The Trauma Deep Within the Genes:
The Epigenetics of PTSD

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Clinical Understanding of PTSD

- Mental Health Disorder TRIGGERED by Traumatic Event
- Adaptive Response

**DSM-IV Diagnostic Criteria for PTSD**

- Exposure to a traumatic event and subjective emotional response of fear, helplessness, or horror
- Persistent re-experiencing of the traumatic event
- Persistent avoidance and numbing
- Persistent symptoms of increased arousal
  - *Significant distress or impairment*
  - *Duration of at least 1 month*
Scientific Understanding of PTSD: The Brain

Key Players:
- Hippocampus
- Prefrontal Cortex
- Amygdala

Comparison Studies:
- Combat Exposure
- Trauma
- PTSD
Gene x Environment

- **Genes**
- **Environment**
- **Phenotype**

- **Genetic variability**
  - e.g. FKBP5, BDNF, SERT

- **Environmental risks**
  - e.g. Adverse childhood experience, High crime rates

- **Incident trauma**
  - e.g. War zone trauma, Violent crime, Car accident

- **PTSD symptoms**
  - Hyperarousal, Re-experiencing, Avoidance
Epigenetic Modifications

DNA methylation

DNMTs 

miRNA-induced PTGS 

Histone modifications

Molecular scaffold

DNMTs, MBDs interact with HDACs

Nucleosome interaction

DNMTs preferentially bind to nucleosomal DNA

Nucleosome remodeling

miRNA-induced PTGS

Noncoding RNAs

NURFs

Transcriptional silencing

Dicer

Drosha

Source: Nat Rev Urol © 2010 Nature Publishing Group
Inside the Epigenome—Animal Studies

-DNA methylation as a result of Maternal Programing of Stress Responses in Rats

-Rat and Animal Model of PTSD (Cat Exposure) - *Bdnf*
DNA methylation in the dorsal hippocampus

-Altered Immune Systems
Inside the Epigenome—Human Studies

- Methylation status of the human NR3C1 gene in newborns to Depressed Mothers
Longitudinal Case Studies: Stress Across Generations

Stress Across Generations

![Graph showing cortisol levels across different groups.](image)

- No parental PTSD; no PTSD (N=11)
- Parental PTSD; no PTSD (N=14)
- Parental PTSD; PTSD (N=10)

Comparison (N=15)  
Holocaust offspring
Implications

Understanding PTSD-Treatment and Diagnosis

New Methods of Treatment

Screening due to Heritability

New Understanding of Effects on Stress and Trauma

PTSD-Manifestation of GXE
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2891396/

http://www.nature.com/mp/journal/v6/n4/full/4000867a.html


