Brain bases of psychological disorders
Kristine M. Jacquin, Ph.D.
Fielding Graduate University

Learning objectives:

1. At the conclusion of this presentation, attendees will be able to summarize the relationship between certain psychological disorders and specific psycholegal questions.
2. At the conclusion of this presentation, attendees will be able to evaluate the reasons for understanding the brain bases of psychological disorders.
3. At the conclusion of this presentation, attendees will be able to understand some of the latest research on the brain bases of psychological disorders.

Presenter biography:
Kristine Jacquin earned a B.A. at Northwestern University, and her M.A. and Ph.D. in clinical psychology at the University of Texas at Austin. Dr. Jacquin is a Professor of Psychology and Dean at Fielding Graduate University. She is also a licensed clinical psychologist with a consulting practice focusing on forensic and neuropsychological evaluations.

Selected references:


Brain Bases of Psychological Disorders

Presentation Purpose
- Provide an overview of new research on brain bases of psychological disorders

Overview of Talk
- Relationship between psycholegal questions and psych disorders
- Reasons for understanding brain bases of disorders
- Framework for connecting brain bases and criminal behavior
- New research on brain bases

Examples that provide context

- Relationship between psycholegal questions and psychological disorders

Is the defendant competent to stand trial?
- Schizophrenia and related disorders
- Neurocognitive disorders including TBI

Is the defendant criminally responsible?
- Schizophrenia and related disorders
- Neurocognitive disorders including TBI
- Post-traumatic stress disorder
Are there mitigating factors that should be considered in sentencing?
- Schizophrenia and related disorders
- Neurocognitive disorders including TBI
- Post-traumatic stress disorder
- Intellectual disability

Is this person likely to re-offend?
- Schizophrenia and related disorders
- Neurocognitive disorders including TBI
- Post-traumatic stress disorder
- Substance abuse and dependence
- Paraphilia

Did this person experience a psychological injury?
- Traumatic brain injury
- Post-traumatic stress disorder
- Other anxiety disorders
- Mood disorders

Is this person fit for duty?
- Traumatic brain injury
- Post-traumatic stress disorder
- Other anxiety disorders
- Mood disorders
- Substance abuse and dependence

Brain Bases of Psychological Disorders

Reasons for Understanding 1
- Explain behavior
- Understand possible causal and contributing factors
### Reasons for Understanding 2
- Support validity of diagnosis
- Contradict allegations of malingering

### Reasons for Understanding 3
- Course
- Prognosis
- Treatment options

### Limitation and Caution
- Some science may be too new to meet standards of evidence

### Brain Bases and Criminal Behavior
A FRAMEWORK FOR MAKING CONNECTIONS

### Raine’s (2008) Recommended Approach
- Connect genes to structural or functional brain abnormalities
- Connect brain abnormalities to problems with emotional or cognitive development
- Connect emotional and cognitive deficits associated with psych disorder to criminal behavior

### Case Example: Jane Doe
- 24-year-old woman
- Arrested for suffocating newborn to death
- 10+ year history of polydrug abuse, including alcohol and heroin
Case Example: Genetic Polymorphisms

- S-alleles of 5-HTTLPR
- Reduce activity of 5-HTT 30-40%
- Associated with violent & impulsive behavior (Gerra et al., 2004; Haberstick et al., 2006; Hallikainen et al., 1999; Sakai et al., 2006; Virkkunen et al., 1995)

Case Example: Brain Abnormalities

- Reduced gray matter volume in left PPC
- Associated with poor behavioral control, difficulty inhibiting impulses (Aron et al., 2003; Li et al., 2006; Swick et al., 2008)

Case Example: Emotional & Cognitive Deficits

- High impulsivity
- Impaired behavioral control
- Poor understanding of others' emotions
- Diagnoses: poly substance dependence, BPD

Case Example: Legal Outcome

- Genetic, biological, emotional/cognitive deficits → diminished capacity
- Resulted in reduced charges

Brain Bases of Psychological Disorders

SOME OF THE LATEST RESEARCH

SCHIZOPHRENIA
Face Processing in Schizophrenia

- Mothersill et al. (2014)
- Processing of angry and neutral faces
- Schizophrenia or schizoaffective disorder or healthy
- fMRI measured brain activation

Implications & Applications of Research

- Weaker deactivation of ACC → increased perception of social threat → increased likelihood of aggression
- Diminished capacity

Suspiciousness in the Brain

- Fisher et al. (2014)
- ERPs (P200, P300, N200)
- Emotion-word Stroop task
- Related to suspiciousness and anxious apprehension

Implications & Applications of Research

- Research + EEG
- Explain exaggerated or quick reaction resulting in criminal behavior
- Suspicious person with psychotic disorder or PTSD

Genetic Bases of Schizophrenia

- Arnedo et al. (2014)
- 8 interacting gene clusters → 8 set of symptoms
- Genetic analysis + symptoms + research → validate diagnosis

Traumatic Brain Injury
Reactions to Emotional Stimuli

- Amick et al. (2013)
- Go/No Go Task – reactions times, errors
- Military veterans – some with PTSD, mTBI
- Heightened response to emotional stimuli
- Difficulty inhibiting responses to emotional stimuli

Response Inhibition in the Brain

- Mediated by prefrontal, orbitofrontal, anterior cingulate (Aupperle et al., 2011, 2012; Esterman et al., 2012; Falconer et al., 2008; Swick et al, 2012)
- Regions negatively impacted by mTBI (Huang et al., 2009; Lo, Shifteh, Gold, Bello, & Lipton, 2009; MacDonald et al., 2011; Sponheim et al., 2011)

Implications & Applications of Research

- Research + relevant test results
- Explain why veteran with mTBI + PTSD responds with violence to non-threatening person/situation

Cytokine Production in Soldiers

- Smid et al. (2015)
- Immune system activation in post-deployment soldiers
- Different levels of combat stress exposure

Cytokine Production & Combat Stress Exposure

- High combat stress exposure: interaction between immune activation, post-deployment SLE, PTSD
- High cytokine production → higher PTSD in response to SLE
- Low combat stress exposure: normal cytokine production, no PTSD symptoms in response to SLE
**Implications & Applications of Research**

- High combat stress exposure: heightened sensitivity to SLE
- Research + tests of immune functioning → mitigation

**Glucocorticoid Sensitivity in Soldiers**

- van Zuiden et al. (2015)
- Glucocorticoid dysregulations before and after deployment
- Dysregulations persisted at least 6 months post-deployment
- Increased risk for PTSD, depression, fatigue

**Brain Activity in Trauma-Exposed Police**

- Covey et al. (2013)
- EEG
- Trauma-exposed police officers
- Task requiring attentional control and response inhibition
- PTSD: symptoms, no dx

**More Brain Activity in Trauma-Exposed Police**

- Peres et al. (2011)
- Police officers exposed to same trauma
- fMRI while recalling trauma memories
  - 3 groups:
    - PTSD sx, psychotherapy
    - PTSD sx, no psychotherapy
    - No PTSD sx ("resilient")

**Implications & Applications of Research**

- Research on biological vulnerabilities to maladaptive responses to SLE
- Predict resilience in face of combat
- Risk for violence or criminality post-combat

**Implications & Applications of Research**

- Trauma-exposed officers → monitoring to ensure not overwhelmed by demands
- Asserting impact of trauma on the brain even without full-blown PTSD
Implications & Applications
- Fitness-for-duty evaluations
- Risk assessments
- Justify psychotherapy

Childhood Maltreatment & the Brain
- De Bellis et al. (2013)
- Maltreated youth:
  - Lower IQ scores
  - Poorer academic achievement
  - Poorer performance on neuropsych tests of:
    - Executive functions
    - Attention
    - Memory
    - Language
    - Visuospatial skills
- CSA – poorer memory & language

Implications & Applications
- Custody and parental termination
- Psychological injury

PTSD from Child Abuse & the Brain
- Thomaes et al. (2010)
- PTSD related to child abuse
- Reduced brain matter in orbitofrontal & ACC
- Injury from child abuse

Substance Use
- Recreational Cannabis Use & the Brain
  - Gilman et al. (2014)
  - Brain morphometry
  - Young adult recreational cannabis users
  - Regular users who are non-dependent vs. non-users
  - Limbic system differences
Recreational use changes reward centers of brain
More sensitive to rewarding effects
Medical malpractice?

Brains of Unsuccessful Psychopaths

- Yang et al. (2010)
- Unsuccessful – caught for crimes
- Successful – not caught for crimes

Implications & Applications

Do not recognize cues of impending arrest
Explain risky and impulsive behavior of unsuccessful psychopaths

Violent Behavior

Serotonin Regulation & Violence

- 5-HTT – regulates serotonin
- Genetic promoter region 5-HTTLPR
  - Short variant (alleles)
  - Long variant (alleles)
- Short variant
  - Poor serotonin regulation
  - Criminality and violence (Cadoret et al., 2003; Liao et al., 2004)
Serotonin Regulation & Emotional Responding

- Papousek et al. (2013); Wacker et al. (2013)
- Electrical activity associated with S-alleles, L-alleles
- Faced with aversive stimuli, people with S-alleles:
  - Increased activity in dorsolateral frontal cortex, shifted right
  - Prefrontal EEG alpha asymmetry: situational emotional demands x appropriate handling of demands

Implications & Applications

- S-alleles of 5-HTTLPR + negative emotionally-laden content
  - Emotional withdrawal
  - Inappropriate responses
- Explain criminal & violent behavior

Conclusions

- Research on brain bases of psychological disorders and behaviors
- Some caution in forensic arena
- Promise for forensic applications

Questions?

- If questions later, email me at kjacquin@fielding.edu or drkristinejacquin@gmail.com