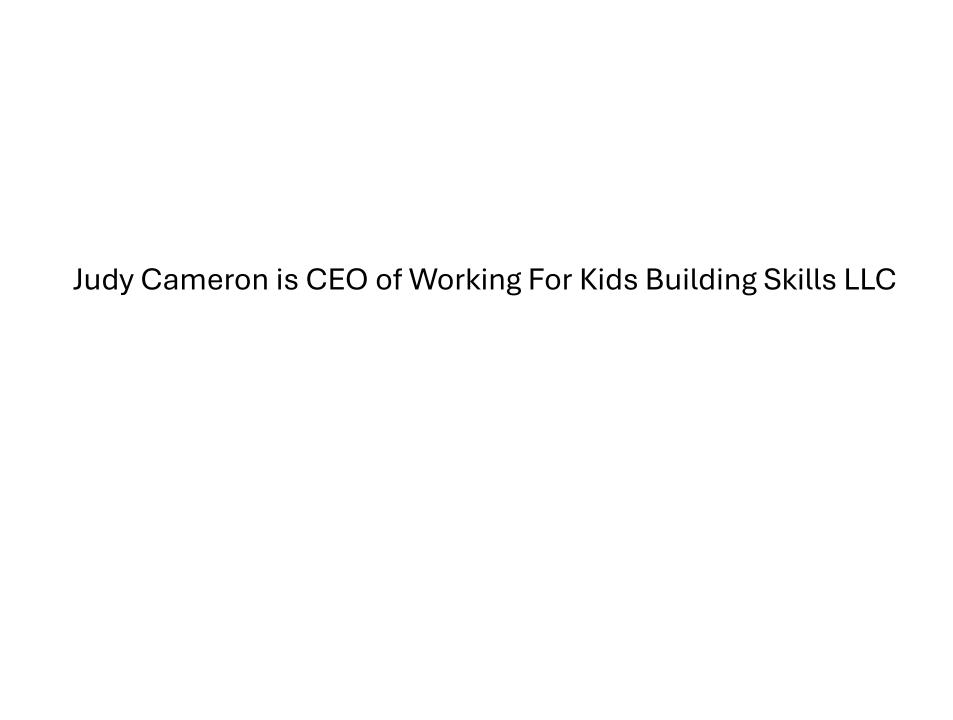
## Neurobiological Mechanisms Underlying Stress Susceptibility and Resilience

Lessons Learned from Studies with Nonhuman Primates and Young Children

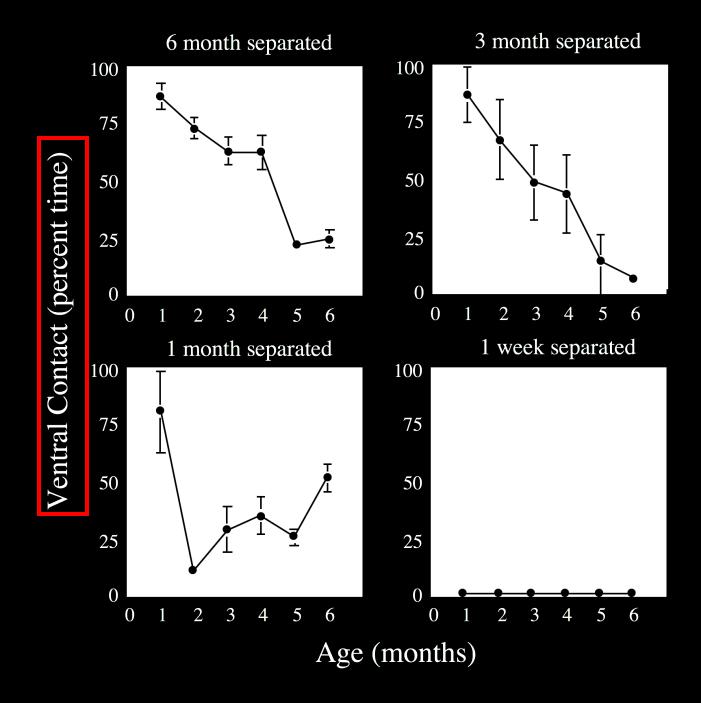
### Judy L. Cameron, PhD

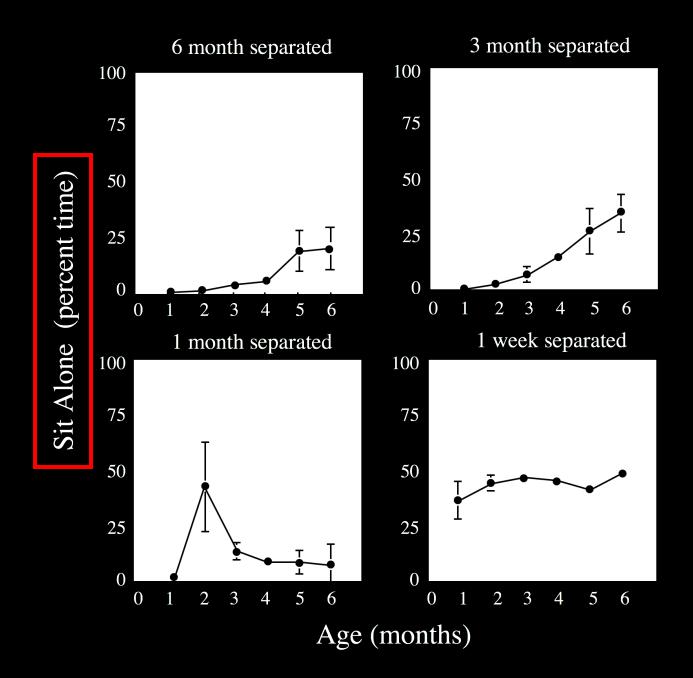
Departments of Psychiatry, Neuroscience, Behavioral & Community Health, and the Clinical Translational Science Institute, University of Pittsburgh





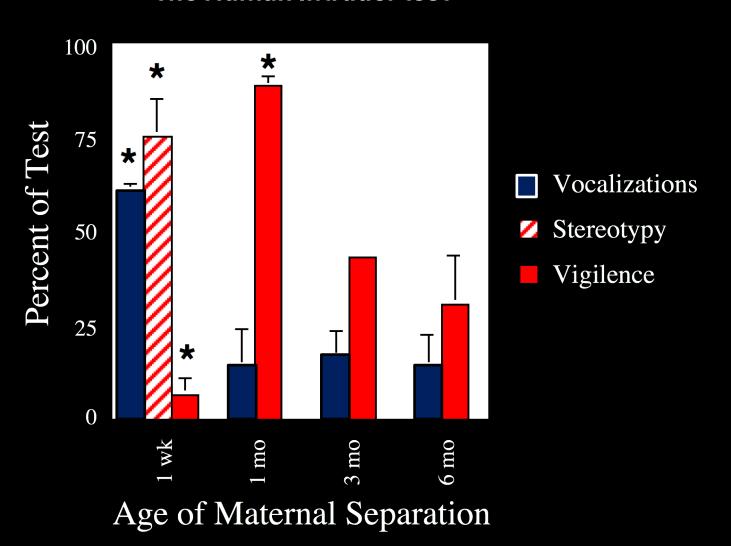






## Social Anxiety Differs Depending on *Timing of Stress*





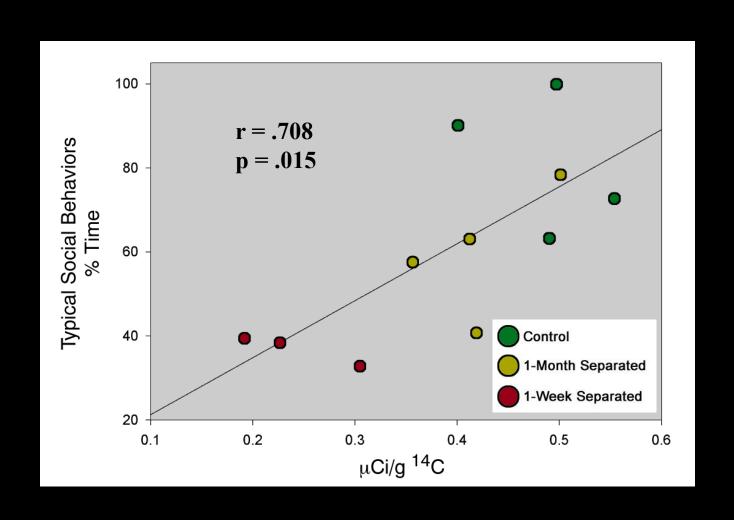
# Timing of Stress Leads to Long-term Differences in Amygdala Gene Expression

#### **Amygdala Microarray Studies**

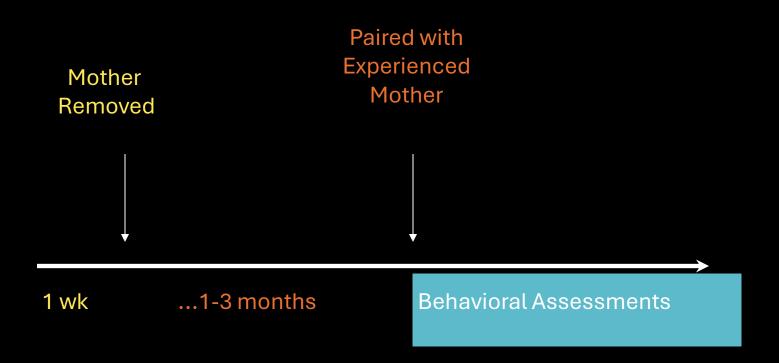
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2 9 (b) 17) ARBSSSO6 (" HOMO SAPENS COMA FULH 1344 PS., CLONE FLACEI BHSSS, MODERATELY SWILAR TO ZINC FINGER PROTEIN 91"
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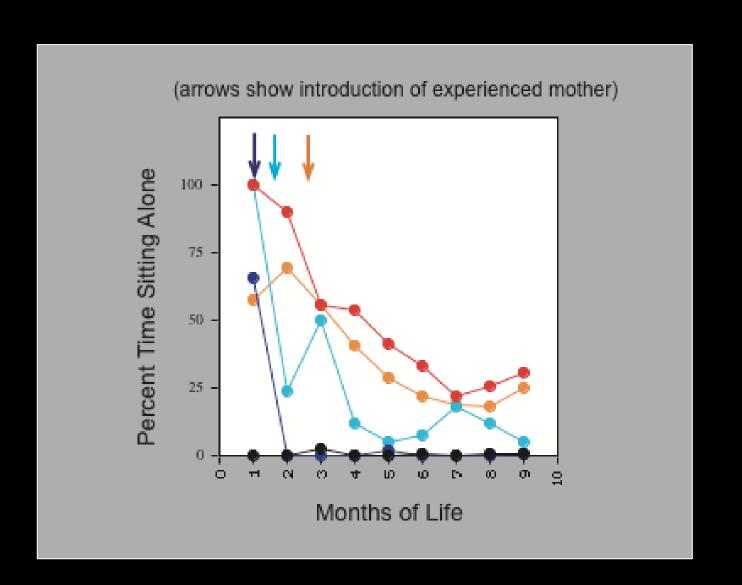
## Typical Social Behavior vs. Guanylate Cyclase $1\alpha 3$



## Intervention Design



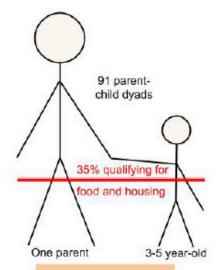
## Pairing with an Experienced Mother is More Effective when Initiated Early



# Lessons Learned from Studies with Young Children

Life stresses are more complex:

Parent Education
Adversities (faced by parents)
Adversities (faced by children)



#### Baseline Data Collected

ACE exposure

Demographics<sup>2</sup>

BRIEF-P<sup>4</sup>

NIH toolbox6: PVT & DCCS

FVI & DCCS

CSHQ5

7-day sleep log

ASQ and ASQ-SE3

interaction

-coded using the Simple Interactions coding system<sup>7</sup>

- Connection
- Reciprocity
- Opportunity to Grow

10 min video of parent-child

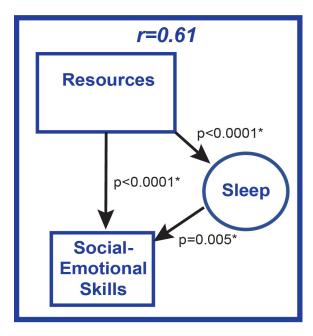
Latent Factor Analyses + Mediation Analyses

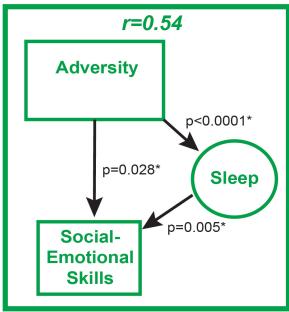
Resources (income + parent education)

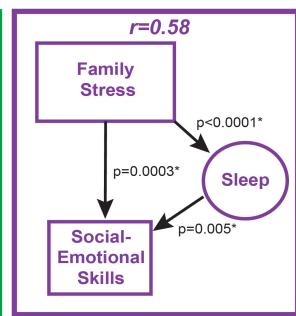
> Adversity (pACEs + cACEs)

Family Stress (pACEs + cACEs + income + parent education)

# Social-Emotional skill development is similarly impacted by adversity and low resources



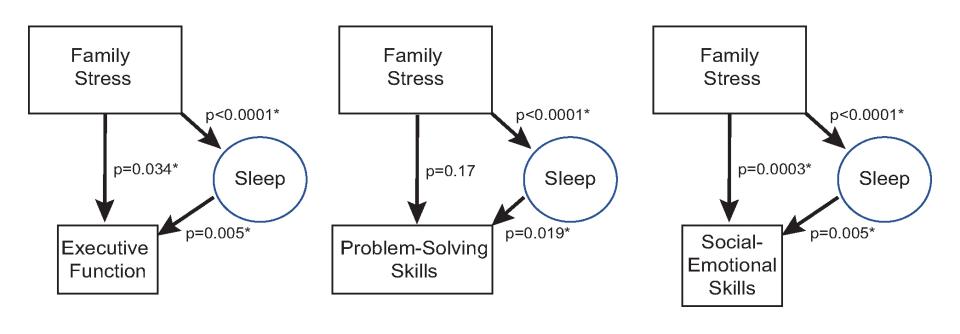




...and in all mediation models

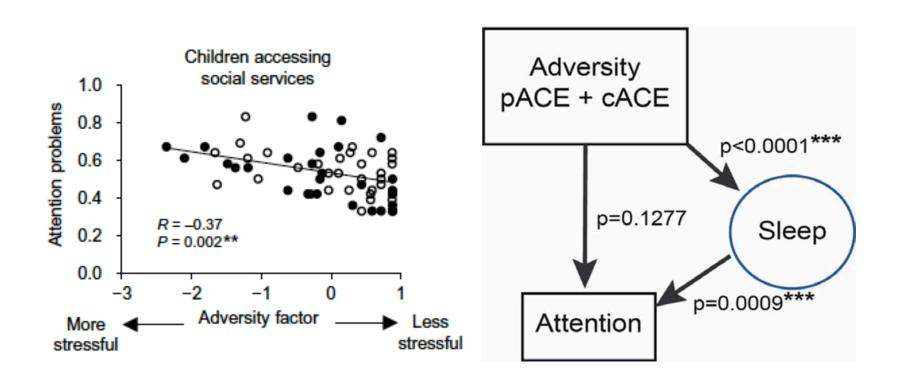
Sleep is a significant mediator.

# Sleep mediates the impact of stress on all of children's developmental skills



## Gender also influences susceptibility to stress/resilience

Adversity is associated with attention problems in boys



Again...Sleep is a significant mediator

## What Have We Learned?

- The *developmental timing of stress exposure* influences whether an individual is stress sensitive or stress resilient for specific outcomes.
- Social support improves resilience, but the timing of providing social support matters.
- Early life stress leads to *long-term changes in behavior, gene* expression and neuroanatomy.
- Sleep is an important mediator of the impacts of stress on developmental skills. Thus, sleep plays an important role in mediating the transition between stress sensitivity and resilience.
- **Gender** can matter when considering stress sensitivity or stress resilience.







# This is the work of very valued Colleagues, Collaborators, and Students



David Kupfer
David Lewis
Neal Ryan
Jeanette Trauth
Emma Doenier
Alexandra Miragaia
Ian Murphy
Christina Codario
Swetha Tummala
Breanna Sullivan

Lani Vargas
Sachi Penha
Julianne Wanner
Sai Bhatte
Delaney Jones
Alison Letavic
Jessica Levenson
Madison Very
Marisa Laws
Nathan Rockcastle



Jelena Komanchuk Amelia Potter Bikram Sekhon Nicole Letourneau



Pat Levitt



Karoly Mirnics



Takao Hensch Yuichi Makino

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