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# Forensic Neuropsychiatry

*Brain, Behavior, and the Courts*

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# Disclosures



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*Neither I nor my spouse/partner has a relevant financial relationship with a commercial interest to disclose.*

# Forensic Neuropsychiatry: Why It Matters



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## OUR JAILS AND PRISONS ARE OUR LARGEST PSYCHIATRIC INSTITUTIONS

- **Mental health evaluations for the courts** — competency, criminal responsibility, sentencing mitigation
- **The courts shape practice** — legal questions drive what we assess and treat
- **Care in secure settings** — prisons, jails, and forensic psychiatric hospitals
  - ~2 million people are incarcerated in the U.S. on any given day
  - Serious mental illness affects ~15% of state-prison and ~20% of jail populations — roughly 10× the number in state hospitals

**≈10×**

more people with SMI in  
jails/prisons than state hospitals

**20–40%**

of the incarcerated have a  
neuropsychiatric disorder

# “Where Is the Lesion?”



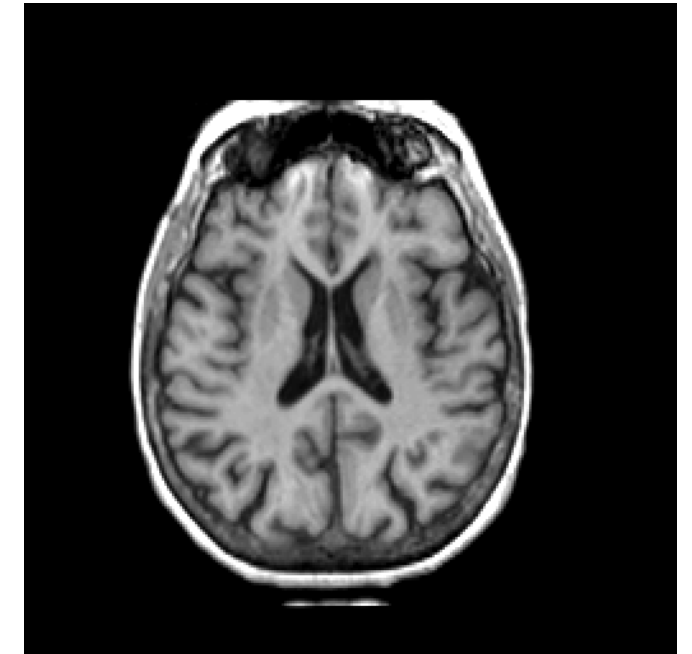
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## NEUROPSYCHIATRY ASKS THE CLASSIC NEUROLOGICAL QUESTION OF BEHAVIOR

- **Neurodevelopmental** — autism spectrum, intellectual disability, developmental delay
- **Neurodegenerative** — frontotemporal & other dementias, Huntington's disease
- **Acquired injury** — head trauma, diffuse axonal injury, stroke, CNS tumors
- **Paroxysmal / other** — seizure disorders, toxic-metabolic states, movement disorders



*Bilateral orbitofrontal encephalomalacia after head trauma*

# Rex v. Hadfield, 1800



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## BRAIN INJURY AS DIRECT EVIDENCE OF A CRIME — THE FIRST TIME

- James Hadfield: British soldier, saber wound to the head (1794) exposing brain tissue
- Developed religious delusions and a belief he must kill King George III
- Attorney Thomas Erskine showed the jury the head injury as the cause
- Judge halted the trial, acquitted him, and ordered treatment

*“Where a man has become insane from violence to the brain, which permanently affects its structure ... his disease is immovable.”*

— Thomas Erskine, defense counsel



Thomas Erskine

# The Guiteau Trial, 1881



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## “MORAL INSANITY” — WHAT WE WOULD NOW CALL PSYCHOPATHY

- Charles Guiteau assassinated President James Garfield
- The trial captivated the public; a prominent neurologist testified to “moral insanity”
- Defense invoked Cesare Lombroso’s theory of inherited criminality
- Convicted and executed despite clear paranoid and grandiose delusions
- **On autopsy:** thickened dura and vascular changes suggesting neurosyphilis

## Lewis & Pincus, 1986 / 1988



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### ADULTS AND JUVENILES ON DEATH ROW

- Capital defendants referred for questions of mitigation
- Psychiatric and neurological exam; record review and family interviews
- Neuropsychological, educational, and neurodiagnostic testing

### The Clinical Triad

- Paranoid psychotic symptoms
- History of physical / sexual abuse
- Brain injury or CNS dysfunction

## Martell, 1992: Organic Brain Dysfunction



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### 50 MAX-SECURITY MENTALLY DISORDERED OFFENDERS — SCREENED FOR BRAIN DYSFUNCTION

- Indicators: organic brain diagnosis, severe head injury with LOC, seizures, cognitive impairment, abnormal neuro exam or testing
- Key result:** brain dysfunction was significantly linked to being indicted for a violent offense

**84%**

had  $\geq 1$  indicator of  
brain dysfunction

**64%**

had multiple  
indicators

**67%**

of NGRI cases  
classified organic

**63%**

of incompetent-to-stand-trial  
cases had indicators

# TBI in Correctional Settings



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## PREVALENCE FAR EXCEEDS THE GENERAL POPULATION

- Associated with repeat offending and more time served
- Associated with greater aggression
- Associated with psychiatric disorders and substance abuse
- **Open question:** is TBI a cause — or a consequence — of criminal behavior?

**≈50%**

TBI prevalence in  
incarcerated populations

**≈39%**

highest general-population  
estimate (all-male sample)

# The Developing Young-Adult Brain



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## THE LAW IS CATCHING UP TO THE NEUROSCIENCE

- The prefrontal cortex — impulse control and judgment — matures into the mid-20s
- Trauma and neglect heighten risk-taking and vulnerability to violence
- Violent-crime rates fall sharply after ~age 35

### From the bench

**Roper v. Simmons (2005)** — no death penalty under 18

**Miller v. Alabama (2012)** — no mandatory JLWOP for juveniles

**Jones v. Mississippi (2021)** — no separate finding of “permanent incorrigibility” required

**Commonwealth v. Mattis (MA, 2024)** — no life-without-parole for ages 18–20, on brain-development grounds

## Billstedt et al., 2017



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### NEURODEVELOPMENTAL DISORDERS IN YOUNG VIOLENT OFFENDERS

- 270 male offenders (18–25) sentenced for “hands-on” violent offenses
- Substantial overlap between disorders was the rule, not the exception
- **The NDD group:** earlier-onset antisocial behavior, more aggression, lower school achievement

**63%**

Childhood ADHD

**43%**

Adult ADHD

**10%**

Autism spectrum

**6%**

Tourette syndrome

# ADHD & Criminal Behavior



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## TREATING THE DISORDER REDUCES OFFENDING

- **Lichtenstein et al., 2012** — Swedish registry, 25,656 patients with ADHD
  - During medication periods, criminality fell 32% in men and 41% in women
- **Chang et al., 2016** — 22,275 released prisoners in Sweden
  - Psychostimulants linked to fewer violent re-offenses

**–32/41%**  
criminality during  
ADHD treatment (M / W)

**–42.8**  
violent re-offenses per  
1,000 person-years

# Orbitofrontal Syndrome



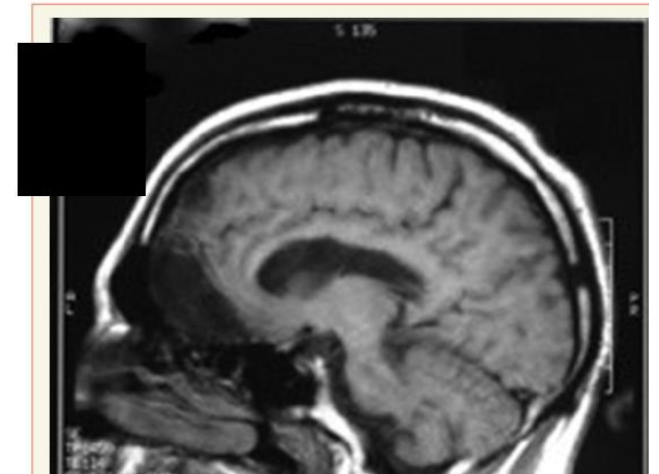
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## AN OVERLOOKED BUT ENDURING LINK TO VIOLENT BEHAVIOR

- Frontal-lobe dysfunction is often missed in forensic evaluations
- Yet it is one of the most durable findings in the neuropsychiatry of violence
- **Imaging here:** encephalomalacia and tissue loss after severe head trauma



*Sagittal MRI: orbitofrontal injury and tissue loss.  
Courtesy of Montgomery C. Brower, MD*

# Phineas Gage



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## THE PROTOTYPE OF ACQUIRED ORBITOFRONTAL PERSONALITY CHANGE

*“He is fitful, irreverent, indulging at times in the grossest profanity ... impatient of restraint or advice when it conflicts with his desires ... Previous to his injury he possessed a well-balanced mind ... he was ‘no longer Gage.’”*

— Dr. John Harlow, Gage’s physician

- Railroad foreman; an iron rod destroyed his orbital skull and basal forebrain
- Survived — but with a profound, lasting personality change

# Acquired Psychopathy?



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## WHEN FRONTAL INJURY MIMICS ANTISOCIAL PERSONALITY

- **Blumer & Benson:** clinical overlap between frontal-lobe syndrome and antisocial personality traits
- Shared features: disregard for social norms, impulsivity, and lack of remorse
- Developmental deficits from childhood head injury may explain some adult antisocial behavior

# Frontal-Lobe Dysfunction & Aggression



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## THREE CONVERGING LINES OF EVIDENCE

- **Blake et al., 1995** — 31 murderers awaiting trial/sentencing/clemency
  - 64.5% had clinical evidence of frontal-lobe dysfunction; minor irritants often triggered the act
- **Heinrichs, 1989** — 45 psychiatric inpatients
  - A CT-confirmed frontal lesion was the single best predictor of violent incidents
- **Krakowski & Czobor, 1997** — prospective case-control, persistently violent inpatients
  - More frontal impairment on testing; worse temper control and ward functioning

## Grafman et al., 1996: VHIS



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### VIETNAM HEAD INJURY STUDY — LOCALIZING AGGRESSION TO THE FRONTAL LOBE

- 279 veterans with penetrating head injury vs. 57 matched controls, 10–15 years post-injury
- Neuro exam, neuropsych & speech testing, EEG, evoked potentials, CT; family-rated aggression (KAS)
- **Higher aggression scores with:** ventromedial prefrontal and orbitofrontal injury
  - First study to show a statistically significant link between aggression and specifically ventromedial/orbital injury
  - Reported aggression was typically verbal; physical assault was less common

## Jensen et al., 1998: Huntington's Disease



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### NEURODEGENERATION OF FRONTAL-SUBCORTICAL CIRCUITS

- Danish registry: 250 patients with HD vs. 334 non-HD first-degree relatives
- **Male HD:** significantly higher crime rates (RR  $\approx$  2.8 vs. relatives, 2.3 vs. controls)
  - Theft, minor sexual offenses, animal cruelty, drug and driving offenses
  - Drunk-driving offenses in >14% of male HD vs. 2% of controls
- **No difference in females;** no cases of murder, rape, or robbery

# Frontotemporal Dementia & Antisocial Behavior



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## NEW-ONSET OFFENDING IN LATER LIFE

- **Miller et al., 1997** — first FTD-vs-Alzheimer's comparison
  - 10 of 22 FTD patients engaged in antisocial behavior vs. 1 of 22 with Alzheimer's
  - Assault, indecent exposure, shoplifting, hit-and-run — some leading to arrest
- **Distinct patterns:** Alzheimer's — agitation, confusion, paranoia; FTD — impulsive, opportunistic
- **Clinical pearl:** new-onset, out-of-character antisocial or sexual behavior in a late-middle-aged adult → consider FTD

## NEW: CTE, Repetitive Head Impact & Aggression



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### A FORENSIC QUESTION THE COURTS INCREASINGLY FACE

- **Mez et al., 2024 (Neurology)** — 845 brain donors with repetitive head-impact exposure
  - 70% had CTE at autopsy (avg. age 60; many former football players)
  - CTE + family history of mental illness → higher mid-life aggression than either alone
- **In the courtroom:** CTE can only be confirmed at autopsy — limiting its probative value at trial (JAAPL, 2020)

**70%**

of exposed brain donors  
had CTE at autopsy

**845**

brain donors studied  
(Boston University, 2024)

## Raine et al., 1994: PET in Murderers



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### IMAGING ENTERS THE PICTURE — FROM PET TO FMRI

- 22 defendants charged with murder (NGRI / competency referrals) vs. 22 matched controls
- FDG-PET during a frontal activation task (continuous performance task)
- **Finding:** significantly decreased prefrontal metabolism — both lateral and medial — in the murderer group
- **Limitations:** attorney selection bias; no non-violent criminal controls

# Yang & Raine, 2009: PFC Imaging



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## META-ANALYSIS ACROSS ANTISOCIAL, VIOLENT, AND PSYCHOPATHIC SUBJECTS

- 43 structural and functional imaging studies pooled
- **Reduced prefrontal structure and function** in antisocial individuals:
  - Right orbitofrontal cortex
  - Right anterior cingulate
  - Left dorsolateral prefrontal cortex
- **Effect sizes:** moderate to large

**43**

imaging studies  
pooled

**789**

antisocial subjects  
(vs. 483 controls)

## Alegria et al., 2017: Disruptive-Behavior fMRI



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### TWO FORMS OF ANTISOCIAL BEHAVIOR, TWO CIRCUITS

#### Disruptive-behavior youth

- Impulsive; fail to anticipate consequences
- ↓ rostro-dorsomedial ACC, fronto-cingulate, ventral striatum
- Impaired reward-based decision-making

#### Psychopathic-trait youth

- Ventromedial prefrontal & limbic dysfunction
- Dorsal prefrontal & fronto-striatal HYPER-function
- ↓ affective reactivity & empathy — intact instrumental planning

# Seizure Disorders & Aggression



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## A COMMON MISCONCEPTION, CORRECTED

- **Key point:** people with epilepsy are no more likely to commit violent crime than those without
- **Ictal** — rare, non-directed aggression during a complex partial seizure or twilight state
- **Post-ictal** — delirium with undirected aggression
- **Interictal** — psychosis of epilepsy; personality changes

# The Clinic vs. the Court



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DIAGNOSIS IS NOT THE SAME AS LEGAL RESPONSIBILITY

*“In order to be found guilty, a person must have a ‘guilty mind.’ ... There are clearly occasions when an act carried out will depend on a brain malfunction of which the person is not aware, or of which he or she is aware, but cannot control.”*

— Peter Fenwick, *British Journal of Psychiatry*, 1993

# Neuroimaging in Court: Promise & Caution



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## HOW FAR THE EVIDENCE CAN — AND CANNOT — GO

*“Functional imaging methods have not reached the level of sophistication required to predict any neurological or psychiatric deficit, much less explain more esoteric behaviors such as lack of judgment or remorse.”*

— Helen Mayberg, 1992

- **Where we are now:**
- Imaging is used more in sentencing than in culpability
- Expert testimony is essential to give an image meaning
- The same scan often yields conflicting expert opinions
- Admissibility and probative value remain contested

# Key Takeaways



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- **Brain & behavior are linked, but not deterministic** — frontal, especially orbitofrontal/ventromedial, dysfunction raises risk for aggression
- **Violence is multifactorial** — biology interacts with development, trauma, and environment; no lesion equals a criminal
- **Screen the incarcerated** — TBI, NDDs, and dementias are common and often treatable; treatment lowers reoffending
- **The law is moving** — from Roper to Mattis, neuroscience is reshaping how we judge young and injured brains



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# Thank you — Questions?

Jhilam Biswas, MD • Psychiatry, Law and Society Program, Brigham and Women's Hospital