

**On the Front Lines: Addressing Stress, Trauma & Suicide Prevention in Community Responders**

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Alabama Activity Center  
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**The Neurobiology of Suicide: Science, Treatment and Prevention**

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**Suicide: National Statistics**

- Contemplated suicide: 8,300,000 (2.6%)
  - Suicide plans: 2,300,000 (28%)
    - 0.7% U.S. population
  - Suicide attempts: 1,100,000 (13%)
    - 0.3% U.S. population
  - Suicides: 42,773 (4%)
    - 0.01% U.S. population

**“If...Then”**

- If
  - People with depression / suicide identified
  - They get to treatment
  - Treatment is done properly
  - Stick with treatment
- Then
  - 80% sustained recovery
  - 90% improved

**“If...Then”**

**Suicides in New York City (Andy Leon):**

- Adults: 23.1% receiving treatment
- Ages 18-24: 13.9%
- Not enough people get the treatment they need

**Suicide Risk Factors: One Path**

- Severe mental disorder (MDD, schizophrenia, substance abuse, etc.)
- AND (OR)**
- Environmental stress (hopelessness)
    - Unemployment
    - Financial problem
    - Separation / loss (e.g., divorce), etc.
  - AND Impulsivity

### Serotonin is Involved in Suicide

- People who commit suicide have fewer serotonin neurons in the brain
- Serotonin and its main metabolite (5-HIAA) are lower in people who make suicide attempts
- The more lethal attempts are associated with lower brain serotonin
- Lower serotonin is associated with more impulsive attempts

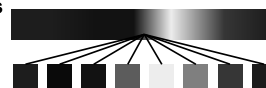
### The Serotonin System

- Serotonin is mainly inhibitory in the nervous system
- One important region affected by serotonin: The frontal lobe (prefrontal cortex)
  - Involved in decision-making and social behavior

- Suicidal behavior appears to be related to serotonin activity, but...
- Serotonin deficits predispose to impulsivity, not suicide per se
- This tells us what happens at the “macro” but not the “micro” level
- It tells us what, not why
- It tells us only about one form of suicide

### Suicide Phenotypes

- **Genotype:** Genetic makeup
- **Phenotype:** The characteristics that heredity produces
  - Helps divide into genetically distinct groups
- Suicide phenotypes
- Irritability/Anger
- Inattention
- Impulsivity
- Emotional instability
- Mistrust



### Is Suicide Genetic?

- Yes, but...not in the way we typically think of genetics
  - Only 1.5% of human DNA is in genes
  - The environment influences behavior, including suicide risk
    - For example, child sexual abuse increases risk 10-14x
    - How does this work?

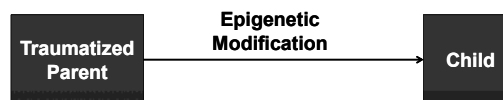
### Evidence for Human Transgenerational Transmission

- Dutch “Hunger Winter” famine > ↑ risk F1 mental health & metabolic disease
  - Highest risk first trimester
  - F1 fathers transmitted risk to F2
- Pregnant women exposed to WTC attacks with PTSD > Δ HPA axis function in offspring ↓ cort.

### Evidence for Human Transgenerational Transmission

- Female holocaust survivors with PTSD > poorer emotional physical health in offspring
  - Differential methylation GR
  - ↓ cortisol

### Intergenerational Effect of Trauma



### Suicide Prevention: Treatment

- Clozapine
- Cognitive behavioral therapy
  - Mindfulness-based cognitive therapy
  - Dialectical behavioral therapy
- Lithium
- Ketamine

### Brief Cognitive-Behavioral Therapy Effects on Post-Treatment Suicide Attempts in a Military Sample: Results of a Randomized Clinical Trial With 2-Year Follow-Up

### Decreased Risk of Suicides and Attempts During Long-Term Lithium Treatment: Meta-analysis

- 31 studies
  - Person years of risk exposure: 85,229
- Effect of lithium treatment:
  - ~80% reduction in suicide risk
    - RR=4.91 (CI=3.82 – 6.81)
  - Attempt-to-suicides: +2.5 fold
    - Decreased lethality
- MDD + bipolar disorder

### Summary

- Suicide rates have been increasing over the last 20 years
- Getting the right treatment to the right person reduces risk
  - But...most people who commit suicide are not in treatment
- Need: To use modern prediction algorithms to determine who is at risk > prevention