- ▶ Babies who had criminal biological fathers & are adopted into noncriminal families are much more likely to become adult criminals
- ▶ Twin studies: significant genetic loading for aggression: Identical twins are much more similar to each other on crime & aggression than fraternal twins; identical twins separated at birth are similar in ASPD
- ▶ Raine, n=1200: .40-.50 of variability in antisocial behavior is genetic; Reactive aggression: .38; proactive aggression: .50

Genetics: Adoption studies

- ▶ 1,000 boys adopted in Denmark between 1927-1947.
- ▶ Children of criminal Biological Parents adopted to non-criminal parents
- ▶ Were the most likely to be criminals,
- ▶ The more extensive criminal history of biological parents the higher risk that the child will be a criminal
- ▶ More convictions biological parents have, more crimes by their adopted biological child
- ▶ Risk factor was unrelated to whether adopted parents knew of biological parents history or not.

XYY males: not dangerous, but acne

- ▶ XYY = male with extra male Y chromosome
- ▶ Taller (ave 6'), more LD, lower IQs, severe acne
- ▶ S. Mednick study: n = in 28K, only 12; commit more petty property crimes
- ▶ Larger studies: younger boys with XYY are more aggressive & delinquent
- ▶ Not heritable; due to random chromosomal mutation

Genetic mutations studies



- ▶ Tg-8 knockouts (lack MAO-A enzyme)
 - ▶ Blind mice with really lousy tempers
 - ▶ Normally mice with plenty of room can share same environment
 - ▶ Tg-8 mice attack any other mice or animal in cage
 - ▶ Knockout in mice: high aggression; replace it - normal

Low Monoamine Oxidase

- ▶ Warrior Gene: low MAOA in aggressive monkeys
- ▶ Low levels of MAOA subtype related to increase in violence and aggression
- ▶ Low MAOA associated with: ADHD, alcoholism, drug abuse, impulsivity, lower IQ, impulsive aggression
- ▶ Intergenerational Dutch Family Violence Study
 - ▶ Men spanning 4 generations
 - ▶ Excessive levels of violence: rapes, assaults, homicides, arson, etc...
 - ▶ 1993: sero tests indicated men were missing MAOA enzyme (breaks down NE, 5HT, and DA)
 - ▶ Men had excessively high levels of 5-HT

MAOA

- ▶ More related to impulsive, hot blooded aggression (often in response to fear, anger, or frustration);
- ▶ More aggressive personalities & more interpersonal hypersensitivity;
- ▶ Abnormal brain response in processing emotional stimuli
- ▶ Low-MAOA gene base rate: 34 % in Caucasian males, 56% in Maori, 77% in Chinese males (homicide rate in China is less than USA)

Low MAO + abuse = violence

- ▶ Bruner: impulsive and criminal behavior with low MAO gene
- ▶ Level of abuse & MAO: interaction; low MAO and severe abuse is recipe for violence
- ▶ Men with the low activity MAOA allele who experienced more punitive discipline at ages 1.5, 2, and 5 years showed more antisocial behavior from ages 15 through 20 years

Low MAOA: More violent if abused

- Parental use of punitive discipline in early childhood, such as spanking and yelling, is one of the most established risk factors for antisocial behavior (AB), yet only a fraction of exposed youths go on to develop AB (Dodge & Pettit, 2003; Gershoff, 2002).
- But Caspi et al. (2002) demonstrated a gene-environment ($G \times E$) interaction whereby a variant in the monoamine oxidase A (MAOA) gene moderated effects of childhood maltreatment (e.g., physical abuse and neglect) on AB.
- Maltreated Caucasian boys with the low-activity MAOA genetic variant showed more serious AB as adults than did boys with the high-activity MAOA allele.

2014 Study: MAOA & CDH13 genes

- ▶ N = 794 Finnish prisoners, 11,600 Finnish controls; had genome done
- ▶ 2 genes predict violence:
 - ▶ 70% have "low activity MAOA genotype," – increases dopamine & suppresses serotonin; low MAOA 3x more often in the extremely violent
 - ▶ CDH13 gene (involved in amygdala self repair); disturbed ability to regulate their strong emotions, and be more prone to aggressive impulsiveness.
 - ▶ These two occurred most frequently in those convicted of 10 or more violent offenses
 - ▶ Account for 5% to 10% of the violent crime in Finland.

XYY males and violent behavior

- ▶ 1960: researchers looked at men born with an extra Y chromosome.
- ▶ However, further studies showed while more men in prison had the extra Y than men in the population, they were not necessarily violent. Many were incarcerated for non-violent crime.
- ▶ Furthermore, XYY males are extremely rare, thus this syndrome could not explain all the violent behavior

Environmental Variables:

Maternal rejection

- ▶ 50% of variance in antisocial behavior is environmental
- ▶ Denmark: 4000 births, birth complications, maternal rejection in 1st year of life (not want pregnancy, attempt to abort, institutionalized for 4 months), 18 years later
- ▶ Remember Harlow and macaques: abnormal personalities in non physically nurtured monkeys
- ▶ 3 x increase in violence

Environmental correlations of being “born bad”

- ▶ Crime and ASPD in parents
- ▶ Low SES
- ▶ Low maternal education
- ▶ Mother's age at birth
- ▶ Family size
- ▶ Poor child rearing behaviors
- ▶ Bad parenting
- ▶ Birth weight
- ▶ Family problems
- ▶ Parental psychiatric conditions
- ▶ ADHD
- ▶ Alcohol or drug use during pregnancy

Correlations of being “born bad”

- ▶ Birth obstetric complications (forceps, breech, preeclampsia, etc.)
- ▶ Hypoxia at birth (correlates with lack of self control, impulsive aggression)
- ▶ Low IQ (esp. with above 2)
- ▶ Reared in public institution (esp. first 4 months); early loss of maternal contact
- ▶ Score on ACEs test: adverse childhood experiences
- ▶ Ultimate developmental epigenetic changes that impact gene expression and function in the brain

Smoking in pregnancy

- ▶ Danish study, n=4000, cigarettes in 3rd trimester
- ▶ At 34 years later, linear relation with number smoked
- ▶ Higher rate of violent offending
- ▶ 8 studies
- ▶ Confounds, more likely to be married to ASPD
- ▶ Only with birth complication subset, not normal births
- ▶ Even second hand smoke

Fetal Alcohol Syndrome (FAS)

- ▶ Fetal alcohol syndrome or effects
- ▶ 415 individuals , 60% become criminal offenders
- ▶ But not in ones from stable homes

Poverty: either your country or you

- ▶ Your country: lower GDP, higher violence (.68); higher income inequality, higher homicide rate (.57)
- ▶ Poverty = childhood malnutrition
- ▶ Covariation between childhood poverty and elevated chronic physiological stress
- ▶ Smaller hippocampal, larger amygdala structures, less connectivity between PFC & amygdala among adults from lower SES backgrounds.
- ▶ Associations between childhood poverty and disturbances in executive functioning

Poor Nutrition

- ▶ Nugbower: 100K, starved pregnant women in Holland
- ▶ Experience of famine while in 1st or 2nd trimester
- ▶ 2.5 increase in criminality in those born from starved pregnancy
- ▶ 1800 Mauritius study: protein malnutrition
- ▶ Age 8, 11, 17: hyperactive behavior, antisocial behavior
- ▶ Conduct disorder closely related to diet
- ▶ Poor nutrition and lower IQ; control IQ, and no antisocial behavior

Fish & Omega 3

- ▶ Fish consumption and homicide rates correlate (-.63); in every country, greater fish consumption, lower the homicide rate
- ▶ Fish food is brain food: 30% of WM is Omega 3; synaptic function, cell size; protects cell death; gene expression; longer axons and dendrites
- ▶ Fish consumption & antisocial kids: study of 12 T pregnant women – women who ate more fish, had more prosocial children at age 7; less fish, more antisocial
- ▶ Rats deficient in omega 3 are 2x more aggressive; causal

Omega 3

- ▶ Homicide rates in 26 countries vs seafood intake: Japan a lot of fish, very low homicide; Bulgaria low fish, high homicide rate (.63 correlation); USA vs Japan - 10 x more fish
- ▶ Mauritius study: 2-3 fishes per week; got better 20 years later
- ▶ No fish group, vs 1-3 fish, vs more than 1 per week
- ▶ More fish, less hostility

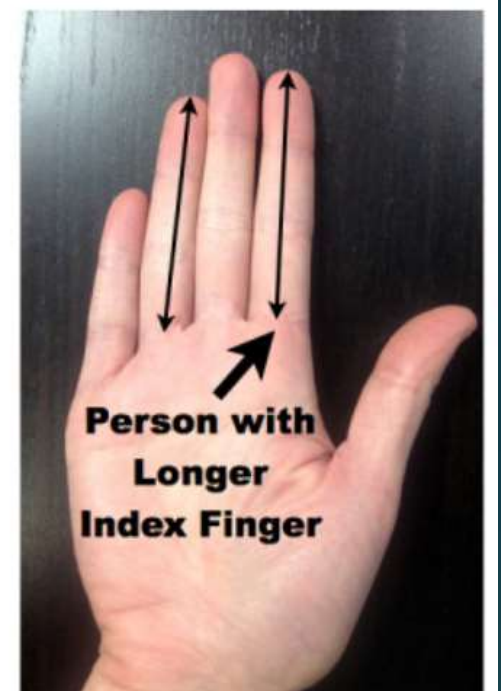
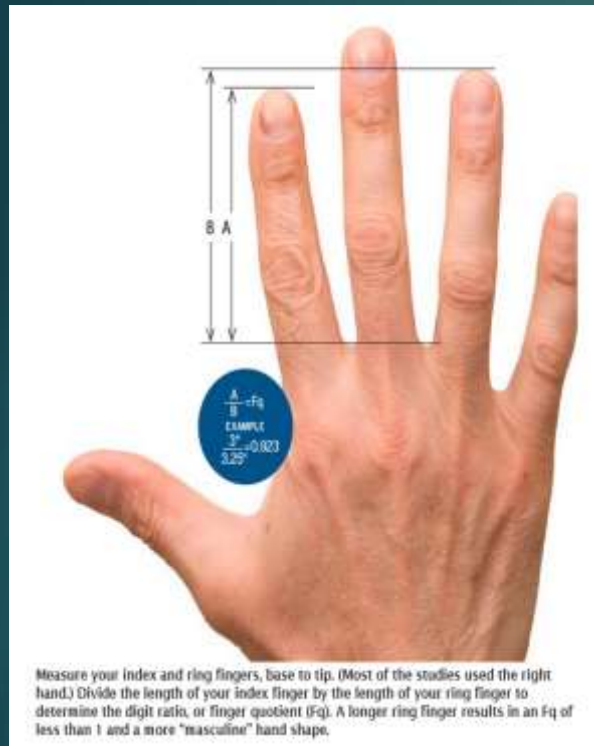
Micronutrients & Metals

- ▶ Less zinc (needed for brain repair), more aggression
- ▶ Low tryptophan (precursor of serotonin), more aggression; eat your spinach, fish & turkey
- ▶ Lower IQ and higher aggression with early exposures to lead
- ▶ Correlation between national lead exposure starting in 1920s and national crime rate, and decrease in both starting in 1970s
- ▶ Cadmium in smoking, manganese exposure & iron deficiency in formula milk, mercury in fish

Marks of Cain

- ▶ Lombroso: atavistic signs
- ▶ Physiological signs of “born criminal”:
 - ▶ Single continuous palmer crease (not normal 2 separate creases)
 - ▶ Big gap between 1st and 2nd toe
 - ▶ Fissure in middle of tongue (these 3 = pregnancy disorder, abnormal brain development)
 - ▶ Minor physical anomalies linked to peer aggression as early as age 3-12, esp. if unstable home

2 Fingers Predict aggression



Males = longer ring finger; higher testosterone, longer ring finger

2 Fingers:

- Increased verbal aggression: The shorter your index finger, the sharper your tongue: In both men and women, a lower Fq can predict more verbal sparring.
- Improved athletic ability: A greater surge of prenatal testosterone can be an indicator of high levels of achievement in sports, as well as a mental toughness in athletics. In one study, college varsity athletes (male and female) were found to have shorter index fingers than other students.
- Improved sense of direction: In women, a more masculine digit ratio tends to predict a better sense of direction, backing up past research that found men tend to have better spatial cognition than women.
- More physical aggression: Men with shorter index fingers are more likely to pick fights. Women with the same hand shape are more likely to react with aggression after being provoked.
- More risk taking
- More in male spouse abusers

Macdonald triad

- ▶ Three behaviors—bedwetting, cruelty to animals and firestarting, known as the Macdonald triad—were first described by John Macdonald as possible indicators, if occurring together over time during childhood, of future episodic aggressive behavior.
- ▶ Subsequent research has found that bedwetting is not a significant factor and the triad as a particular profile has been called an urban legend.
- ▶ Questions remain about a connection between animal cruelty and later violence, though it has been included in the DSM as a possible factor in conduct disorder and later antisocial behavior.
- ▶ Kiehl: bedwetting due to amygdala dysfunction may be predictor

Proactive vs. Reactive Aggression

- ▶ Proactive: violence with a purpose; (instrumental), controlled; cold blooded
 - ▶ Predatory: normal prefrontal, abn subcortical
 - ▶ Harold Shipman in England: 284 elderly women
 - ▶ Ted Kaczynski, Unabomber
- ▶ Reactive: impulsive, hot blooded
 - ▶ Impulsive, emotional: Poor frontal functional; get caught sooner
 - ▶ 20% of homicides take place in family; 60% reactive aggression

Temp agencies

- ▶ ASPD location: Temp agencies
- ▶ ASPD base rate = 3%; in temp agency = 24% (42% meet full criteria)
- ▶ AD for experiments: “Wanted: charming, aggressive, carefree people who are impulsively irresponsible but are good at handling people and at looking after number one”
- ▶ 43% Raped, 53% physically attacked stranger 29% armed robberies, 38% fired gun, 21% homicides; 56% arrested
- ▶ Lower skin and heart rates; 14% reduced prefrontal volumes

Heuristic prediction of ASPD

- ▶ 3 predictors: low heart rate & sweat rate, lower activation of PFC
- ▶ Predicts ASPD: 77% correct classification
- ▶ 10 classic social risk factors for ASPD: only 73%
- ▶ Add these 2: 88%

Low Resting Heart Rate



Unabomber, Ted Kaczynski (above), for example, had a resting heart rate of just 54 beats per minute, which put him in the bottom 3 per cent of the population.

Cardiovascular arousal & violence:

Low Heart rate

- ▶ Rabbits who are aggressive and dominant have lower resting heart rates; as heart rate goes down, dominance goes up
- ▶ Raine metaanalysis: low resting heart rate is common in antisocial kids; 5% of difference (higher than most medical relationships); 12% if measured under stressor; males lower than females; highly genetic
- ▶ Low heart rate in childhood predicts later delinquent, violent behavior; of 48 predictors, only low resting heart rate and poor concentration predicted later violence; kids with low heart rates are less empathic & more antisocial; more stimulus seeking
- ▶ A biomarker for dx of conduct disorder

Skin conductance & gambling

- ▶ Skin conductance to socially meaning stimuli (disaster, mutilation): bigger the skin-conductance response, greater the degree of attentional processing
- ▶ ASPD = low skin conductance
- ▶ Iowa Gambling Test: those with vmPFC deficits never learn; lack of automatic nonconscious reactivity to punishment

If fearless, born to be bad? Amygdala & low fear conditioning deficit

- ▶ Gao et al. tested fear conditioning in children at age 3. Twenty years later, they probed the association of poor fear conditioning in early childhood with adult criminal behavior. Fearless tots, future crime.
- ▶ Skin responses to the conditioned stimulus were significantly smaller in children who became criminal later on.
- ▶ Deficient amygdala function has been proposed to render individuals unable to recognize cues that signal threat, making them relatively fearless.
- ▶ Poor fear condition leads to poor conscience.

Genetics: Violence as a biological predisposition

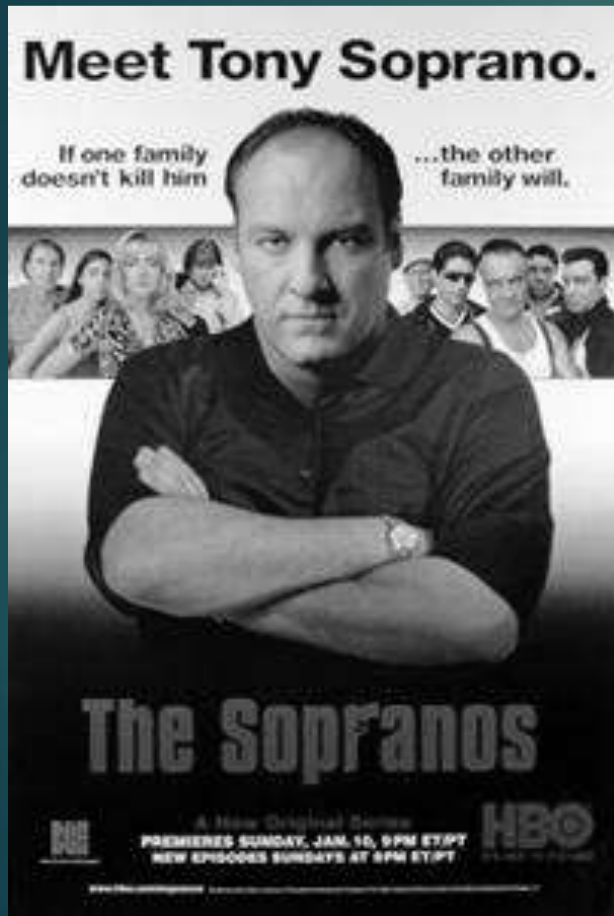
2 constants across cultures:

1. Men are most likely to commit violent acts.
 - ▶ Sex difference is a universal.
 - ▶ Average man is more aggressive than women even in infancy prior to sex role socialization by adults.
 - ▶ In USA 85% of arrests for violent crimes are men.
2. Young persons are more likely to be violent than older persons

Mental Illness & Crimes

- ▶ The vast majority of people with mental illness are not violent, not criminal and not dangerous.
- ▶ Few crimes committed by mentally ill patients were directly linked to symptoms
- ▶ Less than 10 percent of crimes committed by mentally ill people are directly linked to the symptoms of their disorders
- ▶ 429 crimes committed by 143 people (2/3rds men) in Minnesota who suffered from depression, schizophrenia or bipolar disorder, over 15 years; 85 percent had substance abuse disorders.
- ▶ Only 7.5 percent of crimes were directly linked to mental illness symptoms: 3 percent to symptoms of depression; 4 percent to symptoms of schizophrenia; and 10 percent to symptoms of bipolar disorder.
- ▶ Two-thirds of those who committed crimes linked to mental illness symptoms also committed unrelated crimes for other reasons, including substance abuse and being jobless, poor and homeless,

ASPD: Diagnosis by Rap Sheet



Antisocial PD (ASPD) per DSM-5

Disregard Rights of Others (and meet Conduct Disorder)

3 + of :

Unlawful

Reckless

Deceitful

Irresponsible

Impulsive

Lack Remorse

Aggressive

- ▶ ≥ 18 y; Evidence of conduct disorder before age 15
- ▶ For psychopathy dx, must do PCL-R

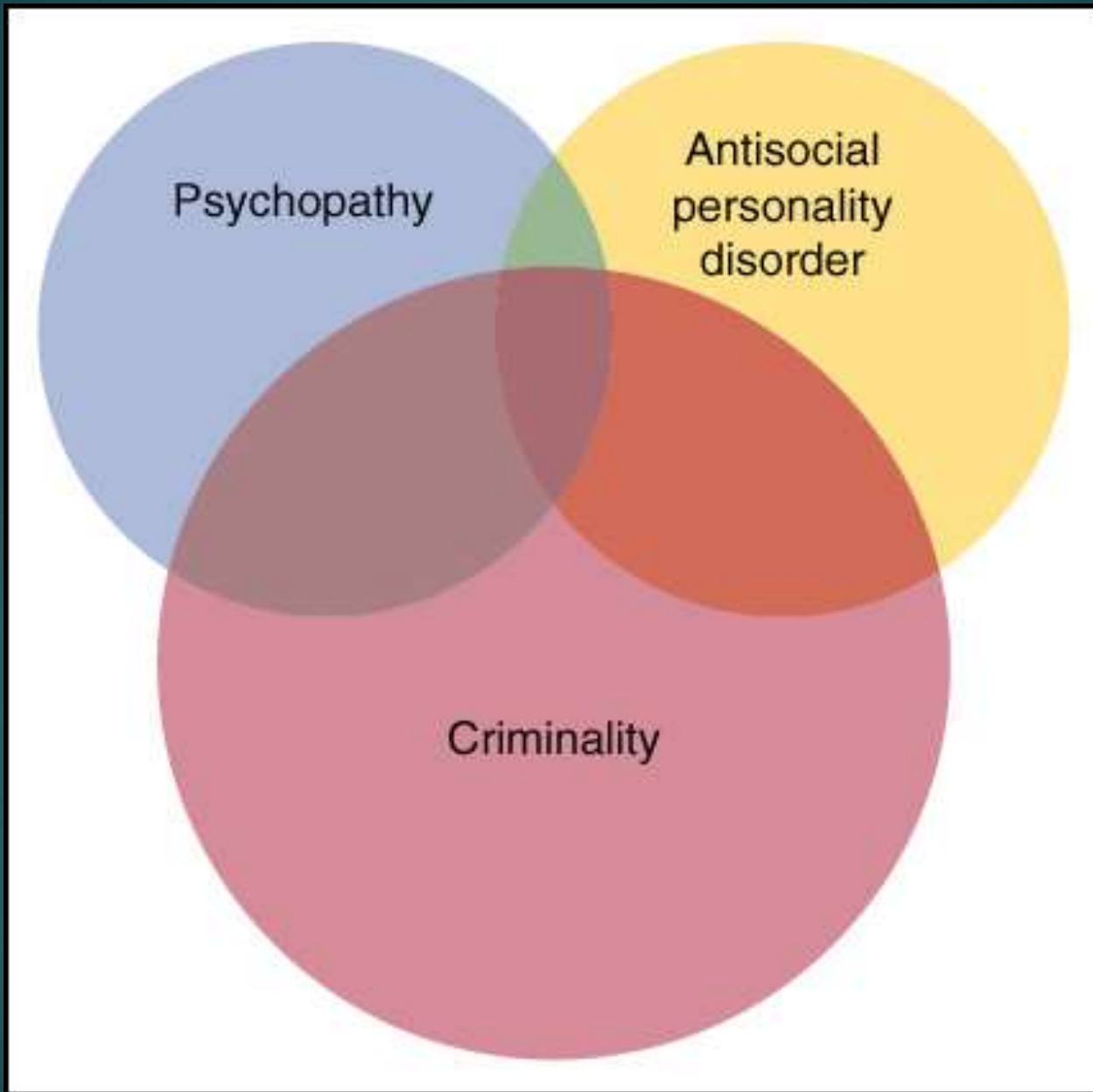
Lack of psychopathy dx in DSM-5

- ▶ Lack of empathy not listed in ASPD dx
- ▶ No psychiatric or psychological organization has sanctioned a diagnosis titled "psychopathy";
- ▶ Only ASPD dx for adults in DSM-5;
- ▶ "With limited prosocial emotions" (at least 2 of: lack of remorse, callous-lack of empathy, unconcerned about performance, shallow affect) specifier for childhood conduct disorder

ASPD vs. Criminality

“Criminal” is a legal term denoting conviction for breaking a law:

- ▶ Not all people with ASPD are criminals (or in jails)
- ▶ Not all people in jail or considered criminal have ASPD
- ▶ Not all people with ASPD are psychopaths



Hot ASPD vs Cold Psychopaths

- ▶ We describe those without psychopathy as 'hot-headed' and those with psychopathy as 'cold-hearted'
- ▶ The 'cold-hearted' psychopathic group begin offending earlier, engage in a broader range and greater density of offending behaviors, and respond less well to treatment programs in adulthood, compared to the 'hot-headed' group.
- ▶ Psychopaths: Profound deficits in empathizing with the distress of others.

Biosocial model of ASPD+P

- ▶ Biosocial model: role of genes, environment, epigenetics in shaping brain development that predisposes someone to childhood aggression and adult violence
- ▶ Bad decision making at cognitive level
- ▶ Callousness at emotional level
- ▶ Disinhibition at behavioral level

ASPD

- ▶ Diagnosis by rap sheet, behavior
- ▶ Adult extension of conduct disorder (age>18)
- ▶ Emphasizes antisocial, rule breaking behavior
- ▶ Conduct disorder before age 15
- ▶ After age 15:
 - unlawful behavior
 - lying, deceitful, use aliases
 - impulsive, fail to plan ahead
 - aggressive, fights
 - reckless disregard for safety of self or others
 - irresponsible, don't honor debts, inconsistent job record
 - lack remorse – indifferent to having hurt others

Causes of ASPD

Genetics

Birth trauma

Sensation-seeking

Family dynamics

Modeling and media

ASPD

- ▶ Genetic contribution to antisocial behaviors is strongly supported (75% monozygotic).
- ▶ Twin, family, and adoption data show strong genetic influence; higher for women; higher rates of Substance Abuse and Somatization disorders
- ▶ Lee Robins' work in mid-1960's formed basis of current ASPD criteria
 - ▶ Found that most antisocial adults were antisocial in childhood
 - ▶ But most antisocial children are not antisocial as adults
- ▶ ASPD is not Psychopathy: "having a cold versus pneumonia"

Prevalence

- ▶ Prevalence is 3.6% (NESARC); higher in men; lower in women; underdiagnosed in women
- ▶ DSM-5: 12 month rates: .2 to 3.3%
- ▶ Highest: (greater than 70%) among most severe samples of males with alcohol use disorder & substance abuse clinics, prisons
- ▶ Higher in poverty and migration samples

ASPD

- ▶ Most violent crimes are committed by a small group of life-course-persistent male offenders, who meet diagnostic criteria for conduct disorder as children and antisocial personality disorder (ASPD) as adults.
- ▶ Such stable antisocial behavior is moderately heritable.
- ▶ Significant clinical heterogeneity
- ▶ Most are characterized by emotional lability, impulsivity, high levels of mood and anxiety disorders, and reactive aggression.
- ▶ Minority are characterized by deficient affective experience, typified by a lack of empathy and remorse, as well as persistent reactive and instrumental aggression.

Course of ASPD

- Progression or career of deviancy - oppositional defiant disorder, conduct disorder, ASPD
- Burnout response – as they age, people with ASPD become less involved in criminal activity
- ▶ Most don't seek treatment for ASPD (usually for substance abuse)
- ▶ No treatment shown to be efficacious
- ▶ More likely to end up in jail than in treatment
- ▶ Focus is on prevention – target antisocial children

ASPD+ Psychopathy = ASPD+P

- ▶ This subgroup meets diagnostic criteria for conduct disorder with callous-unemotional traits in childhood and for the syndrome of psychopathy as defined by the Psychopathy Checklist - Revised (PCL-R) in adulthood (ASPD+P).
- ▶ Begin offending earlier, engage in a broader range and greater density of offending behaviors, and respond less well to treatment programs in childhood and adulthood compared with those with ASPD without psychopathy (ASPDP).

Psychopaths

David Berkowitz



ED



Beltway Snipers



Charles Manson



Mugshot, Charles Manson

Aileen Wuornos



TED



Albert Fish



Jeffrey Dahmer

John Gacy



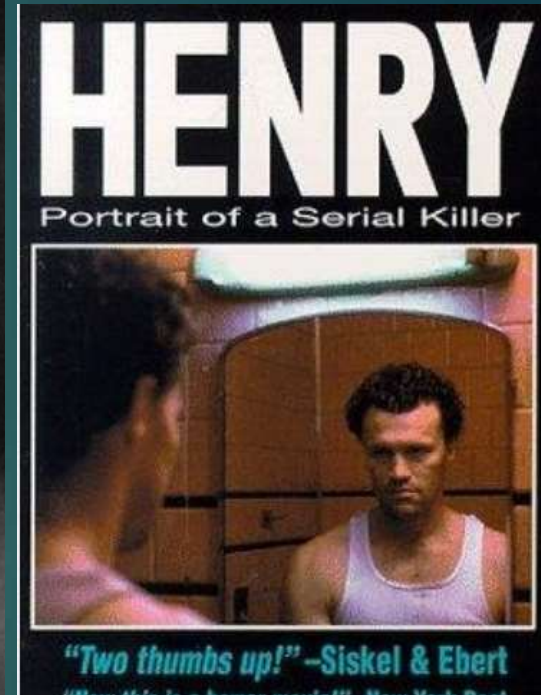
Best Psychopaths in Film



Javier Bardem
Anton Chigurh
No Country for Old Men



Peter Lorre
Hans Beckert
M



Michael Rooker
Henry
Henry

Real & Fictional Psychopaths



Ted Bundy,
killed 16 women
aged 12-23



Real and Fictional Psychopaths



Monster (2003) –
Charlize Theron



Aileen “Lee” Wuornos
Killed 7 men



Dexter

Kiehl conclusions

- ▶ John Wilkes Booth who assassinated Abraham Lincoln in 1865 was not a psychopath (score of 8.4 of 40 on PCL-R); an assassin
- ▶ Charles Julius Guiteau who assassinated President Garfield in 1881 was a psychopath (37.5 of 40)
- ▶ Average American male scores 4 of 40.

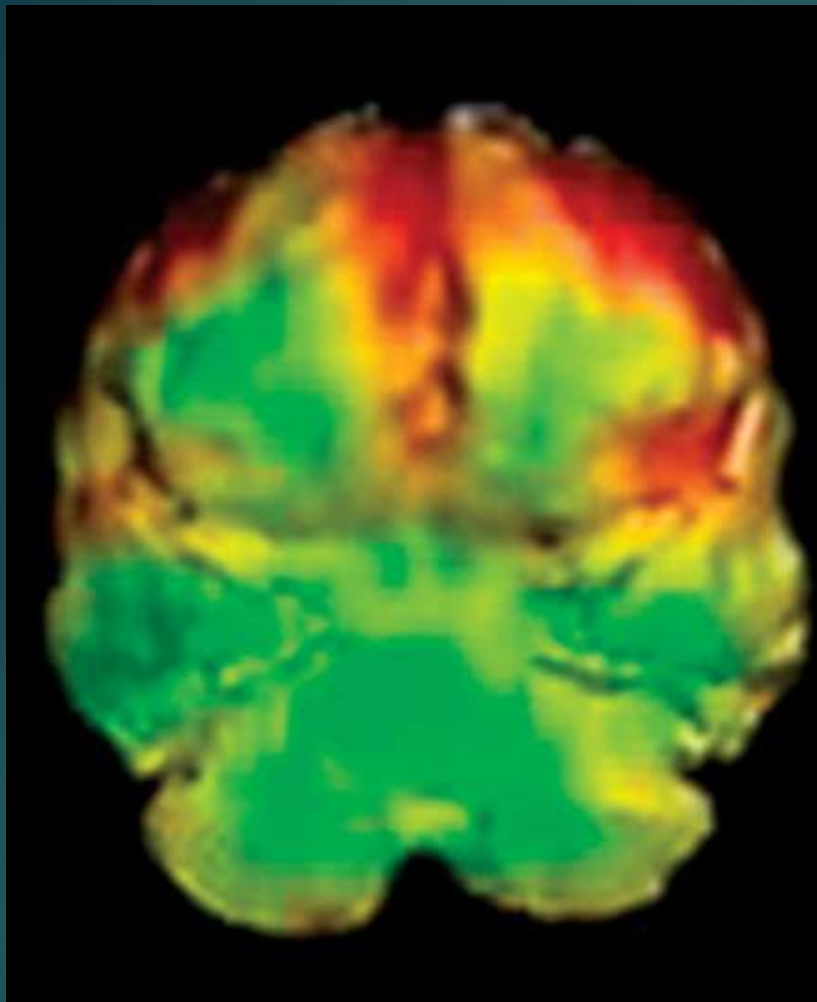
Donta Page

Take the case of Donta Page, who in 1999 robbed a young woman in Denver named Peyton Tuthill, then raped her, slit her throat and killed her by plunging a kitchen knife into her chest. Mr. Page was found guilty of first-degree murder and was a prime candidate for the death penalty.

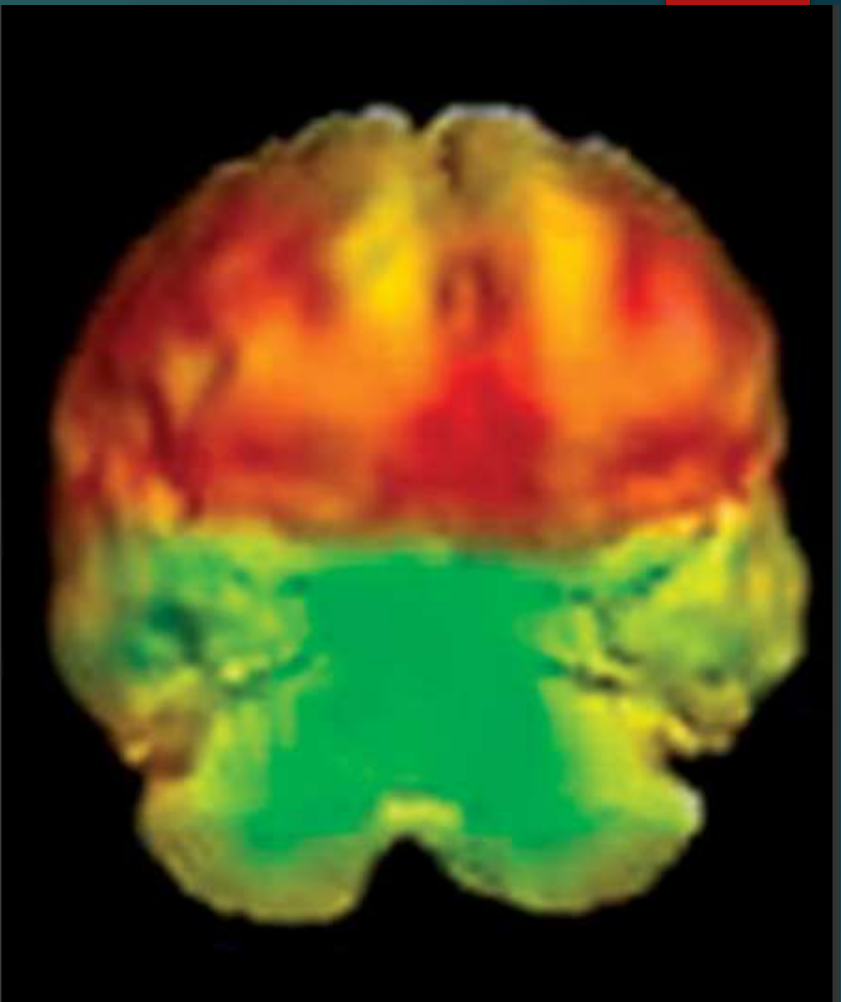
His files documented: as a child he suffered from poor nutrition, severe parental neglect, sustained physical and sexual abuse, early head injuries, learning disabilities, poor cognitive functioning and lead exposure. He also had a family history of mental illness. By the age of 18, Mr. Page had been referred for psychological treatment 19 times, but he had never once received treatment. A three-judge panel ultimately decided not to have him executed, accepting the argument that a mix of biological and social factors mitigated Mr. Page's responsibility.

At the time he committed the murder, he had been out of prison for only four months. Sentenced to 20 years for robbery, he was released after serving just four years.





Donta Page's brain scan



Normal Control

Left shows the reduced functioning of the ventral prefrontal cortex compared to a normal brain, right.

Are these people psychopaths?

- ▶ • Serial killer
- ▶ • Door to door sales person
- ▶ • Wall street or corporate executive
- ▶ • Skilled crime solver
- ▶ • Politician

What's differentiates "failed" from adaptive psychopaths?

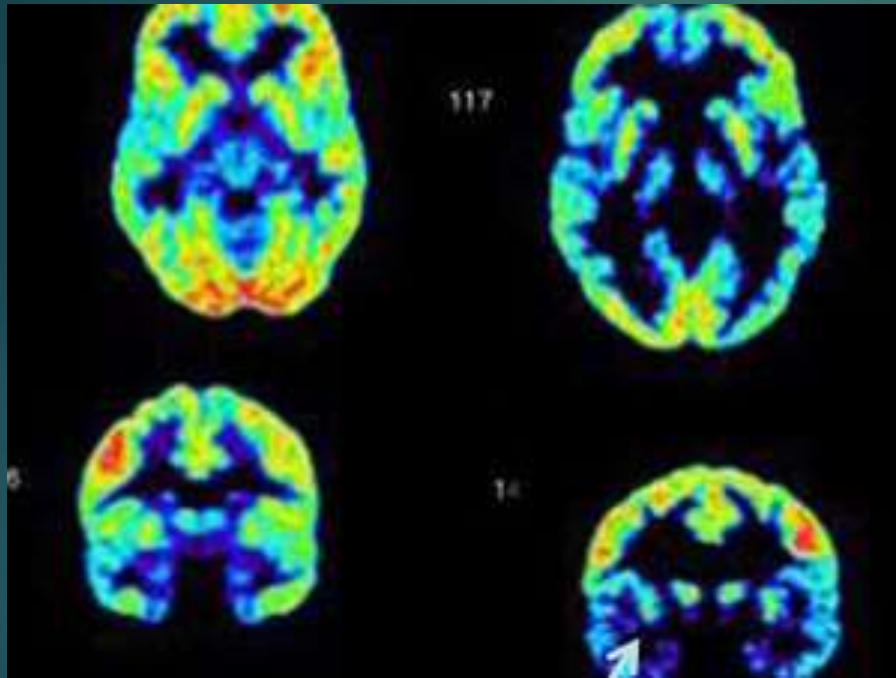
- ▶ • Impulsive antisociality
- ▶ • Fearless dominance

Dr. James Fallon Is One Of The Nicest, Most Honest, And Most Competitive Psychopaths You'll Ever Meet

- ▶ Dr. James Fallon is a research neuroscientist, UC Irvine.
- ▶ Author: *The Psychopath Inside*
- ▶ Relative of 7 murderers
- ▶ Discovered low OFC activation on his scan
- ▶ Has Warrior Gene



Brains of James Fallon PhD and son (cousins of Lizzy Borden): Thwarted Sociopathy



Right: Low Orbital Frontal
Activation in Fallon



Fallon's brain (on the right) has dark patches in the orbital cortex. This is the area that Fallon says is involved with ethical behavior, moral decision-making and impulse control. The normal scan on the left is his son's. His is on right.

Fallen on Psychopathy: Combination of Factors

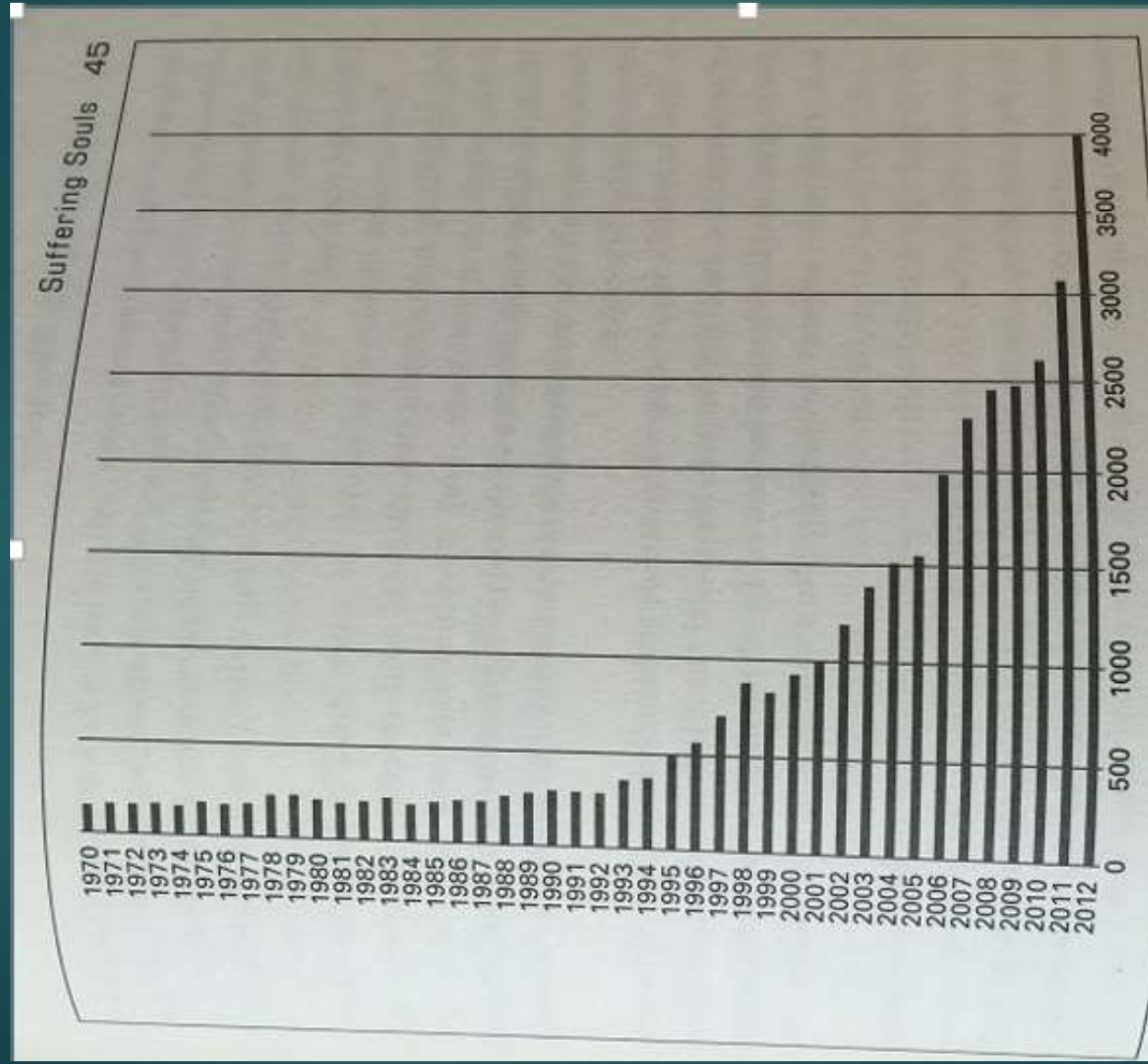
- 1 – Low Orbital Frontal activation pattern
- 2 - MAO-A gene (monoamine oxidase A):
high-aggression variant (low Serotonin),
Warrior gene
- 3 – Mother transmission to son
(X chromosome), too little Serotonin:
higher rates among males
- 3 – History of childhood abuse or
seeing lots of traumatic violence

Psychopaths: Less Gray matter

- ▶ ASPD+P offenders displayed significantly reduced grey matter volumes in the anterior rostral prefrontal cortex and temporal poles compared to ASPD-P offenders and healthy non-offenders.
- ▶ Damage to these areas is associated with impaired empathizing with other people, poor response to fear and distress and a lack of 'self-conscious' emotions such as guilt or embarrassment.



Google scholar search: 1970-2012 studies on “psychopathy”



Early descriptions of psychopathy

- ▶ Philippe Pinel (1745-1826): insanity without delirium (lack of psychosis)
- ▶ Use of term “moral insanity”
- ▶ German psychiatrist J. L. A. Koch (1841-1908) coined term *psychopastiche* or *psychopath* in 1888. In Kraepelin's 8th edition.
- ▶ Ongoing issue: smart person who did not learn from their errors; never changed their behaviors; don't believe there is anything wrong with themselves
- ▶ Conclusion: untreatable

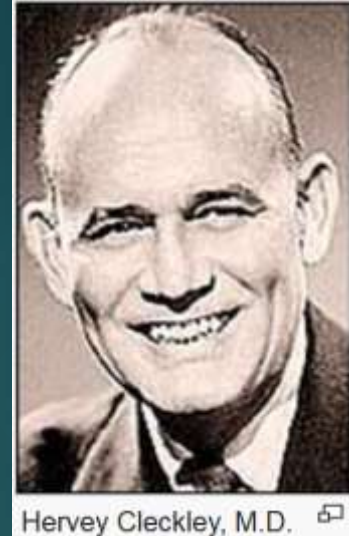
20th Century Ideas of Neurobiology of Violence

- ▶ Term sociopathy in 1930s signifying social influences
- ▶ Blumer and Benson (*Psychiatric aspects of neurologic disease*, 1975) described “pseudopsychopathic” personality from frontal lobe damage
- ▶ Eslinger and Damasio (*Neurology* 1985; 35: 1731-1741) described “acquired sociopathy” after surgery for an orbitofrontal meningioma

Psychopathy:

Hervey M. Cleckley, M.D.

- ▶ *The Mask of Sanity: An Attempt to Clarify Some Issues About the So-Called Psychopathic Personality.* 1941
- ▶ American psychiatrist, pioneer in the field of psychopathy. His book, *The Mask of Sanity*, provided the most influential clinical description of psychopathy in the twentieth century.
- ▶ "Mask" conceals a mental disorder: psychopath exhibits normal function according to standard psychiatric criteria, yet privately engages in destructive behavior: a master deceiver secretly possessed of no moral or ethical restraints, yet behaving in public with excellent function
- ▶ In 1956, Cleckley co-authored a book *The Three Faces of Eve* with Corbett H. Thigpen, her therapist.



Cleckley's 16 characteristics

- ▶ 1. Superficial charm & good intelligence +
- ▶ 2. Absence of delusions
- ▶ 3. Absence of nervousness
- ▶ 4. Unreliability +
- ▶ 5. Untruthfulness +
- ▶ 6. Lack of remorse or shame +
- ▶ 7. Inadequately motivated antisocial behavior +
- ▶ 8. Poor judgment and failure to learn from experience
- ▶ 9. Pathologic egocentricity & incapacity for love +
- ▶ 10. Poverty in major affective reactions +
- ▶ 11. Loss of insight
- ▶ 12. Unresponsiveness in interpersonal relations +
- ▶ 13. Fantastic behavior with drink and sometimes without
- ▶ 14. Suicide rarely carried out
- ▶ 15. Sex life impersonal, trivial, and poorly integrated +
- ▶ 16. Failure to follow any life plan +

Robert D. Hare, Ph.D.: Father of Psychopathy

- ▶ University of British Columbia
- ▶ Hare Psychopathy Checklist, or PCL-R, 1991, a twenty-item diagnostic instrument created by Robert Hare; based largely on the list of traits advanced by Cleckley
- ▶ Advises the FBI's Child Abduction and Serial Murder Investigative Resources Center (CASMIRC)
- ▶ In the 1970s he published Psychopathy: Theory and Research
- ▶ ASPD+P: A basic lack of social emotion or moral reasoning; pathology is likely due in large part to an inherited or 'hard wired' deficit in cerebral brain function



Psychopathy Checklist

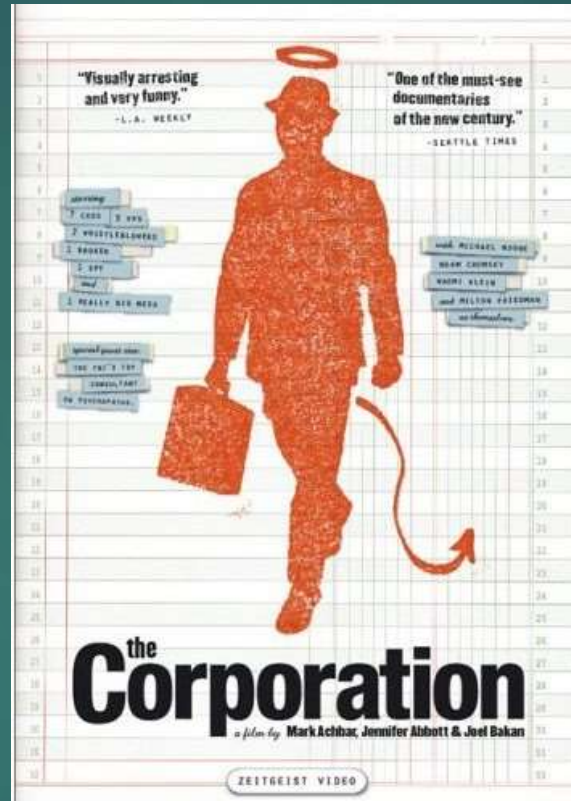
- ▶ Psychopathy Checklist, created by Robert Hare
- ▶ Requires a clinical interview and review of records by a trained clinician
- ▶ The “gold standard” measure of psychopathy, which has been found to predict future violent behavior among adult male offenders. ($r = .30$ for violent recidivism); strong predictor of recidivism (4-8x higher), violence and response to therapeutic intervention, though some studies have attributed this largely to the inclusion in the measure of past offending history.
- ▶ Don't focus on index crime
- ▶ Occupations: professions likely to attract psychopaths are law enforcement, the military, politics, and medicine.

PCL Factors

- *Factor 1 - Arrogant and Deceitful Interpersonal Style*
 - Impression Management
 - Grandiose Sense of Self-Worth
 - Pathological Lying
 - Manipulation for Personal Gain
- *Factor 2 - Deficient Affective Experience*
 - Lack of Remorse
 - Shallow Affect
 - Callous/Lack of Empathy
 - Failure to Accept Responsibility
- *Factor 3 - Impulsive and Irresponsible Behavioral Style*
 - Stimulation Seeking
 - Parasitic Lifestyle
 - Lacks Goals
 - Impulsivity
 - Irresponsibility
- *Factor 4 – Antisocial Behavior*
 - Poor Anger Control
 - Early Problem Behaviors
 - Juvenile Delinquency
 - Serious Violations of Conditional Release
 - Criminal Versatility

Score = 0-40; dx = 30+; Average inmate = 22; Average person = 4

Documentary about Corporations modeling psychopathy



The most agreeable vocation for psychopaths is business ("Snakes in Suits: When Psychopaths Go to Work") Traits that may be desirable in a corporate context, such as ruthlessness, lack of social conscience, and single-minded devotion to success, would be considered psychopathic outside of it.

Kent Kiehl's Mobile MRI



3500 imprisoned psychopaths have been scanned

Kent Kiehl, PhD & his 3500 Psychopaths



Kent Kiehl in front of the semi-trailer that houses a portable MRI scanner at the Western New Mexico Correctional Facility.



Kiehl grew up a few blocks from Ted Bundy's home.

Kent Kiehl on Psychopaths: Facts

- ▶ 1 in 4 maximum-security inmates is a psychopath
- ▶ A psychopath is born every 47 seconds.
- ▶ 1 % of US population. (1 in 150). There are over 29 million psychopaths worldwide (.04%)
- ▶ There are ~500,000 adult male psychopaths in USA
- ▶ 1 in 4 maximum-security inmates is a psychopath (15-35%; more in high security)
- ▶ Psychopaths kill more people in North America every year than the number killed on 9/11/2001 (2,977)

Kent Kiehl on Psychopaths: Facts 2

- ▶ 77 % of psychopaths in USA are incarcerated
- ▶ FBI estimates there are as many as 50 active serial killers in USA
- ▶ Psychopaths are 6 x more likely than other criminals to commit new crimes following release from prison
- ▶ Incarceration in a maximum security juvenile prison costs \$514,000 per year per youth
- ▶ Some forms of group therapy may make psychopaths more likely to commit new crimes post release from prison than no TX at all.

Kiehl on Psychopaths:

Facts 3

- ▶ More likely to reoffend
- ▶ Fail to show faster response to emotional words than to neutral words (know the word but not the feeling)
- ▶ Deficits in processing emotional stimuli
- ▶ Children with CU traits fail to activate amygdala when viewing fearful faces (more aggression) and show impairments in engaging OFC during learning tasks (punishment does not restrain behavior)
- ▶ Opposite of PTSD (increased amygdala & Acing response) – reduced activation in psychopathy; no psychopaths with OCD
- ▶ Poor processing of abstract words (poor anterior temporal pole activation)

Kiehl's Paralimbic Dysfunction Theory

- ▶ Psychopathy is result of combined deficits in amygdala, hippocampus, anterior and posterior cingulate, orbital frontal cortex, insula, and temporal pole.
- ▶ Paralimbic damaged pts: Damage to any part of this system can precipitate ASPD+P sx: problems with aggression, motivation, empathy, impulsivity, irresponsibility, lack of behavioral control
- ▶ Can be triggered by TBI, dementia, CTE
- ▶ Callousness only develops developmentally

Paralimbic theory

- ▶ Incarcerated youth with elevated CU traits on YPC have same brain abnormalities as adult psychopaths: majority of paralimbic system has reduced gray matter

Kiehl on Psychopaths

- ▶ Psychopathy: Score of 30 of 40 on Hare's Psychopathy Checklist-Revised (PCL-R) (normals score 4); trait must be pervasive
- ▶ Psychopaths typically exhibit impulsivity, poor planning, little insight and an utter absence of guilt or empathy.
- ▶ Most had engaged in sexual activity by the age of 12 and showed early signs of violence, including a predilection for arson and animal torture.
- ▶ 1-2% of the general population, but 15 to 20 % of prisoners in minimum to medium security prisons qualify as psychopaths, and as high as 30 percent for those in maximum security.

Psychopathy: “Suffering Souls”

- ▶ Condition of moral emptiness that affects between 15-25 % of the North American prison population, and 1% of the general adult male population. (Female psychopaths are thought to be much rarer.)
- ▶ Kiehl: 1 in 100 in normal; 1 in 20 prison
- ▶ Their main defect is "severe emotional detachment"--a total lack of empathy and remorse--is concealed.
- ▶ The average psychopath will be convicted of four violent crimes by the age of forty.
- ▶ Criminal life style factor (lower after age 40): SES, bad friends, Chem. Depend.
- ▶ Callous aggressive narcissism: predator-prey

Kiehl on causation

- ▶ Nature/Nurture?: "It seems to be 50-50," he says.
- ▶ "It's absolutely possible that some psychopaths are more genetically predisposed than other people, but there is no good evidence for a trigger theory. Psychopathy is a developmental disorder, so even as kids they are very different."

The Issue

- ▶ Research suggests that brain dysfunction may PREDISPOSE a person to being violent
- ▶ The FRONTAL brain region may be associated with violent behaviour
- ▶ Some violent offenders plead NGRI (not guilty by reason of insanity) to murder charges

Neuroimaging and Violence – Pros

- ▶ Structural neuroimaging has revolutionized neurology and psychiatry by identifying brain lesions that could not formerly be seen until autopsy
- ▶ Functional neuroimaging has the potential for identifying brain regions that appear normal on structural neuroimaging, but may be abnormal at the cellular or synaptic level

The Problem with Neuroimaging

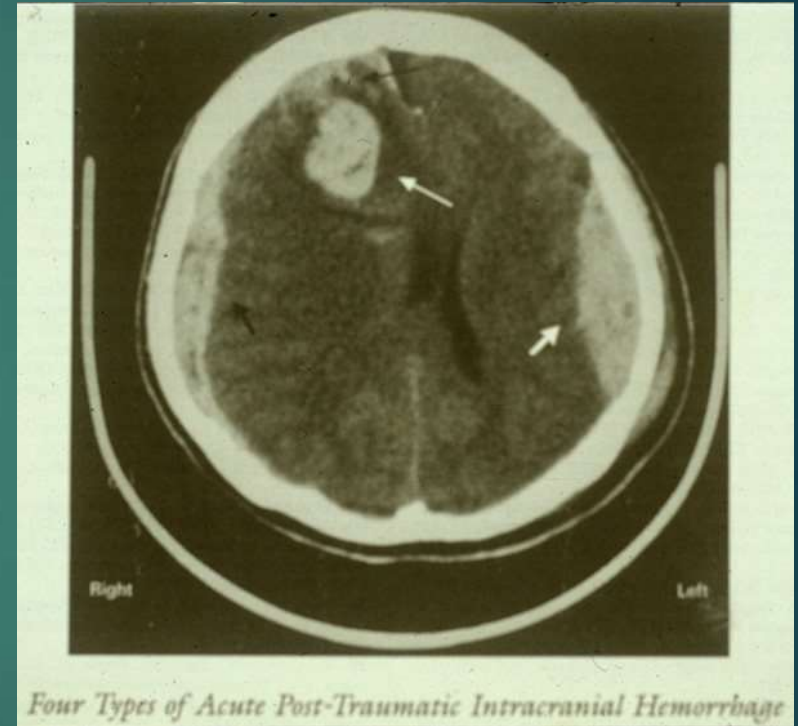
- ▶ Most violent and criminal behavior is not committed by people with obvious brain lesions, and even when present, brain damage may have an uncertain, or no relationship to the violence
- ▶ Functional neuroimaging is beset by a host of methodological limitations, including lack of standardization, low signal-to-noise ratio, and inter-individual variability

- ▶ This man had AD
- ▶ Violent behavior was severe and intractable despite extended hospitalization and ~ 40 medication trials



CT Frontal Lobe Lesions – TBI

- ▶ This scan shows four lesions of a patient with TBI
- ▶ The variety of lesions make it impossible to associate one lesion with a specific clinical feature such as violence

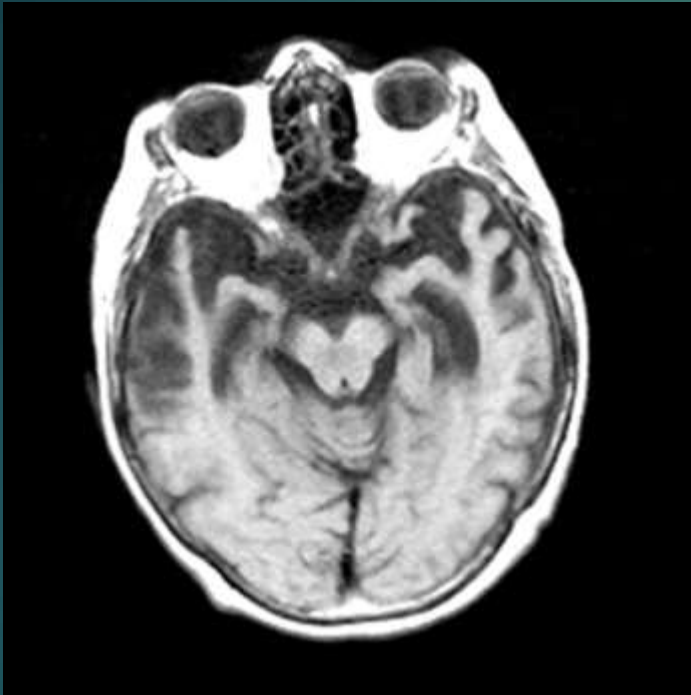


MRI Frontal Lobe Lesion – Neoplasm

- ▶ This scan is from a young man with a prolonged confusional state after falling on a ski slope in Vail, Colorado
- ▶ Biopsy showed gliomatosis cerebri (infiltrative diffuse astrocytosis/brain tumor)
- ▶ At no time was he violent



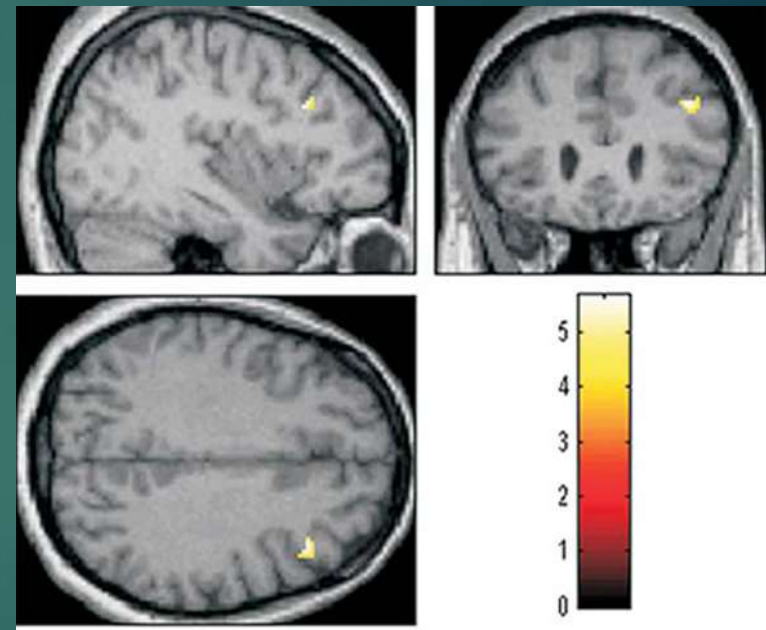
MRI Frontal Lobe Lesion – FTD



- ▶ This patient has massive bitemporal and bifrontal atrophy
- ▶ Although violent behavior might be expected, this scan could just as reasonably be associated with aphasia, agnosia, or visuospatial dysfunction

fMRI of Impulse Control

- ▶ Asahi et al. found that in 17 normal young adults, fMRI showed right dorsolateral prefrontal cortex activation during the go-no go task
- ▶ Does a lesion in that area predict loss of impulse control, or exonerate a violent criminal?



Asahi et al. (Eur Arch Psychiatry Clin Neurosci
2004; 254 : 245–251)

Structural Neuroimaging in Antisocial Personality Disorder

- ▶ Raine, 2000: The ASPD group showed an 11.0% reduction in prefrontal gray matter volume and reduced autonomic activity during the stressor. This prefrontal structural deficit may underlie the low arousal, poor fear conditioning, lack of conscience, and decision-making deficits that have been found to characterize antisocial, psychopathic behavior.
- ▶ Narayan et al. used MRI to show decreased cortical thickness in inferior mesial frontal cortices of violent antisocial personality disorder subjects
- ▶ Yang et al. used MRI to show bilateral amygdala volume reduction in psychopaths

Raine et al. (Arch Gen Psychiatry 2000; 57: 119-127; Narayan et al. (Am J Psychiatry 2007; 164: 1418-1427; Yang et al. (Arch Gen Psychiatry 2009))

Raine Hypothesis

- The Raine hypothesis: some seriously violent individuals have localised brain damage in certain areas of the brain including the prefrontal cortex; the amygdala; the thalamus; the hippocampus; and the corpus callosum.
- Violence is a complex behavior derived from genetic and environmental impact on brain development

Brain Abnormalities in Murderers Indicated by Positron Emission Tomography.

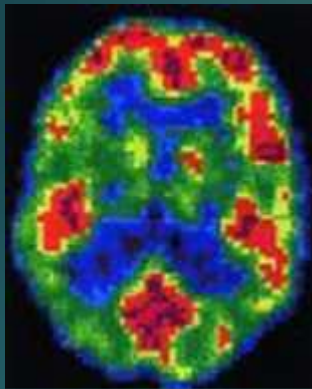
Adrian Raine, M Buchsbaum, & L LaCasse (1997)



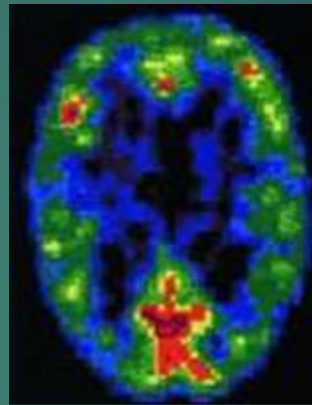
Raine study: NGRI

- ▶ The aim of the experiment was to discover if murderers who have pleaded not guilty by reason of insanity (NGRI) show evidence of brain abnormalities.
- ▶ Used PET scans to examine the brains of 41 people (39 males and 2 females) who were charged with murder and were pleading Not Guilty for Reasons of Insanity (NGRI), and compared them with 41 controls.
- ▶ All the NGRIs were referred to the imaging center for legal reasons, such as to obtain evidence for the defense. The reasons for the referrals included schizophrenia, head injury, and personality disorders.

Activity Deficit: Raine's PET scans show greater activity (red) in Prefrontal cortex of a normal brain than in a murderer's brain



Normal



Murderer

Murderers: Reduced activity in prefrontal cortex & corpus callosum. The Left hemisphere showed less activity than the right. Abnormal asymmetries in the amygdala



Current Neuroimaging evidence of brain pathology in psychopathy

ASPD+P: Psychopathy

- ▶ Psychopathy is a neurodevelopmental disorder characterized by structural abnormalities from a young age.
- ▶ Reduced GM volume of bilateral anterior rostral medial prefrontal cortex (arMPFC) and the bilateral temporal poles among the violent offenders with ASPD+P
- ▶ GM volume reductions in the bilateral insulae.

Neurobiology of Psychopathy

- ▶ Kiehl: a defect in what he calls "the paralimbic system," a network of brain regions, stretching from the orbital frontal cortex to the posterior cingulate cortex, that are involved in processing emotion, inhibition, and attentional control.
- ▶ Atypical responding within the amygdala and ventromedial prefrontal cortex (vmPFC).
- ▶ VM PFC deficit : push people off bridge in bridge paradigm
- ▶ Know right from wrong

A Model of the Neurobiology of Violence

- ▶ The frontal lobes, most notably orbitofrontal cortices, can fail to exert control over limbic structures, and violence may result
- ▶ Limbic structures, most notably the amygdalae, can be excessively activated under certain circumstances to produce violence
- ▶ Right cerebral dysfunction may be crucial
- ▶ Serotonin may inhibit and dopamine may enhance violent behavior

Limbic override Frontal Systems

- ▶ Literature review: model in which violence occurs when:
 - ▶ temporolimbic “bottom-up” drives – the amygdalae – cannot be inhibited
 - ▶ by “top-down” prefrontal structures such as the orbitofrontal and anterior cingulate cortices
- ▶ Violence occurs when frontal inhibition cannot control limbic impulses; anger provocation and substance abuse are often involved

Neuroanatomy of Aggression and Violence

- ▶ The frontal lobes, particularly the orbitofrontal cortices, are prominent because of their critical role in social cognition and impulse control
- ▶ Limbic structures, particularly the amygdalae, are implicated because of their mediation of basic emotion and drive-related behavior

Prefrontal Cortex

- ▶ Low Number of Neurons in the Prefrontal Cortex: Raine, 11% prefrontal gray reduction; 2009 meta-analysis of 12 studies found that the prefrontal cortex of the brain is indeed structurally impaired in offenders.
- ▶ Lack of Activation in the Prefrontal Cortex: Violent criminals' brains show a significant reduction in prefrontal glucose metabolism.

Frontal Cortex

- ▶ Damage to medial frontal and orbitofrontal cortex is associated with increase risk of reactive aggression in humans.
- ▶ Neuroimaging studies show evidence of frontal dysfunction in aggressive individuals.
- ▶ Violent individuals showed significantly less CBF in frontal cortex than comparison individuals.
- ▶ Neural integrity of prefrontal cortex (proton magnetic resonance spectroscopy (H-MRS) in violent patients showed reductions in N-acetylaspartate (NAA-a marker of neural density). (Chritchley, et al. 2000)

arMPFC & Temporal poles

- ▶ These brain regions are thus central to the development of self-conscious emotions, such as guilt or embarrassment, which promote prosocial behavior and form the basis of moral learning.
- ▶ Atrophy in offenders with ASPD+P contribute to the profound social impairments that characterize psychopathy.
- ▶ While the basic cognitive aspects of empathic processing (as assessed by first- and second-order mentalizing tasks) appear to be intact in ASPD+P, the emotional aspects are clearly impaired, with diminished responsivity to both fear and distress in others.
- ▶ Men with the syndrome of psychopathy fail to learn from their experience of punishment and to experience self-conscious emotions such as guilt, remorse, or embarrassment, which facilitate desistance from the use of inappropriate behaviors, most significantly aggression and violence.

ASPD+P Brain

- ▶ Offenders with ASPD+P displayed significantly reduced GM volumes bilaterally in the anterior rostral prefrontal cortex (Brodmann area 10) and temporal poles (Brodmann area 20/38) relative to offenders with ASPD-P and nonoffenders.

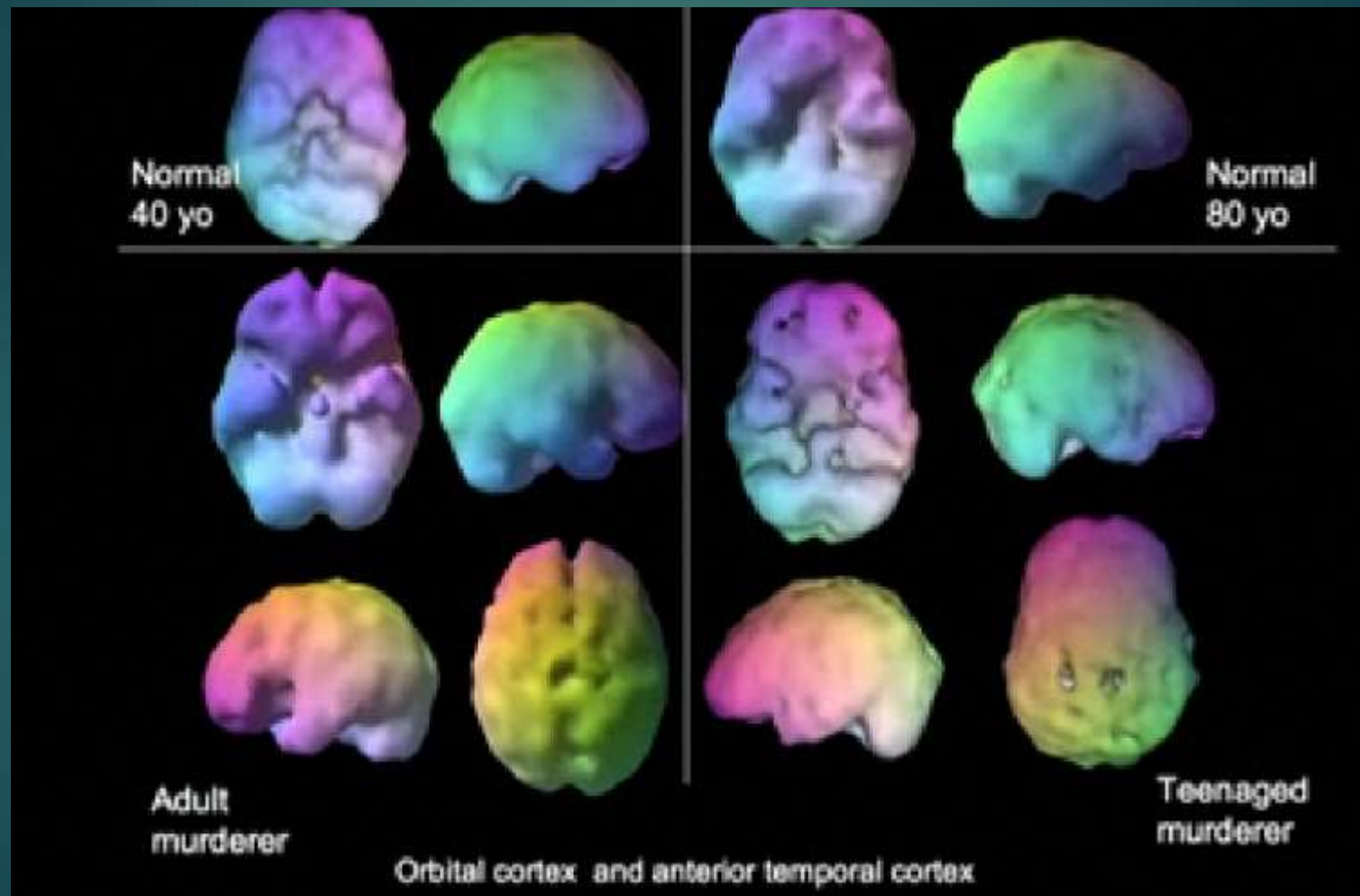
ASPD+P: underactive vmPFC

- ▶ Reactive violence is purportedly underscored by dysfunction within the ventromedial prefrontal cortex (vmPFC). This region regulates emotional reactivity to perceived environmental threats or frustration in the absence of an expected reward and modulates behavior accordingly.
- ▶ Instrumental violence is hypothesized to be associated with abnormalities within both the vmPFC and amygdala.
- ▶ Deficits in aversive conditioning, reinforcement learning, and recognition of fearful facial expressions, which characterize children with conduct problems and callous-unemotional traits and adult psychopaths, are associated with dysfunction in both regions.

Frontal Cortex

- ▶ VL OFC activates with lying in normals, not in psychopaths; check temporary-employment agencies
- ▶ Limbic, Anterior Cingulate, Orbital Frontal activation when experience event of negative emotional response in normals; not in psychopaths
- ▶ White collar psychopaths & serial killers: better prefrontal (EF)

Psychopathy: Orbital cortex and Anterior Temporal cortex Low Activation



The Frontal Lobes in Violence and Criminality

- ▶ Brower and Price: associated focal frontal lesions with aggressive dyscontrol
- ▶ Orbitofrontal lesions are most implicated, and impulsive violence (vmPFC) is more likely than predatory (more normal dlPFC)
- ▶ Frontal lobe lesions do not predict violent crime, but may increase the risk of violence by 10% over the base rate for a given population

(J Neurol Neurosurg Psychiatry 2001; 71: 720-726)

Right Prefrontal More Involved

- ▶ Loss of moral behavior with right frontotemporal dementia
- ▶ Affiliative traits including warmth and empathy rely on right ventromedial prefrontal and anteromedial temporal regions.
- ▶ Sociopathic behavior can result from damage in these regions combined with right orbitofrontal damage causing disinhibition

(Mendez MF. J Am Acad Psychiatry Law 2010; Sollberger et. al. Neuropsychologia 2009)

IFC & self control

- IFC may be a common domain-general region for the regulation of emotion, craving, and motor impulses
- Inferior Frontal Cortex (IFC), a region that has been implicated in different types of self-control
- IFC is activated during motor inhibitory control, such as in the stop-signal task; during cognitive inhibition, such as in the color-word Stroop task and in thought suppression; during emotion regulation; and during regulation of craving for food and cigarettes.
- Share a common feature, namely, that of inhibiting a dominant response.

Inhibition and Right IFC

- The right inferior frontal cortex (rIFC) in humans is critical for inhibiting response tendencies.
- rIFC is best characterized as a brake. The right inferior frontal cortex (rIFC) implements a brake over response tendencies.
- This brake can be turned on totally or partially by external signals. It can also be turned on by goals/intentions.
- Damage to this region and/or its network contributes to impulse control disorders.

Unjustified Killing: lateral OFC activation

- ▶ 2015 study: Participants in the study played video games in which they imagined themselves to be shooting innocent civilians (unjustified violence) or enemy soldiers (justified violence)
- ▶ When participants imagined themselves shooting civilians compared to soldiers, greater activation was found in the lateral orbitofrontal cortex (OFC), an important brain area involved in making moral decisions, The more guilt participants felt about shooting civilians, the greater the response in the lateral OFC. When shooting enemy soldiers, no activation was seen in lateral OFC.
- ▶ The results show that the neural mechanisms that are typically implicated with harming others become less active when the violence against a particular group is seen as justified.

Lying Brain

- ▶ Lying is associated with increased activation of PFC & parietal cortex; telling the truth is not associated with any increase in cortical activation
- ▶ Liars have more white matter in PFC (22%), esp. ventrally; often higher verbal IQs
- ▶ Deceit is harder to do; a complex executive function; involves theory of mind (have to understand what you know about me & what you do not); active suppression/inhibition
- ▶ MRI can detect lying at 88% accuracy

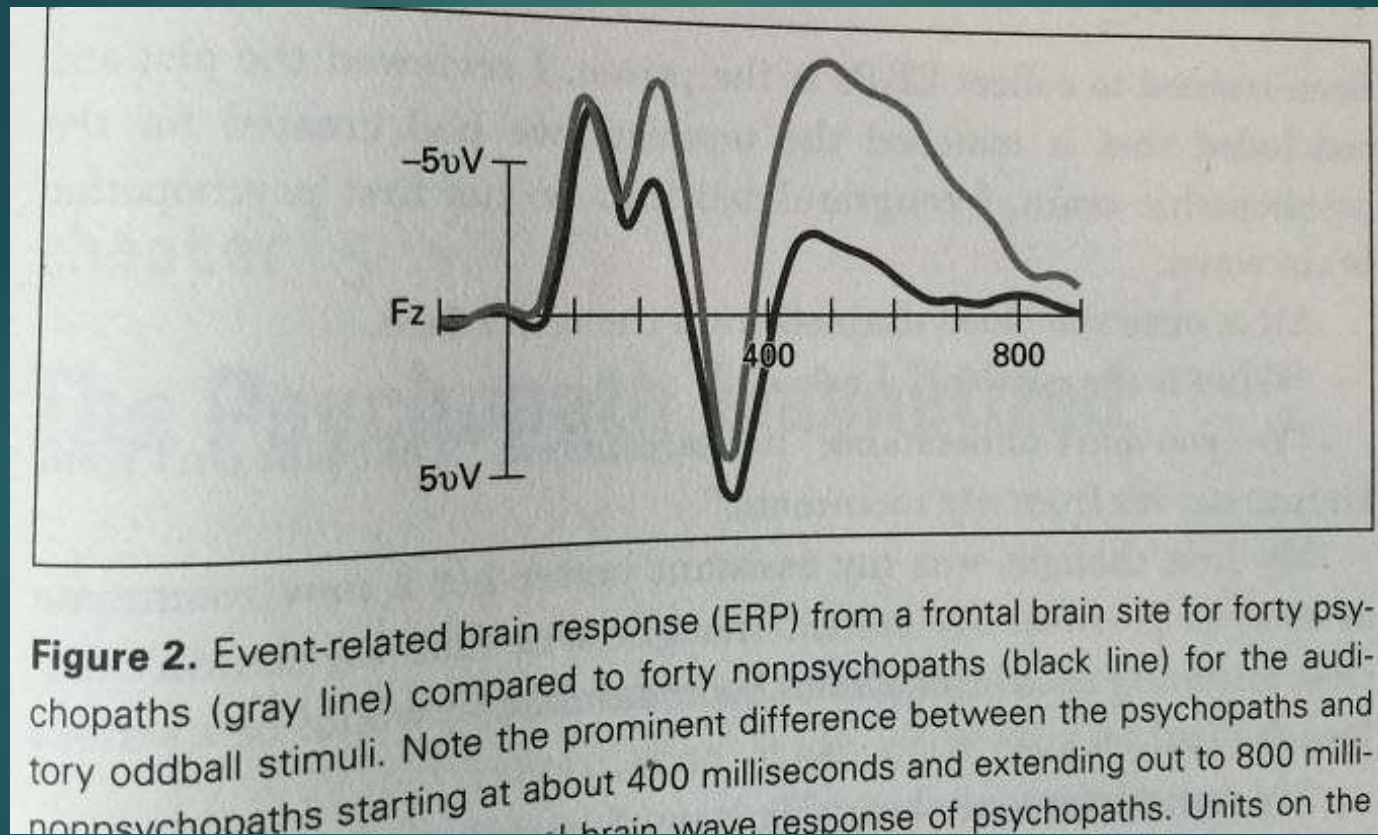
White collar crime

- ▶ Better executive functioning (WCST)
- ▶ Good skin conductance (better attention)
- ▶ Greater vmPFC volumes; greater right PFC & parietal) volumes
- ▶ Experience higher adoption rates

Moral Brain

- ▶ Josh Greene's Trolley Problem & smothering crying baby: 85% won't push person to his death; 45% with vmPFC deficits would
- ▶ vmPFC is crucial for making appropriate moral decisions, as are medial PFC, amygdala, temporal gyrus (all those paralimbic areas): translate cognitive recognition that act is immoral into behavioral inhibition; your emotional braking system
- ▶ Psychopaths know right from wrong, but lack *feeling* of what is moral; cannot empathize emotionally with suffering of others; high PCL scorers have reduced activation in amygdala during emotional moral decision making; no remorse
- ▶ Less capable of recognizing negative emotions (fear, sadness) in others

Kent Kiehl's 1st EEG finding in psychopaths: What is this ERP?



Psychopath vs nonpsychopaths ERPs

Kent Kiehl: Psychopath ERP = temporal lobe (Amygdala) damage

Psychopaths

Temporal
Lobe
Damage

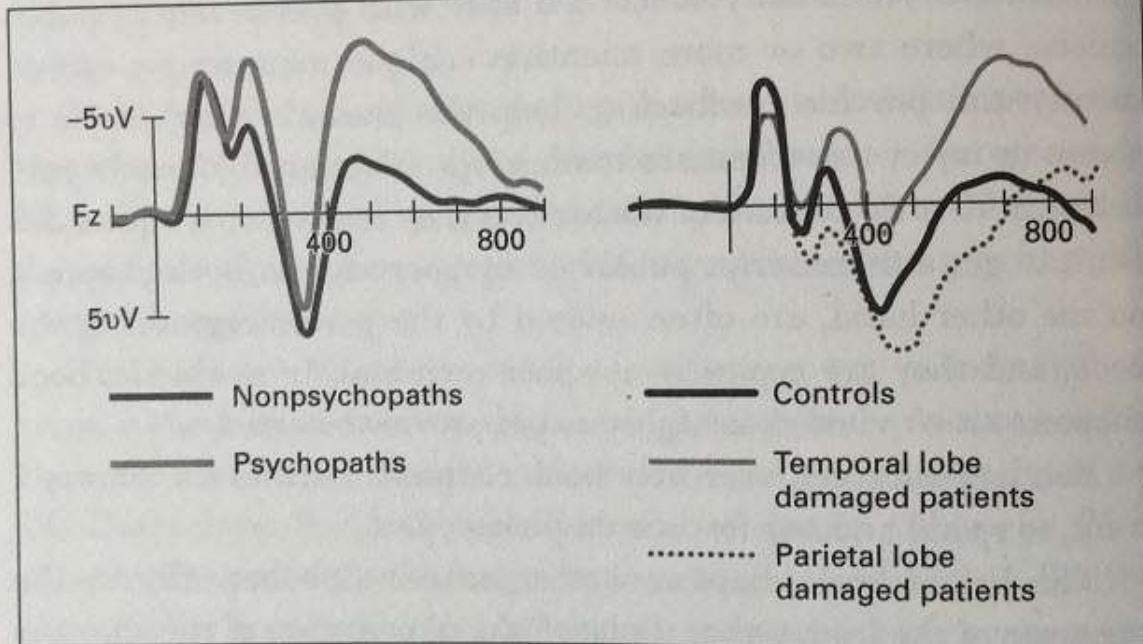
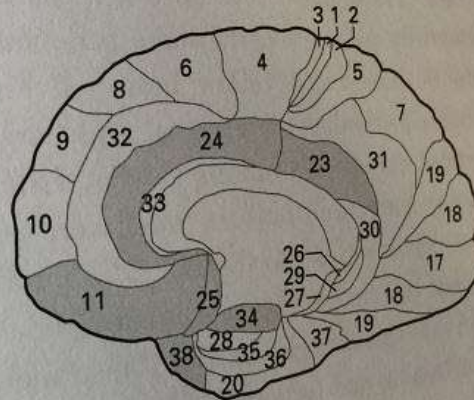
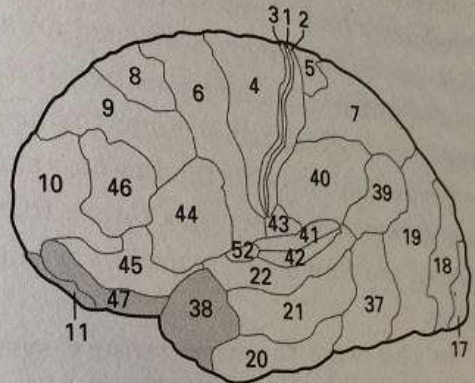


Figure 3. Brain wave plots for psychopaths from Kiehl et al. (2005; left plot) and Yamaguchi and Knight (1993; right plot) for auditory oddball stimuli. Both plots have been adapted to the same time scale and amplitude. Negative amplitude is plotted up. Note the similarities between the psychopaths' brain waves and those of patients with temporal lobe damage. Both groups show enlarged negative response at

Damage to Amygdala

Kiehl: Lower Activation in paralimbic system in Psychopathy

Figure 6. Summary of the brain regions believed to be implicated in psychopaths by the year 2000. Regions include the amygdala, hippocampal complex, anterior and posterior cingulate, anterior temporal pole, and the orbital frontal cortex. The numbers represent different areas of the brain as defined by the work of Dr. Brodmann. See prior figures for complete details on the illustrations.



Amygdala

Hippocampus

Anterior & Posterior Cingulate

Orbital Frontal cortex

Limbic system is not engaged during moral or emotional trigger

Amygdala

- ▶ Possible to increase aggression by modulation of the amygdala.
 - ▶ Electrical stimulation of amygdala increases all types of aggression
 - ▶ Charles Whitman (Austin, Texas University tower mass murder) left a note begging for his brain to be studied. His autopsy revealed he had a tumor pressing into his amygdala

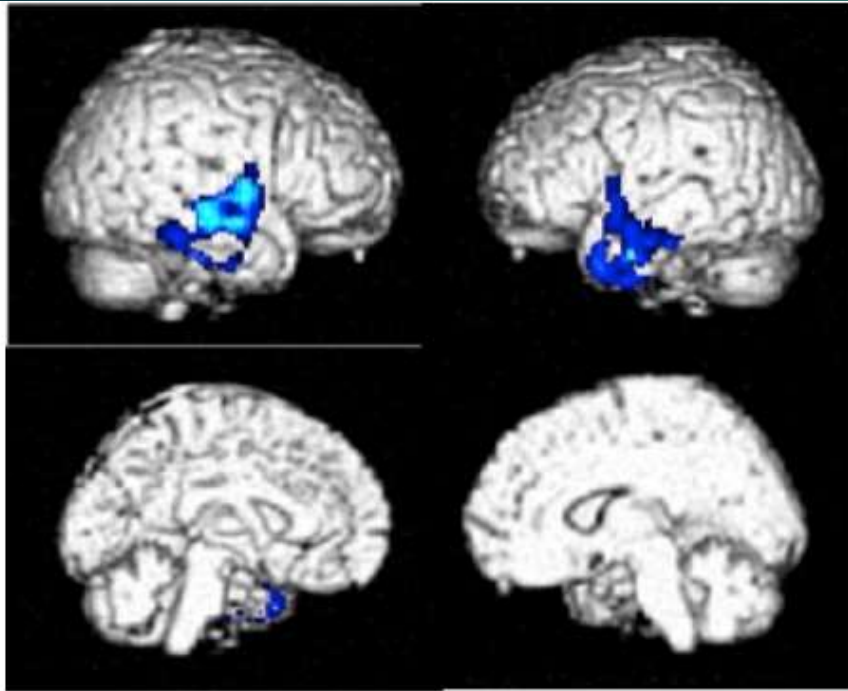
Amygdala

- ▶ Underdeveloped Amygdalae: both the left and especially the right amygdalae are impaired in psychopaths; 18 % reduction in the volume of the right amygdala. Dysfunctions in the amygdala and ventromedial prefrontal cortex may also impair stimulus-reinforced learning in psychopaths, whether punishment-based or reward-based
- ▶ Amygdala: psychopaths are hypolimbic (emotionally deactivated)
- ▶ Reduced Activity In The Amygdala. Correlation of high psychopathy scores and reduced activity in the amygdala during emotional, personal moral decision-making.

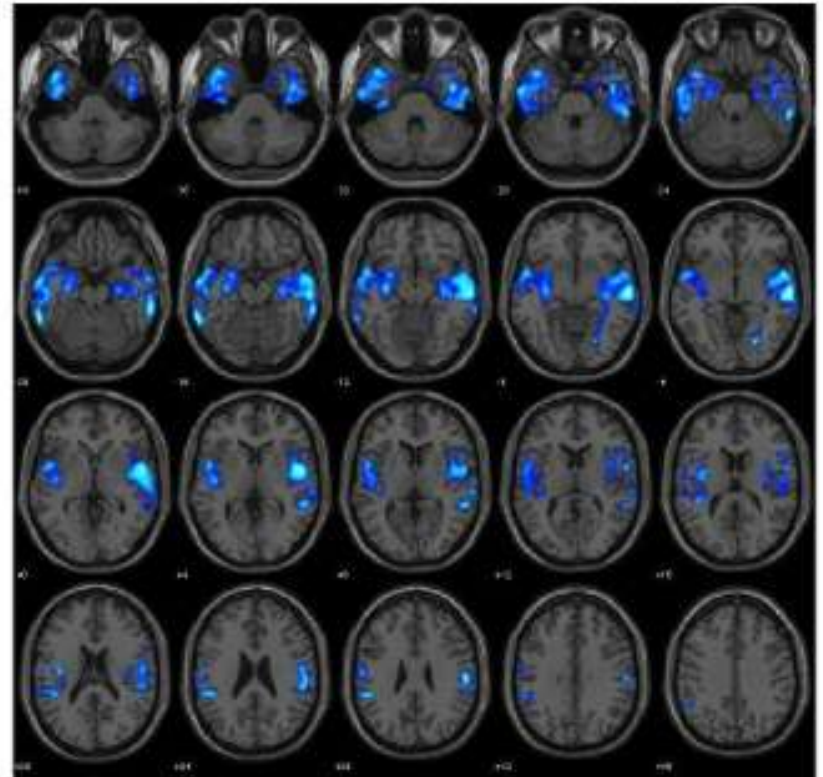
Amygdala

- ▶ Higher Activation of Subcortical Limbic Regions: higher activation of subcortical limbic regions of both reactive and proactive murderers, especially in the right hemisphere of the brain (aggression and rage responses); but proactive/instrumental psychopaths have more normal dlPFC.
- ▶ Reduced autonomic activity. This may underlie the low arousal, poor fear conditioning, and decision-making deficits described in antisocial personality disorder. Lower skin conduction in socially stressful situation

Limbic areas smaller in young killers

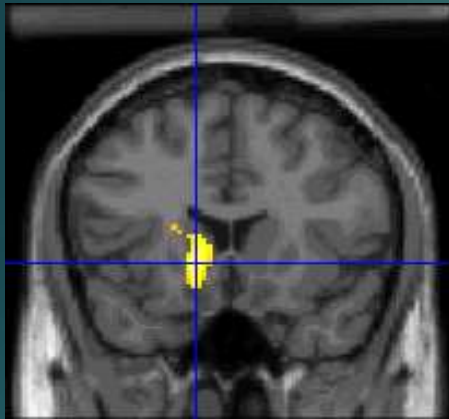


Blue depicts areas of the brain with less gray matter in youths who committed homicide relative to their peers who didn't. The areas include the medial and lateral temporal lobes. (Courtesy of the Mind Research Network)



Psychopathy and Risky Decision Making:

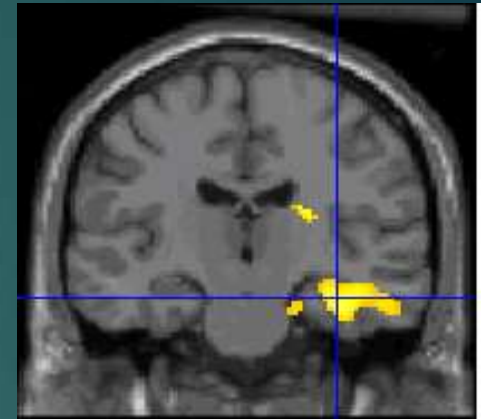
Neural Activation Patterns for Psychopaths > Non-Psychopaths



Left Caudate



Right Caudate



Right Hippocampus



Left Infragranular ACC

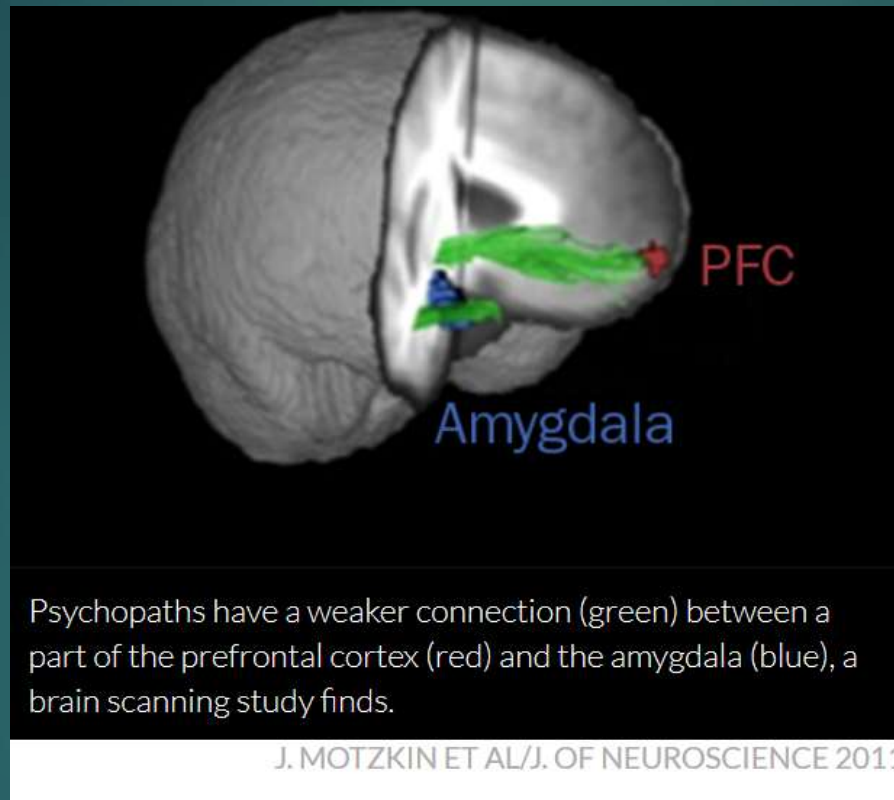


Left Ventral Striatum



Right Ventral Striatum

VmPFC in psychopaths



2011 study found that psychopaths have weak connections between the amygdala and the vmPFC

Impaired emotional perception

- ▶ Psychopathy is associated with atypical responses to distress cues (e.g. facial and vocal expressions of fear and sadness), including decreased activation of the fusiform and extrastriate cortical regions, which may account for impaired recognition of and reduced autonomic responsiveness to expressions of fear, and impairments of empathy.
- ▶ The underlying biological surfaces for processing expressions of happiness are functionally intact in psychopaths, although less responsive than those of controls.
- ▶ Some recent fMRI studies have reported that emotion perception deficits in psychopathy are pervasive across emotions (positives and negatives).

Pedophilia

- ▶ Case studies of men who have committed sexual offences against children implicate frontal and temporal abnormalities that may be associated with impaired impulse inhibition. Structural neuroimaging investigations show volume reductions in pedophilic men.
- ▶ Smaller amygdala volume has been replicated repeatedly.

Cingulate

- ▶ Dysfunctional Posterior Cingulate: Posterior cingulate is poorly functioning in adult criminal psychopaths and aggressive patients.
- ▶ Compromised insula-dorsal anterior cingulate circuit in psychopathy.

Recidivism prediction

- ▶ Use of brain imaging in decisions about which soon-to-be-released offenders are at a greater risk for reoffending.
- ▶ 2013 Kent Kiehl study: 96 male offenders; prisoners with low activity in the anterior cingulate cortex where twice as likely to commit an offense in the four years after their release
- ▶ Dustin Pardini study: men with a smaller amygdala are three times more likely to commit violence three years after their release.

Insula

- ▶ Psychopaths had significantly thinner cortex & reduction in functional connectivity between in left insula and dorsal anterior cingulate cortex
- ▶ Area of greatest difference in cortical thickness was the left insula.
- ▶ Severity of psychopathy is negatively correlated with left insula volume

Hippocampus

- ▶ Bigger Right Hippocampus: 2004 study suggested that the psychopaths' right hippocampus was significantly bigger than the left. This asymmetry was also true in normal people, but it was much more noticeable in psychopaths.
- ▶ Functional Disturbances of the Hippocampus and Its Parahippocampal Gyrus: regions do not work properly in murders and violent offenders in general (Kiehl)
- ▶ Reduced functioning of hippocampus during attention; correlate with higher PCL scores
- ▶ Impaired fear conditioning; regulation of emotions

White Matter Is Also Implicated

- ▶ Hoptman et al.: DTI in schizophrenics: associate impulsivity with lower fractional anisotropy (FA) in the inferior frontal white matter
- ▶ Craig et al.: DTI in psychopaths to correlate antisocial behavior with reduced FA in the uncinate fasciculus (UF)
- ▶ People scoring 25 or higher in the PCL-R, with an associated history of violent behavior, have significantly reduced integrity in their uncinate fasciculus—white matter connecting the amygdala and orbitofrontal cortex
- ▶ An orbitofrontal cortex-UF-amygdala network is implicated in violent behavior

Hoptman et al. (Biol Psychiatry 2002; 52: 9-14); Craig et al. (Mol Psychiatry 2009; 14: 946-953)

Angular Gyrus

- ▶ Reduced Cerebral Blood Flow in Angular Gyrus: reduced CBF in angular gyrus of murderers and impulsive, violent criminals.
- ▶ Psychopaths often have school difficulties

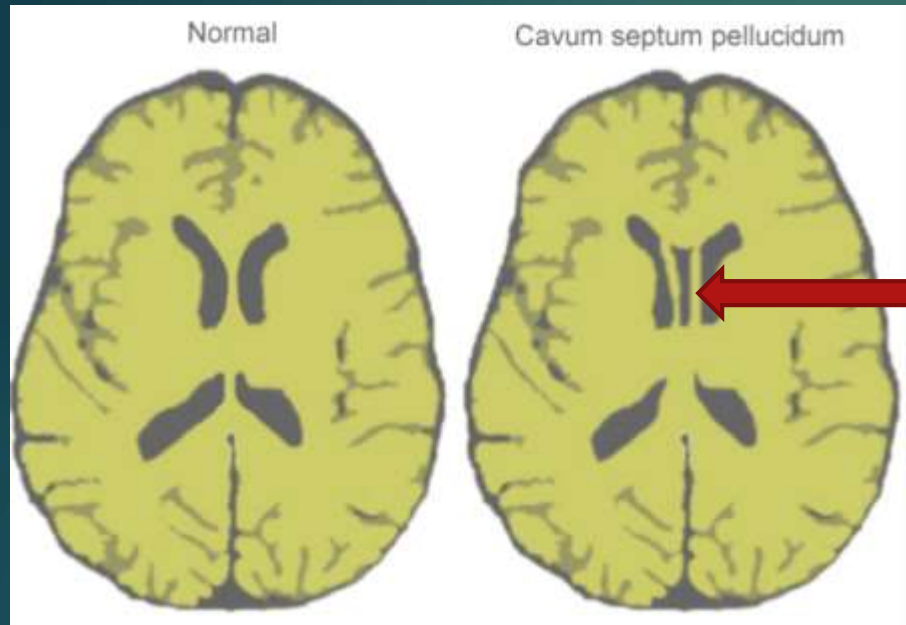
Striatum

- ▶ *Increase in the Volume of the Striatum*: 2010 found that psychopathic individuals showed a 10 percent increase in the volume of the striatum.

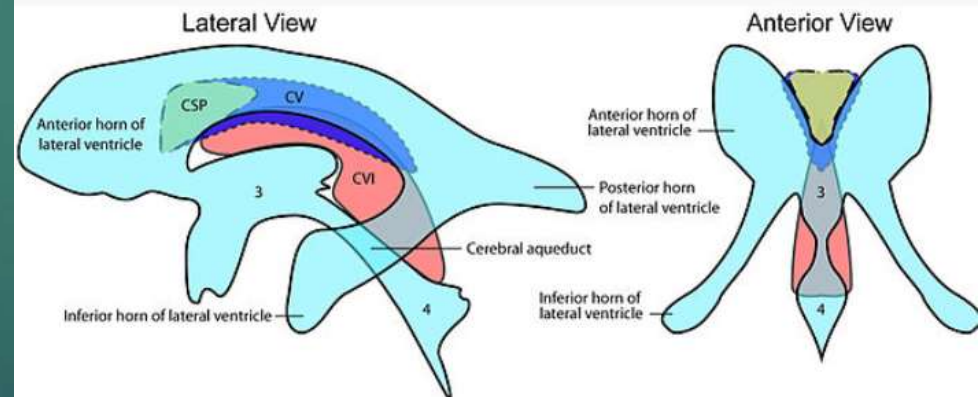
Cavum Septum Pellucidum

- ▶ Cavum Septum Pellucidum Maldevelopment: 2010 suggested that people with cavum septum pellucidum were prone to psychopathy, antisocial personality disorder, and had more charges and convictions for criminal offenses. This brain maldevelopment was especially linked to lifelong antisocial behavior

Cavum septum pellucidum



CSP



Difference between cavum septum pellucidum (CSP), cavum vergae (CV), and cavum velum interpositi (CVI).

3=third ventricle, 4=fourth ventricle.

Cavum Septum Pellucidum

- ▶ 17 individuals
- ▶ CSP has been loosely associated with schizophrenia, PTSD, traumatic brain injury, as well as with antisocial personality disorder. CSP is one of the distinguishing features of individuals displaying symptoms of dementia pugilistica.
- ▶ For the majority of individuals, CSP produces no ill effects.
- ▶ Significant increase in ASPD and convictions

Traumatic Brain Injury

- ▶ Traumatic Brain Injury: adults suffering head injuries damaging the prefrontal cortex show impulsive and antisocial behavior
- ▶ The Vietnam Head Injury Study demonstrated that veterans with penetrating wounds of the ventromedial frontal lobes had a higher frequency of aggressive and violent behavior than control subjects, or veterans with lesions elsewhere in the brain

(Grafman et al. Neurology 1996; 46; 1231-1238)

Nonpenetrating TBI

- ▶ Aggressive behavior is one of the major limitations to successful recovery after nonpenetrating TBI
- ▶ Kim et al. found that 20-49% of children and ~33% of adults had agitation and aggression, usually beginning within the first year post-injury
- ▶ Presence of frontal lobe lesions was associated with higher risk of post-TBI aggression

Tumors

▶ Damage by Tumors:

- ▶ Charles Whitman, 138 IQ, Eagle scout, U of Texas tower shooter, killed 15; hypothalamic tumor that pressured amygdala;
- ▶ Michael Ott, pedophilia based on orbitofrontal tumor; normal when removed, relapse when reoccurred; 2nd tumor removal, normal since

▶ XXX

Dementia

- ▶ Considering the two most common dementias, Alzheimer's Disease (AD) and vascular dementia (VaD), Ballard et al. concluded that 40% display agitation

Alzheimer's Disease

- ▶ Phenomena studied are typically aggression, assaultiveness, and agitation
- ▶ Cummings and Victoroff reported that 18-65% of AD patients display aggression or assaultiveness
- ▶ Senanarong et al. correlated agitation in AD with markers of irritability, delusions, and disinhibition, and concluded that agitation is a manifestation of frontal lobe dysfunction

(Cummings and Victoroff, Neuropsychiatry Neuropsychol Behav Neurol 1990; 3: 140-158; Senanarong et al., Dement Geriatr Cogn Disord 2008; 17: 14-20)

Frontotemporal Dementia

- ▶ Miller et al. studied 22 patients with FTD and 22 with AD for evidence of antisocial behavior
- ▶ 10/22 patients with FTD had antisocial behavior as compared to 1/22 patients with AD
- ▶ Behaviors included assault, indecent exposure, shoplifting, and hit-and-run driving, and did not occur before dementia developed
- ▶ Disinhibition accounted for antisocial behavior

Anatomic areas in morality network

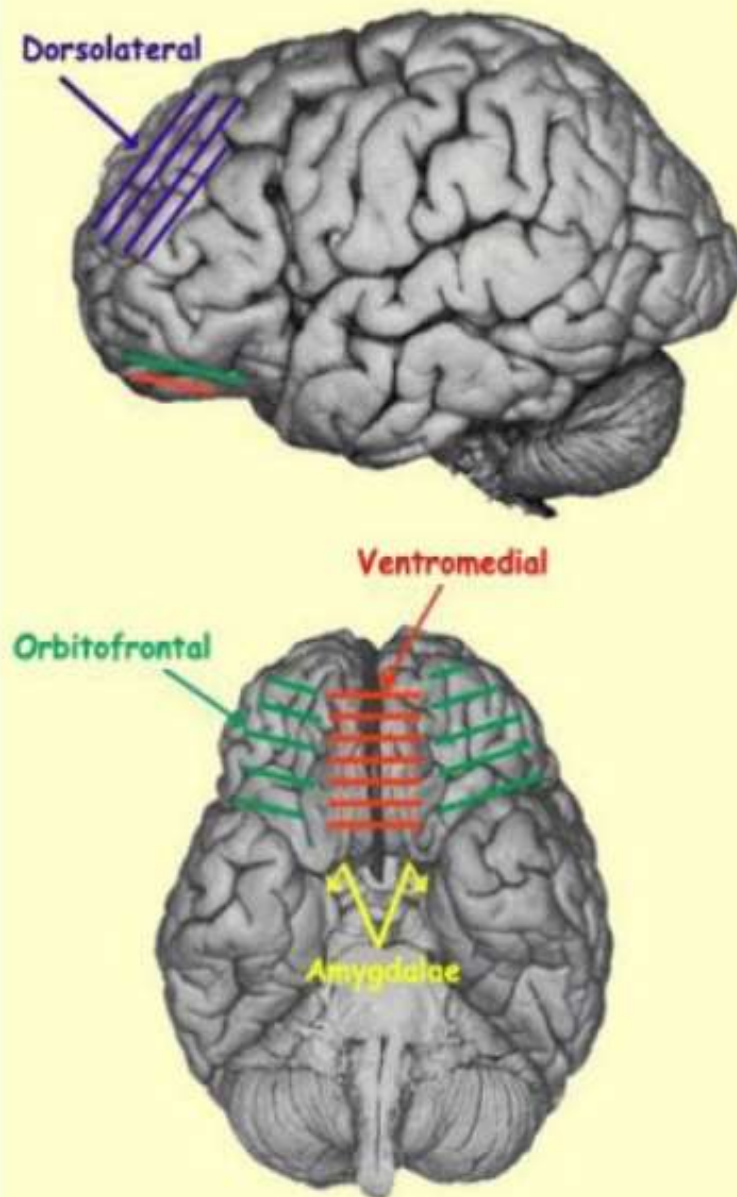


TABLE 4.

Sociopathic Acts among 16 Patients with Frontotemporal Dementia¹⁴⁵

<i>Number</i>	<i>Type</i>
3	Unsolicited sexual approach or touching
3	Traffic violations including hit-and-run accidents
2	Physical assaults
1	Shoplifting
1	Deliberate non-payment of bills
1	Pedophilia
1	Indecent exposure in public
1	Urination in inappropriate public places
1	Stealing food
1	Eating food in grocery store stalls
1	Breaking and entering into others' homes

Mendez MF. *CNS Spectr.* Vol 14, No 11. 2009.

Neuropharmacology of Violence

- ▶ Serotonin is the major neurotransmitter implicated in the regulation of violence
- ▶ Low levels of behavioral inhibition may be mediated by serotonergic dysregulation (low levels) in the septohippocampal system. No harm avoidance.
- ▶ Catecholamines (dopamine, norepinephrine) may potentiate violent behavior
- ▶ Testosterone may influence aggressiveness, but is more associated with dominance than aggression

(Glenn and Raine, Psychiatric Clin N Am 2008; 31: 463-475)

Serotonin

- ▶ 5HT exerts inhibitory control over impulsive aggression
- ▶ 5-HT receptor activation decreased aggression; decreased receptor activation increase aggression.
- ▶ Fewer 5HT binding sites in frontal area of alcoholic impulsive violent offenders
- ▶ 5-H IAA reduction in some impulsive offenders with personality disorders
- ▶ 5-HT promotor genes are associated with early onset alcoholism and violent behavior.
- ▶ Tryptophan depletion increase aggression in both men and women.
- ▶ Aggressive effect of tryptophan depletion is mediated via the 5-HT₁ receptor.

Serotonin and the Orbitofrontal Cortex improve inhibition

- ▶ Serotonergic neurons project to the orbitofrontal cortex, and patients with impulsive aggression show decreased orbitofrontal metabolism on PET in response to serotonergic stimulation
- ▶ Prozac reduces aggression: Show increased orbitofrontal metabolism on PET and clinical improvement after 12 weeks of fluoxetine in impulsive aggression patients
- ▶ Serotonin facilitates prefrontal limbic inhibition

PFC & Serotonin and Suicide

- ▶ Jollant et al. reviewed neuroimaging studies of suicide attempters and ideators published through 9/2010, and postulated dysfunction in ventrolateral, orbital, dorsomedial, and dorsolateral prefrontal cortices; anterior cingulate; amygdala; and white matter
- ▶ Mann et al. showed decreased serotonin transporter binding in the prefrontal cortex of autopsied suicide brains
- ▶ These dysfunctions resemble those associated with aggression and violence (but right side not implicated)

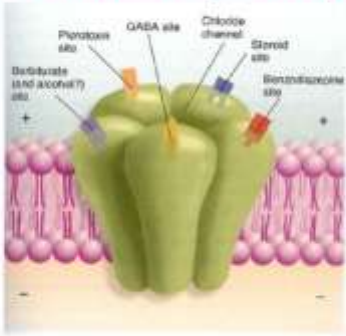
Jollant et al. (World J Biol Psychiatry; 2011 Mar 8; Mann et al. (Arch Gen Psychiatry 2000; 57: 729-738))

Dopamine and Impulse Control Disorder (ICD)

- ▶ Pathological gambling can follow dopamine agonist treatment of Parkinson's Disease – pramipexole first reported; L-dopa can also produce ICD
- ▶ Aggression and hypersexuality may occur in ICD
- ▶ PD patients are typically cautious, avoid risk, and seek less reward, consistent with loss of dopamine in the ventral tegmental area and decreased innervation of the nucleus accumbens
- ▶ Dopamine may contribute to aggressive behavior

(Driver-Dunckley et al. Neurology 2003; 61: 422-423);
(Stamey and Jankovic, Neurologist 2008; 14: 89-99)

GABA Ionotropic Receptor



GABA: γ -Aminobutyric Acid

- Alcohol and benzodiazepines have consistently shown to increase aggression. Both alcohol and diazepam affects the lateral orbitofrontal cortex.
- Specifically, GABA_A receptor complex (receptor agonists benzodiazepines, barbiturates and alcohol.)
- ▶ Both alcohol and benzodiazepines impair recognition of angry expression in others.

Summary of 5-HT and GABA

- ▶ Both 5-HT and GABA appear to modulate aggression.
- ▶ 5-HT leads to a suppression of aggression
- ▶ GABA leads to a increase in the probability of aggression.
- ▶ However, this is only developed for reactive aggression.
- ▶ These transmitters have little effect (GABA) and no effect on instrumental aggression.

Testosterone

- ▶ In animals, increased levels of testosterone is related to social aggression
 - ▶ reducing testosterone in the alpha male eliminates his dominant social status, and restoring testosterone (through injection) causes him to regain his social status.
 - ▶ However, giving testosterone to non-alpha dominant males does not make them dominant or alpha
- ▶ So, for animals testosterone does not increase violence or aggression, but does increase social aggression in alpha males.

Humans and testosterone

- ▶ Abnormally high levels of testosterone in humans is related to increased social aggression, but there is no evidence they are more violent.
- ▶ Thus, there is no evidence that testosterone levels have any predictive value in identifying violent behavior, nor does it increase violent behavior.

Childhood diagnosis of ASPD+P

- ▶ 80% of conduct disorders grow out of it
- ▶ Children with callous & unemotional (CU) traits are different;
 - ▶ Antisocial Process Screening Device (APSD)
 - ▶ Hare Psychopathy Checklist-Youth Version
- ▶ Youth with high CU traits are more violent, offend earlier, greater number of police encounters
- ▶ Fledgling Psychopath Studies: age 6-12
 - ▶ HIA (hyperactive, impulsive, attention deficit)
 - ▶ Conduct Disorder
 - ▶ Callous/unemotional

Childhood diagnosis

- ▶ Fairchild, 2008: Adolescents with severe antisocial behavior do not exhibit the same increase in cortisol levels when under stress as those without antisocial behavior.
- ▶ Conduct problems coupled with callous-unemotional traits are highly heritable,
- ▶ Childhood psychopathic traits are stable into adolescence and early adulthood. Childhood CU traits predict adult psychopathy.

Lack of abstraction

- ▶ Kiehl: One common denominator among psychopaths: They are unable to understand and interpret metaphors. Whenever Kiehl asked what love meant to them, they would typically reply, "sex," and launch into their favorite sexual escapades.
- ▶ "Psychopaths get stuck on the physical, the concrete, and they fail to describe the abstract connections that love provides," he says. "It's because they typically have damage to their right temporal lobe. The more abstract the concept, the more difficulty they have understanding it."

Reduced spontaneous but relatively normal deliberate vicarious empathy in psychopathy

- ▶ fMRI has shown that witnessing the emotions of others triggers neural activations in insula and cingulate cortex (Mirror Neurons) normally associated with feeling similar emotions oneself, and witnessing what others do and sense recruits one's own motor and somatosensory cortices.
- ▶ Study: that psychopathy is:
 - ▶ not a simple incapacity for vicarious activations
 - ▶ but rather reduced spontaneous vicarious activations co-existing with relatively normal deliberate counterparts.
 - ▶ Can turn on empathy at will

Psychopaths & instrumental violence

- ▶ It has been suggested that psychopaths tend to commit more "instrumental" violence than "reactive" violence.
- ▶ 2002 study of homicide offenders, which reported that the homicides committed by psychopaths were almost always (93.%) primarily instrumental, while about half (48%) of those committed by non-psychopaths were.
- ▶ However, contrary to the equating of this to mean "in cold blood", more than a third of the homicides by psychopaths involved emotional reactivity as well.
- ▶ In addition, the non-psychopaths still accounted for most of the instrumental homicides, because most of these murderers were not psychopaths.

Two Types of Violence



1. Affective, impulsive, purposeless

▶ Typical of acquired sociopathy

▶ Orbitofrontal pathology on structural imaging

2. Predatory, premeditated, instrumental

▶ Typical of ASPD-P

▶ Associated with both orbitofrontal and amygdala dysfunction

(Brower and Price, J Neurol Neurosurg Psychiatry 2001; 71: 720-726;
Glenn and Raine, Psychiatric Clin N Am 2008: 31: 463-475)

Affective vs. Predatory Violence

- ▶ Raine et al. studied 9 affective murderers, 15 predatory murderers, and 41 normal controls with PET
- ▶ Both types of murderers had increased activity in the right amygdala, hippocampus, thalamus, and midbrain, but only affective murderers had decreased prefrontal cortical activity. Right limbic activation produces negative affect: affective murderers have little control and act impulsively; predatory murderers exert control and commit premeditated murder
- ▶ Prominent right side dysfunction, as in later studies

Raine et al. (Behav Sci Law 1998; 16: 319-332)

Domestic violence

- ▶ 13% of relationship
- ▶ Raine: Spouse abusers/batterers have strong brain based reactive aggression
- ▶ Slower in responding to emotional words
- ▶ Greater amygdala reaction to negative emotional words & less activation of PFC
- ▶ Greater visual arousal to perceived threats
- ▶ Reactive aggressive personality, more likely to lash out if provoked, less able to inhibit distracting emotional stimuli, under respond with cognitive control
- ▶ Don't listen to reason; emotionally overreact

Neuroimaging and Violence: Summary

- ▶ Structural neuroimaging can identify brain lesions – most often frontal – that may contribute to violent behavior, but there is no direct correspondence between frontal lesions and violence
- ▶ Structural neuroimaging cannot identify obvious brain lesions in the majority of violent offenders, many of whom have antisocial personality disorder
- ▶ Structural and functional neuroimaging have shown subtle frontal and limbic abnormalities in violent individuals, most notably in orbitofrontal cortices and the amygdalae

Conclusions

1. The frontal lobes – mainly the orbitofrontal cortices – normally act to regulate limbic impulses – which arise prominently from the amygdalae
2. Violence can occur as a result of dysfunction in a distributed frontolimbic network related to aggression and its regulation; the right side may be more critical
3. A distinction may exist between affective violence from orbitofrontal injury (e.g. acquired sociopathy) – vs. predatory violence from both orbitofrontal and amygdala damage (e.g. ASPD-P)

Conclusions

4. Serotonin appears to inhibit violence, and dopamine may enhance it
5. Traumatic brain injury, both penetrating and nonpenetrating, is associated with an increased risk of violence
6. Dementia, most notably frontotemporal dementia, is associated with an increased risk of violence
7. Neuroimaging has promise in the evaluation of violent behavior and recidivism, but cannot accurately predict the risk of violence in an individual person

Conclusions

8. Impaired impulse control from altered brain function is relevant because some violent people are unable to act by the rules they have learned
9. Given the uncertainties introduced by neurobiology, the legal system should consider brain-behavior relationships in dealing with violent crime

Not Guilty by Reason of Brain Damage?

- ▶ Although much more study is needed of brain lesions increasing the risk of violence, people with certain disorders know the rules of conduct but fail to act by them
- ▶ These people have reduced impulse control, either from frontal lobe or limbic system dysfunction
- ▶ Sapolsky suggests that in cases of violent crime, the insanity defense – not knowing right from wrong – should be expanded to consider the possibility of *impaired volition* – diminished impulse control

Sapolsky (Phil Trans R Soc London B 2004; 359: 1787-1796)

Gender

- ▶ OFC most important, poor decision making
- ▶ Dorsolateral: executive skills
- ▶ Low volume in both, higher level antisocial
- ▶ Gender differences: temp agency women don't commit as many crimes; higher gm in OFC and middle frontal gyrus
- ▶ Gur: gender differences
- ▶ Men: sign correl in 2 areas; 12 women if both areas ofc and mfc; aspd women same
- ▶ Gender crime differences; control for sex differ in medial frontal (46% loss of gender difference)
- ▶ Social forces or biology?

Gender

- ▶ 46 studies, 1200 individuals, meta-analysis
- ▶ ASPD effect .64 and frontal lower
- ▶ 27 studies, .84 effect and frontal; only in violent ASPD; not property offending
- ▶ Not all frontal impairment

- ▶ Case: ASPD before and depressed, made suicide attempt with crossbow below chin; after neither; only sx inappropriately cheerful; puerile jocularity is sx of prefrontal deficit

Trustworthiness

- ▶ “In spite of the hardness and ruthlessness I thought I saw in his face, I got the impression that here was a man who could be relied upon when he had given his word.”
- ▶ An error in judgment: English Prime Minister Neville Chamberlain on first meeting Hitler
- ▶ Formula to predict untrustworthiness: hand touch, face touch, arms crossed, lean away. The more often a player expressed this set of cues, the more selfishly they play in economic risk games.

Neurolaw issues

- ▶ Neuro-ethical considerations:
- ▶ Legal implications: if poor brain, brain imaging data for sentencing; bad parenting, diet/nutrition, bad brain
- ▶ Less executions
- ▶ Slippery slope: no regulatory control; need to deter vs retribution
- ▶ Did they ask for their brain
- ▶ At what % of brain damage should there be legal consequence or mitigation

Solutions

- ▶ Prosecutors want data out; defense want it in
- ▶ Most who experience child abuse or brain damaged don't become violent
- ▶ But if 100 causal factors known, count up number of factors for sentencing?
- ▶ If we could treat it successfully, would that change law
- ▶ Dx & Treating in childhood will create stigmatization

Solutions

- ▶ Minority Report film
- ▶ Away from punitive system, criminals seen as morally defective (like mentally ill, alcoholics; as disease)
- ▶ Recidivistic violence as public health or clinical disorder
- ▶ Need for more benign prison system if lifetime sentence becomes norm vs current horrific prison conditions for lifers

Wisdom of Psychopaths

- ▶ The Wisdom of Psychopaths: What Saints, Spies, and Serial Killers Can Teach Us About Success by Kevin Dutton
- ▶ There are “functional psychopaths” among us who use their detached, unflinching, and charismatic personalities to succeed in mainstream society, and that in some fields, the more “psychopathic” people are, the more likely they are to succeed.
- ▶ Psychopaths tend to be fearless, confident, charming, ruthless, and focused—qualities that are tailor-made for success in the twenty-first century.
- ▶ The key traits include: ruthlessness; intense capacity to focus, excluding all distractions such as fear; powerful reward motivation; a disposition to action; acute ability to read emotions in other people, without being moved by them; charisma; mental resilience; and mindfulness, the ability to live in the present moment.
- ▶ Most "psychopaths" aren't violent, and indeed most aren't locked away. Many excel in society: CEOs ranked highest on his scale, followed by lawyers, TV and radio workers, salespeople, surgeons and journalists

Can Psychopaths Be Cured?

Posted by **Ross Pomeroy** July 11, 2014



Michael Caldwell

- ▶ Psychopathy can be changed in the young
- ▶ CBT for 9-12 months reduced recidivism by 50%

ASPD + P Treatment

- ▶ Don't do insight/feeling therapy: make them better psychopaths
- ▶ Set firm limits.
- ▶ Try not to be manipulated.
- ▶ Have high level of skepticism.

Enrichment decreases crime

- ▶ Mauritius study: 100 kids, randomize vs control: enrichment (cognition stimulation, good nutrition, exercise)
- ▶ Slept after lunch in control
- ▶ Enriched kids: 8 y later, less slow wave eeg, more alert
- ▶ Skin conduction to sound: enriched, larger orienting response
- ▶ Age 17: conduct disorder sig reduced in poor prior nutrition
- ▶ Crime at 20 years self report: 36% vs 23% enriched
- ▶ Official crime 10 vs 3%
- ▶ Nutrition status moderates at age 3 poor or enriched before age 3: conduct no effect if good before; better enrichment in prior poor had positive effect

Prevention of violence

- ▶ Early prevention programs to address environmental variables listed earlier
- ▶ Dietary interventions
- ▶ Childhood detection of CU traits
- ▶ Antipsychotic and anticonvulscent medications
- ▶ Mindfulness training
- ▶ Gun control!!

Treatment

- **Currently**, there is no cure for psychopathy. No pill can instill empathy, no vaccine can prevent murder in cold blood, and no amount of talk therapy can change an uncaring mind. For all intents and purposes, psychopaths are lost to the normal social world.
- Mendota Juvenile Treatment Center (MJTC) in Madison, WI. Their Decompression Model operates without the strict deterrence and punishment commonplace at a normal juvenile facility. They averaged in the severe range on the Youth Psychopathy Checklist
- The hallmark of the Decompression Model is positive reinforcement. The institutionalized youth are monitored continuously by all staff members for any sign of positive behavior, however small. When spotted, the behavior is reinforced with some sort of reward. The youth are also told that their rewards can scale, meaning the longer they persist with good behavior, the greater the prizes become.
- 98% of the non-MJTC youth were arrested again within four years, while only 64% of MJTC youth were. The MJTC program had resulted in a 34 percent reduction in recidivism, MJTC youth were 50% less likely to commit a violent crime, and, while non-MJTC youth killed 16 people after their release, MJTC youth didn't commit a single homicide!

Serial Killers

WHAT IS A SERIAL KILLER?

- Has committed more than 3 murders
- Murders committed over a short period of time
- Very cautious about their murders
- Mass murderers are different from serial killers

COMMON MISCONCEPTIONS

- Social misfits, dysfunctional or “loners”
- Have no social control
- Are “evil geniuses” or insane
- Always male
- Always white

Statistics on Serial Killers

- ▶ Serial homicide is quite rare
- ▶ 1 percent of all murders committed in the U.S.
- ▶ 150 victims of serial murder in the U.S. in any given year.
- ▶ FBI: 25 to 50 serial killers operating throughout the U.S. at any given time.

Spree killers vs. serial killers

- ▶ Most spree killers — alienated loners who suddenly lash out with little or no warning, such as Aurora, Colorado's James Holmes, Seung-Hui Cho at Virginia Tech or Adam Lanza at Sandy Hook Elementary School — are not psychopaths. Instead, they suffer from psychosis. Often kill themselves.
- ▶ Most serial killers, however, are indeed psychopaths. They do not

Myths about serial killers

- ▶ **Myth #1: All Serial Killers Are Men:**
- ▶ 17 percent of all serial homicides in the U.S. are committed by women.
- ▶ Only 10 percent of total murders in the U.S. are committed by women. Therefore, relative to men, women represent a larger percentage of serial murders than all other homicide cases in the U.S.

Serial killers

- ▶ **Myth #2: All Serial Killers Are Caucasian.**
- ▶ Racial diversity of serial killers generally mirrors that of the overall U.S. population. There are well documented cases of African-American, Latino and Asian-American serial killers. African-Americans comprise the largest racial minority group among serial killers, representing approximately 20 percent of the total. Significantly, however, only white, and normally male, serial killers such as Ted Bundy become popular culture icons.
- ▶ Coral Eugene Watts, a black man from Michigan, known as the “Sunday Morning Slasher,” who murdered at least seventeen women in Michigan and Texas; Anthony Edward Sowell, a black man known as the “Cleveland Strangler” who kidnapped, raped and murdered eleven women in Ohio; and Rafael Resendez-Ramirez, a Mexican national known as the “Railroad Killer,” who killed as many as fifteen men and women in Kentucky, Texas, and Illinois.

Serial killers

- ▶ **Myth #3: All Serial Killers Are Isolated and Dysfunctional Loners.**
- ▶ Those who successfully blend in are typically also employed, have families and homes and outwardly appear to be non-threatening, normal members of society.
- ▶ **Myth #4: All Serial Murderers Travel Widely and Kill Interstate.**
- ▶ Ted Bundy is the rare exception who traveled and killed interstate. Most serial killers have very well defined geographic areas of operation, i.e. Jack the Ripper & White Chapel
- ▶ serial killers are most likely to commit their first murder very close to their place of residence due to the comfort and familiarity it offers them. John Wayne Gacy “The Killer Clown” buried most of his thirty-three young, male victims in the crawl space beneath his house after sexually assaulting and murdering them.

Serial killers

- ▶ **Myth #5: All Serial Killers Are Either Mentally Ill Or Evil Geniuses.**
- ▶ Serial killers are much more likely to exhibit antisocial personality disorders such as sociopathy or psychopathy
- ▶ In fact, very few serial killers suffer from any mental illness to such a debilitating extent that they are considered to be insane by the criminal justice system. To be classified as legally insane, an individual must be unable to comprehend that an action is against the law at the exact moment the action is undertaken.
- ▶ Serial killers rarely are determined to be mentally incompetent to stand trial and their lawyers rarely utilize an insanity defense on their behalf. Once again, this is due to the extremely narrow legal definition of insanity

Serial killers

- ▶ The image of the evil genius serial killer is mostly a Hollywood invention. Real serial killers generally do not possess unique or exceptional intellectual skills. The reality is that most serial killers who have had their IQ tested score between borderline and above average intelligence.
- ▶ Contrary to mythology, it is not high intelligence that makes serial killers successful. Instead, it is obsession, meticulous planning and a cold-blooded, often psychopathic personality that enable serial killers to operate over long periods of time without detection.

Common Misconceptions

COMMON MISCONCEPTIONS

- Are all entirely sexually driven
- Have been abused in the past or have grown up in “broken” homes

SERIAL KILLER'S TRUE COLOURS

- Many have not finished high school
- Are generally middle class citizens
- Can easily blend into society
- Unlike murderers, serial killing is not a one time offense, and serial killers usually have a motive

Psychological Perspective

COMMON TRENDS IN SERIAL KILLERS

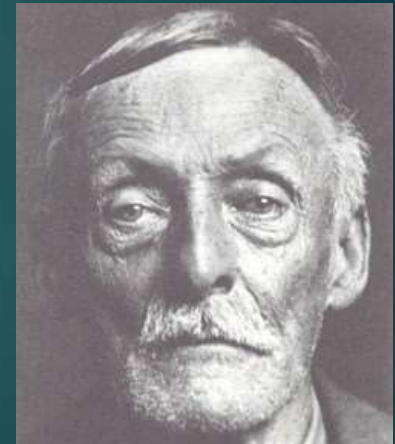
- Many similarities seen in serial killers
- May stem from abuse
- Hatred towards a certain group of people may be a motive

NURTURE

- Neglect and abuse at home
- John Gacy, serial killer in 1970's
- Albert Fish, serial killer in 1920's



John Gacy



Albert Fish

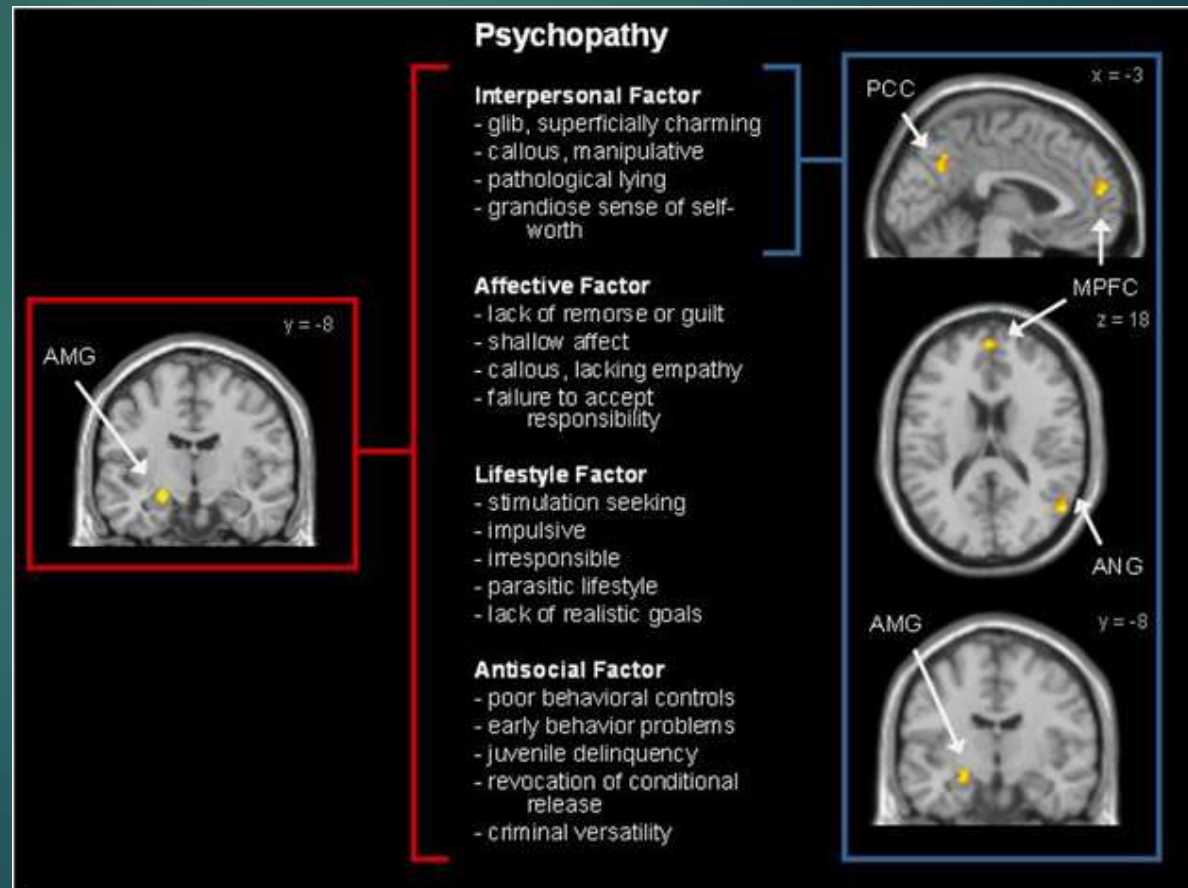
Psychological Perspective

NATURE

*“In this functional magnetic resonance imaging (fMRI) study, we find that **more psychopathic individuals show reduced activity in the amygdala during emotional moral decision-making, with particularly conning and manipulative individuals showing reduced activity in the entire moral neural circuit.** These results provide initial evidence that psychopaths exhibit deficits in brain regions essential for moral judgment in normal individuals.”*

- Dr. Adrian Raine, Department of Psychology and Neuroscience Program, University of Southern California

- Defects or differences of the brain
- Lack of remorse and guilt
- Strong signs of psychopathy



Psychological Perspective

BOTH NATURE AND NURTURE

- Jeffrey Dahmer, serial killer in 1970's
- Same environment, different results



Jeffrey Dahmer

Bad seeds blossom in bad environments.

Sociological Perspective

NATURE AND NURTURE

- Many socialization techniques may affect how the person grows up and interacts with others
- Are able to smooth talk their way past officials and authority figures
- No treatment for psychopathy
- Many are granted early release from prison

*"All those convicted of 2nd degree murder will receive a sentence of life imprisonment. Their parole eligibility date will be within a range of 10 to 25 years at the discretion of the judge. **Despite a sentence of "life imprisonment" being imposed, the vast majority of first degree murders will eventually be released back into society.** Their freedom, however, will be limited by the conditions of parole for the remainder of their lives. Further, a breach of parole could easily result in them having to return to prison to serve additional time."*

*- Section 222 of the Criminal
Code of Canada*

Anthropological Perspective

TYPES OF SERIAL KILLERS

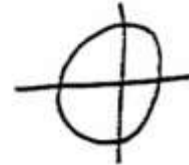
1. Thrill Seekers: Enjoy media attention, police pursuit and evading the authorities
2. Mission Oriented: Doing society a favour by eliminating certain people
3. Power and Control: Enjoy the victim's terror
4. Souvenir Oriented: Keep mementos of the victims, such as souvenirs and "trophies"

ChasingtheFrog.com - Zodiac

Below is a copy of the letter that the Zodiac sent to the Chronicle on July 24, 1970. In the letter he refers to a woman, her baby, and burning their car.

This is the Zodiac speaking

I am rather unhappy because you people will not wear some nice ~~+~~ buttons. So I now have a little list, starting with the woeman + her baby that I gave a rather interesting ride for a couple hours one evening a few months back that ended in my burning her car where I found them.



Anthropological Perspective



Canada

- ▶ Serial killers are automatically assigned a life time imprisonment
- ▶ No death penalty in Canada
- ▶ Many rehabilitation programs and other similar activities available

Russia

- Life imprisonment is an option in much lighter circumstances
- Death penalty still an option in modern day Russia
- Rehabilitation is once again taken lightly, used mainly for youth, may occasionally be used for adults

Anthropological Perspective

Paul + Karla Bernardo

- ▶ “The Ken and Barbie Killers”
- ▶ Murdered and raped 20 men, women and children
- ▶ Were arrested in 1995, Karla was released in 2006, Paul continues to be held at Kingston Penitentiary.

Andrei Chikatilo

- ▶ “The Red Ripper”
- ▶ Murdered and raped over 50 men, women and children
- ▶ Was arrested and released in 1984 for “good behavior”
- ▶ Final arrest took place 1992, was given the death penalty

Nature VS Nurture

NURTURE

- Socialization agents and the environment around them as they're growing up plays a massive role in the development of a child
- Criminologist Eric Hickey discovered in a study of sixty two male serial killers, that forty eight of the subjects had been rejected as children by someone important in their lives.
- When rejected or neglected as children, they begin to stress and get confused as they get older
- Hatred towards certain groups of people may also be a motive for many serial killers

Conclusion

All in all, we believe that both nature and nurture make a serial killer. Sociological and psychological aspects such as socialization agents prove that a person's initial nurturing and the environment around them may influence the decisions they make in the future, however, psychological and anthropological perspectives also aide in shedding light on the differences in the brain of "normal" humans and psychopaths. Although it seems that the debate of nature versus nurture on the topic of psychopathy is never ending, through the psychological, sociological, and anthropological lenses, we believe it is evident that both nature and nurture play a vital role in the making of a serial killer.

4 Types of Serial Killers

- Thrill Seekers: Enjoy media attention, police pursuit and evading the authorities
- Mission Oriented: Doing society a favor by eliminating certain people
- Power and Control: Enjoy the victim's terror
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Table 8.1 Summarizing Biosocial Perspectives and Theories

Theory	Key Concepts	Strengths	Weaknesses
Behavior genetics perspective	Genes affect behavior in interaction with environmental influences. Heritability estimates the relative contribution of genetic and environmental factor traits affecting criminality. All individual traits are at least modestly influenced by genes.	Looks at both the genetic and environmental risk factors for criminal behavior Understanding genetic contributions also identifies the complementary contributions of environmental factors.	Requires twin samples of twins and/or adoptees, which are difficult to come by. While general environmental factors are identified, behavior genetics does not specify what they are.
Evolutionary psychology perspective	Human behavior is rooted in evolutionary history. Natural selection has favored victimizing tendencies in humans, especially males. These tendencies arose to facilitate mating effort but are useful in pursuing criminal behavior as well. Criminals emphasize mating effort over parenting effort more than males in general.	Ties criminology to evolutionary biology. Mating effort helps to explain why males are more criminal than females and why criminals tend to be more sexually promiscuous than persons in general. Emphasizes that crime is biologically "normal" (although regrettable) rather than pathological.	Gives some the impression that because crime is considered "normal," it is justified or excused. Makes assumptions about human nature that may or may not be true. While recognizing that culture is important, it tends to ignore it.

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Neuroscience perspective	Whatever its origin, all stimuli are channeled through the brain before given expression in behavior. The development of the brain is strongly influenced by early environmental experiences, especially those involving nurturance and attachment.	Shows how environmental experiences are physically "captured" by the brain. Emphasizes the importance of nurturing for optimal development of the brain. Uses sophisticated technology and provides "harder" evidence.	High cost of neuroimaging studies is a drawback. Very small samples of known criminals are often used, thus limiting generalizations. Linking specific brain areas to specific behaviors is problematic.

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Evolutionary neuroandrenic theory	Androgens alter the brains of males to make them more prone toward status striving, especially following puberty. Crime is a crude expression of status striving.	Integrates evolutionary and neuroscience concepts. Explains why sex, age, and social status are related to violent and property crimes, as most studies have shown.	Does not explain most forms of victimless crimes. Does not pay sufficient attention to specific environmental factors.
Reward dominance theory	Behavioral activating system (BAS) and behavioral inhibiting system (BIS) are dopamine and serotonin driven, respectively. Among criminals, the BAS tends to be dominant over the BIS. This BIS/BAS imbalance can lead to addiction to many things, including crime.	Explains why low serotonin is related to offending (low serotonin = low self-control). Explains why criminality is persistent in some offenders because they develop a taste for the "thrill of it all."	The neurological underpinnings of the BAS and BIS have been difficult to precisely identify. Studies difficult and expensive to conduct.
Prefrontal dysfunction theory	Frontal lobes control long-term planning and temper emotions and their expressions. Criminals have frontal lobes that fail to function as they do in most people, especially in terms of inhibiting actions that harm others.	Explains why moral reasoning is inversely related to involvement in persistent criminality. Explains why criminality has been linked to frontal lobe damage and to abnormal brainwaves.	Dysfunction of the prefrontal lobes remains difficult to precisely measure, even with fMRI scans. Same sampling difficulties noted for the neurosciences in general.

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