

STRESS, BUFFERS, RESILIENCE, AND THE BRAIN

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National Academies of Sciences, Engineering, and Medicine Workshop on Stress and Resilience

Disclosures

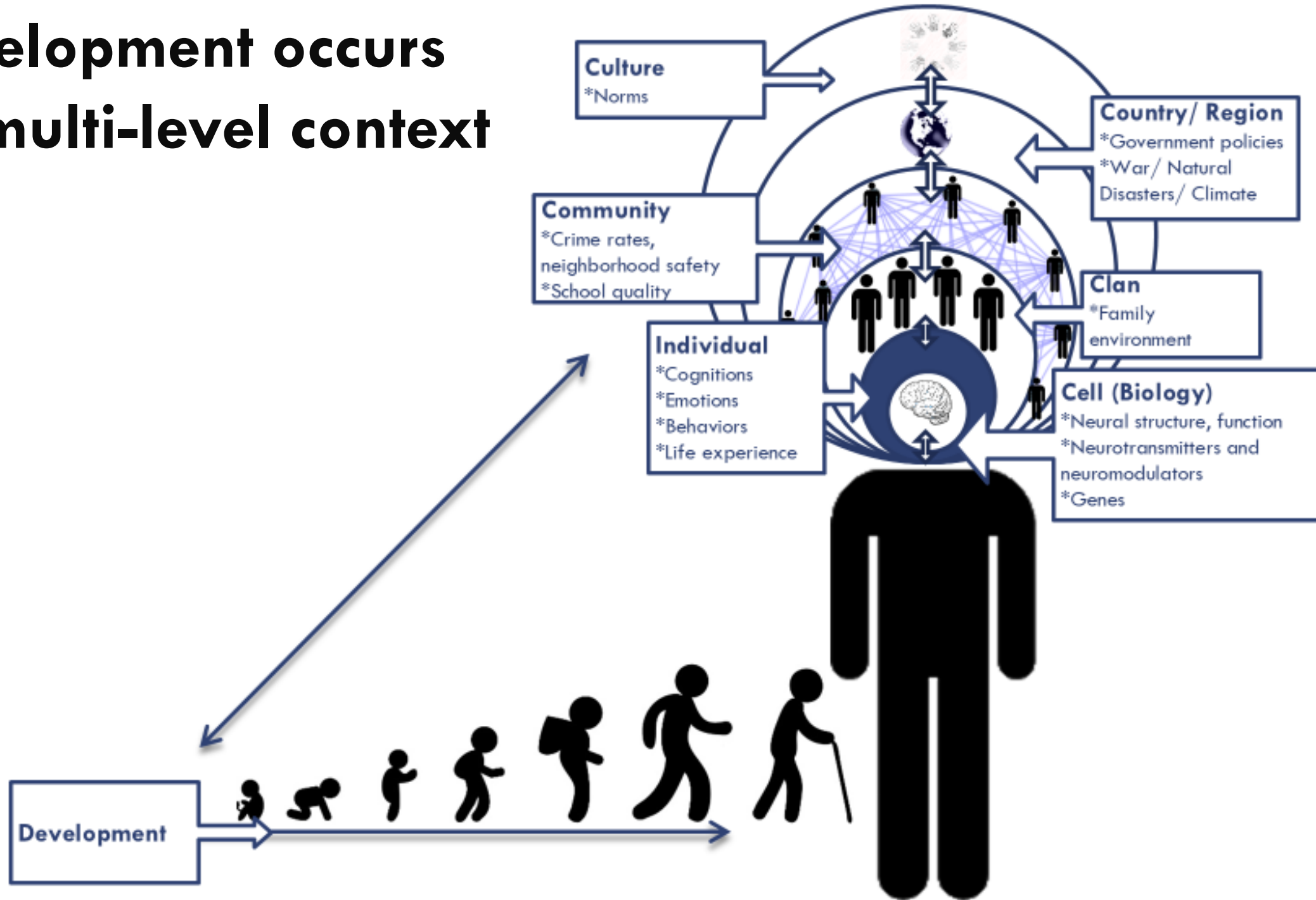
- Current Research Funding:

- ▣ NIH: R01-MH139198, R0-MH130442, U01-HD11063, R01-MH130158, R01-HD103699, R01-HD104297, R01-MH121079, UG3/UH3-MH114249, R01-MD011716, U01-DA041106, R01HD093334, R01-MH103761

- ▣ National Institute of Justice: MU-CX-0044

- Other: my wife, Kelley Kidwell, is co-founder/owner of SMART Workshops which provide statistics, methods, and research training.

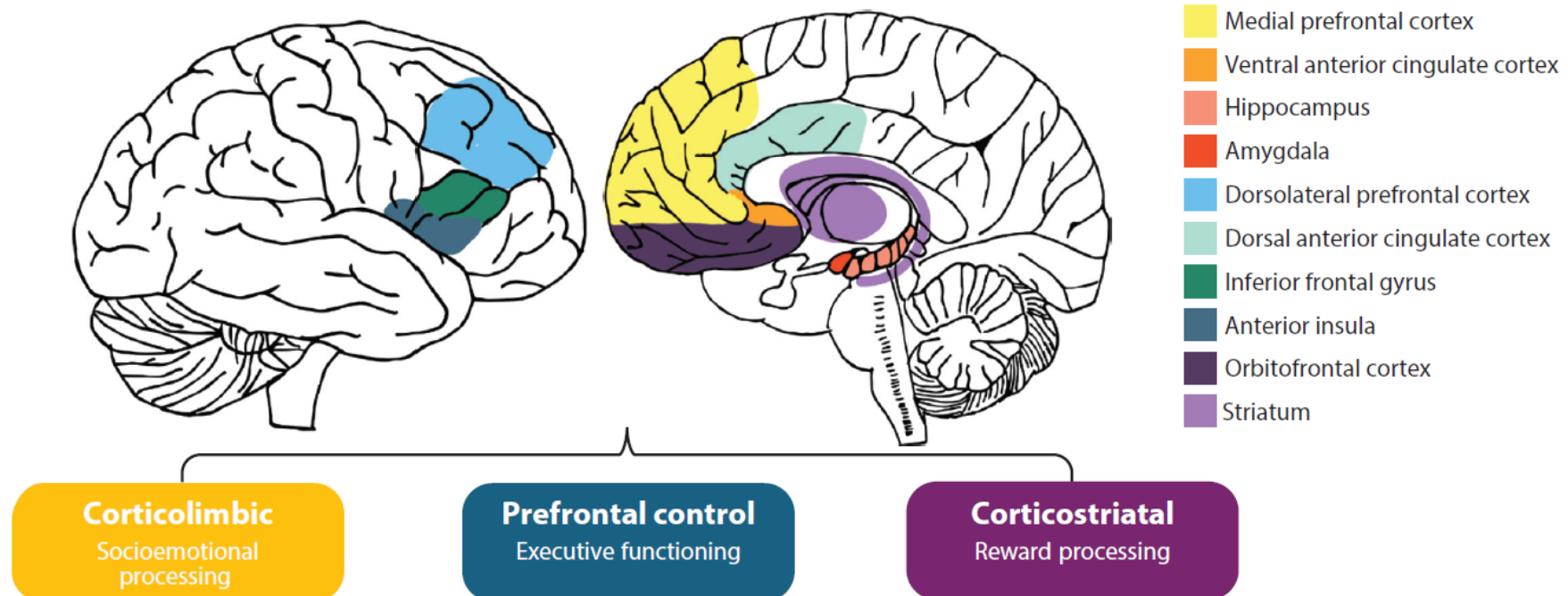
Brain development occurs within a multi-level context



Falk et al., 2013,
PNAS
Hyde et al., 2024,
Dev and Psycho
Hyde et al., 2022,
Child Dev Persp

How does adversity undermine development?

- Adverse experiences are linked to differences in brain structure and function
 - ▣ In brain areas important for processing threat, learning, emotion and emotion regulation, and behavioral control



Mechanisms of the impact of adversity

- Early harsh parenting predicts amygdala to emotional faces
 - ▣ Amygdala activity is a mechanism linking harsh parenting and neighborhood disadvantage to antisocial behavior

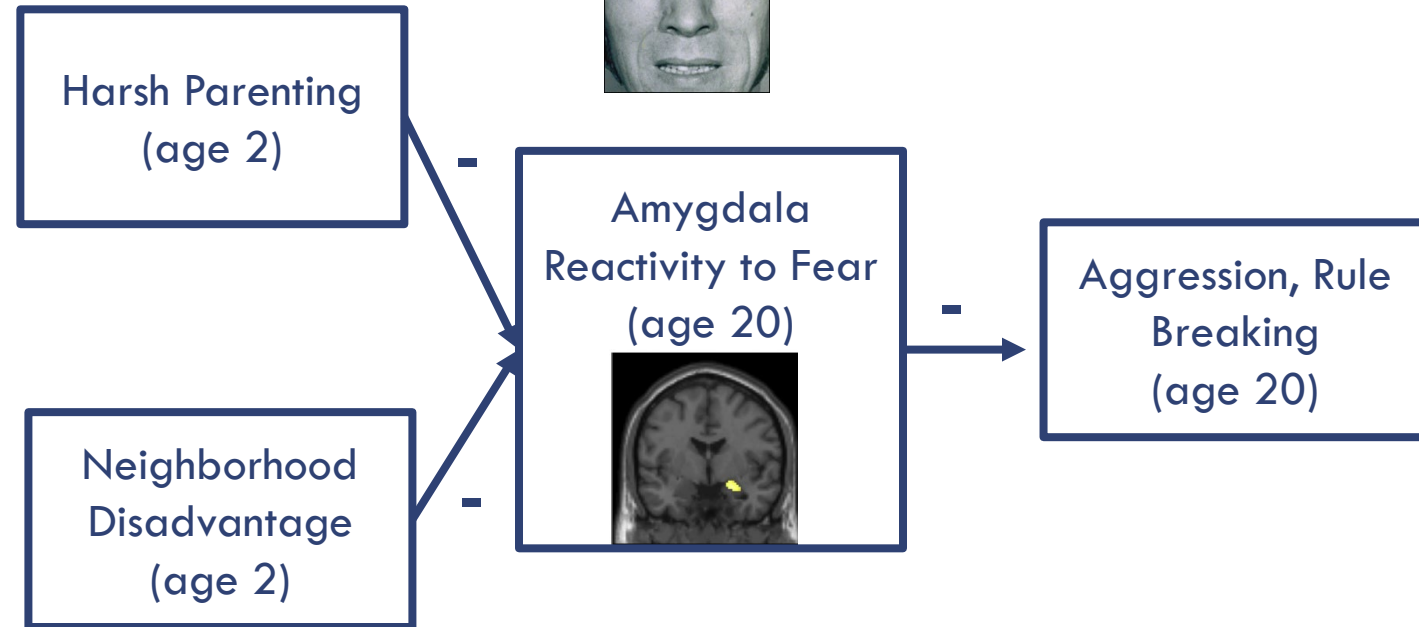
Sample:
167 boys from low-income families in Pittsburgh
Recruited from WIC sites



Arianna Gard



Daniel Shaw



Mechanisms of the impact of adversity

□ Neighborhood disadvantage

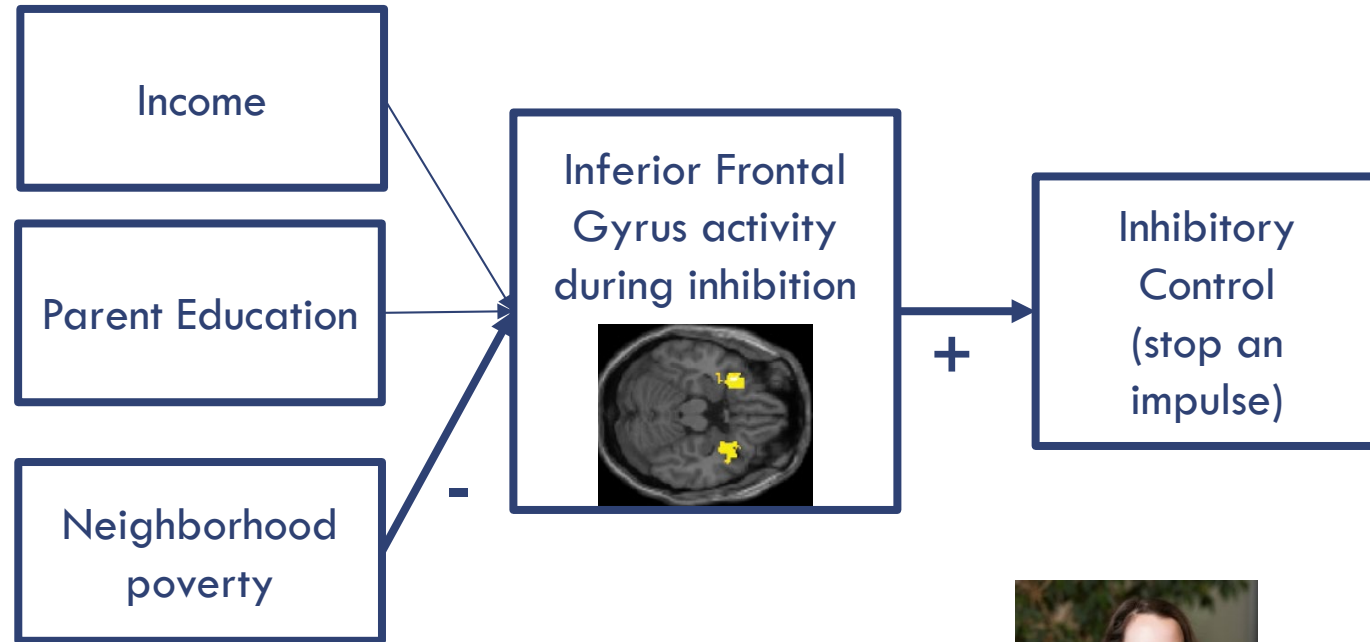
▣ Inferior frontal gyrus activity during inhibition

▣ Ventral striatum response during reward

Westerman et al., 2024, SCAN

▣ Amygdala reactivity to threat

Suarez et al., 2024, Dev Psych



Sample:
215 twins recruited from birth records in Michigan neighborhoods with above average levels of family poverty

Tomlinson et al., 2020, NeuroImage



Rachel Tomlinson



S. Alexandra Burt

The timing of these exposures matter

- The parts of the brain most rapidly developing may be most impacted

- ▣ Harsh parenting:

- Sample: 237 youth from the Future of Families and Child Wellbeing Study (FFCWS)

Age 3:
amygdala
reactivity



Change from
3 – 9:
ACC activity



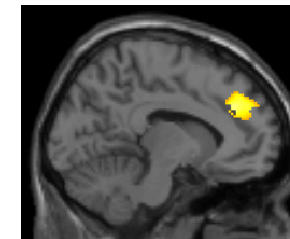
- ▣ Neighborhood Disadvantage:

- 2 samples of youth; neighborhood measured via census data

Age 1-5:
amygdala
reactivity



Age 15
ACC activity



Chris
Monk



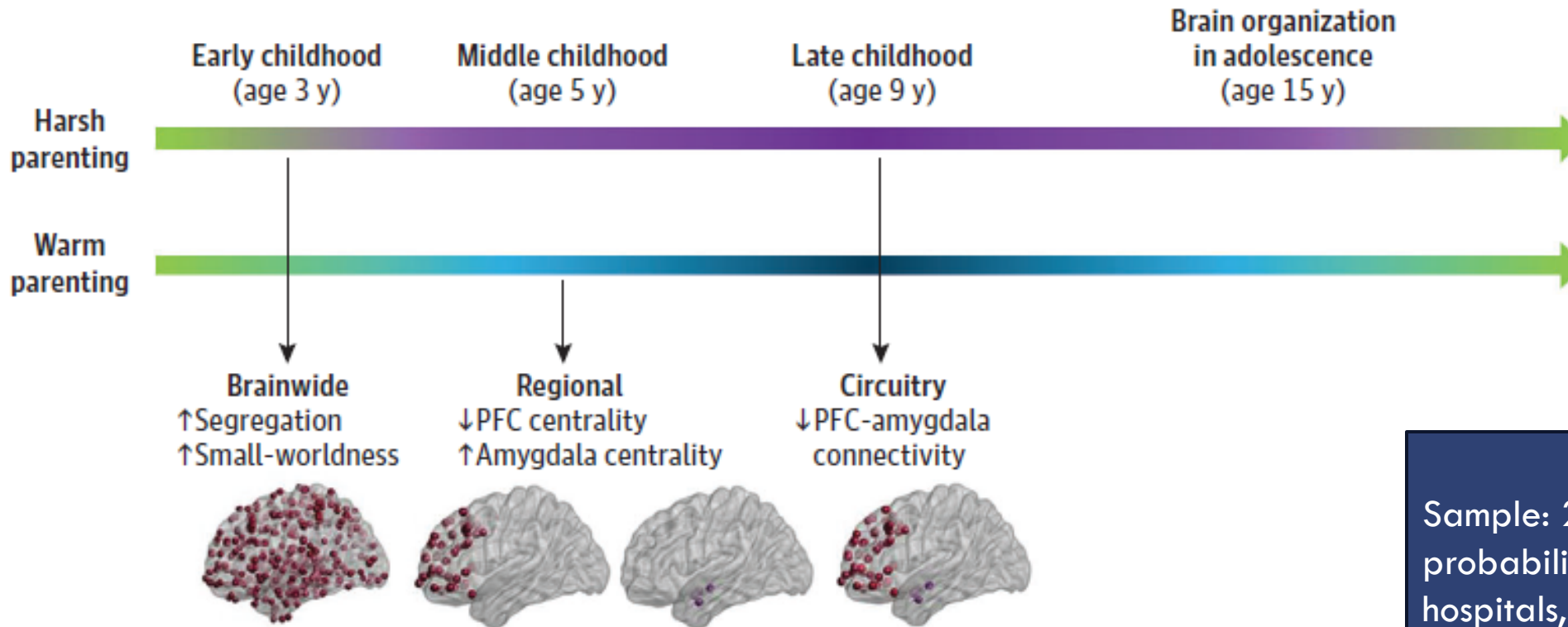
Colter
Mitchell



Arianna
Gard

Timing Matters

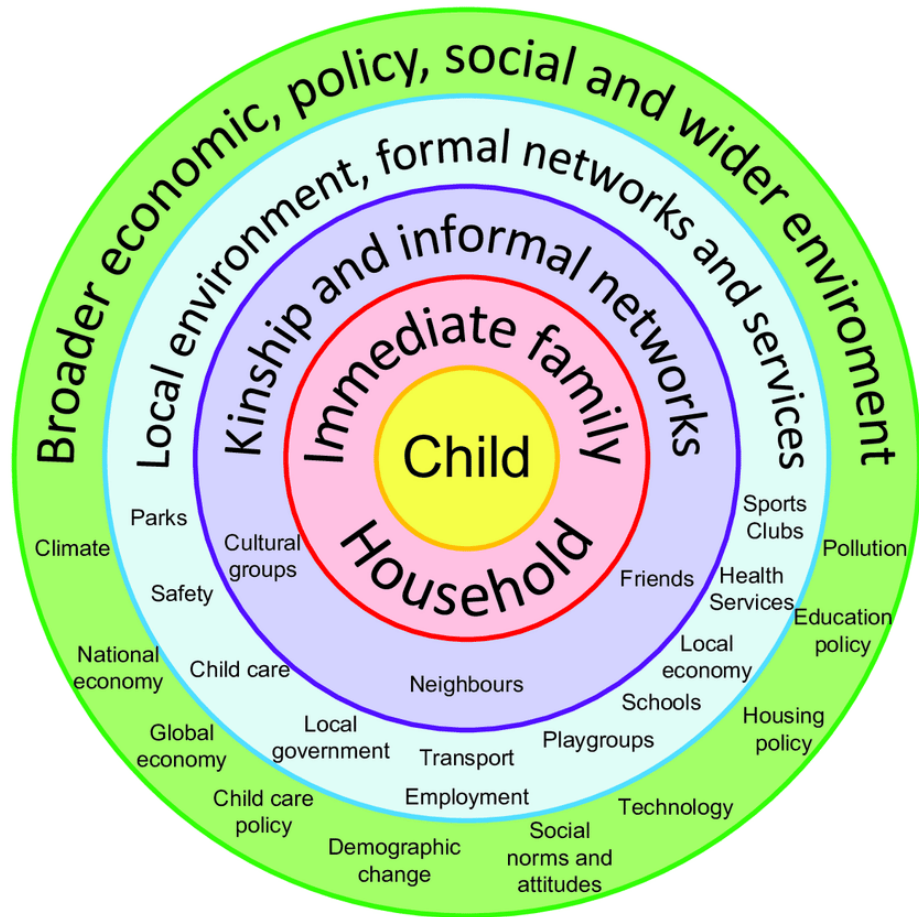
- Impacts may move from broader to more specific



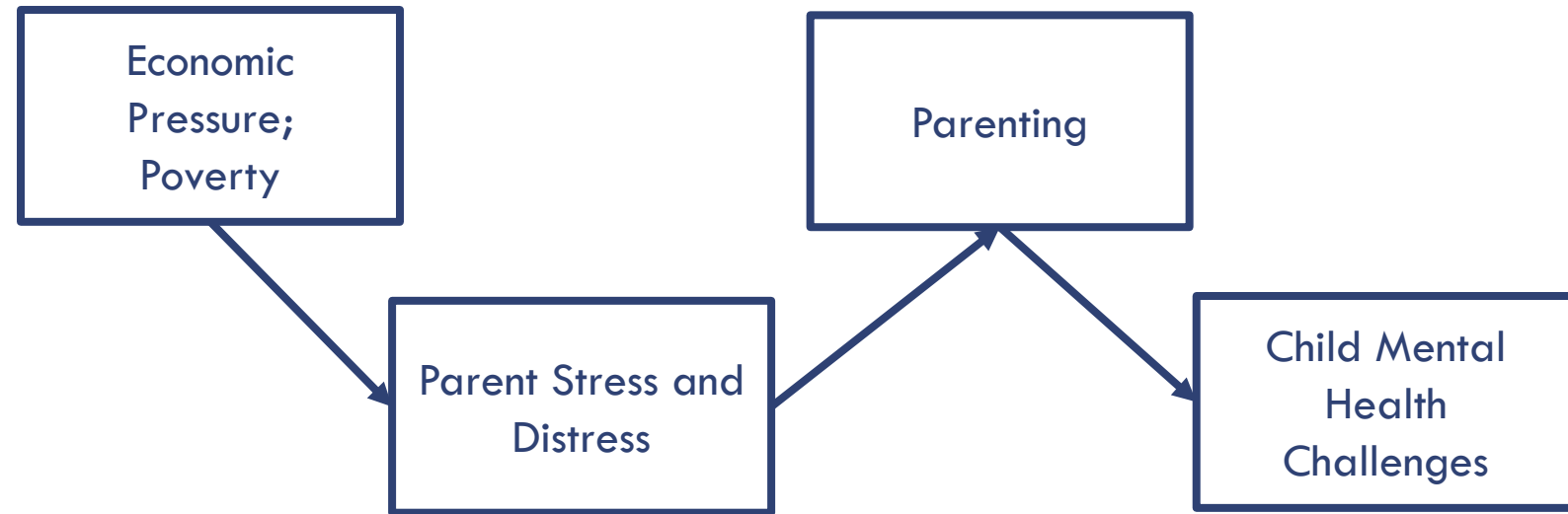
Cleanthis Michael

Sample: 237 youth (age 15)
probability sampled from urban US
hospitals, oversampled for low-
income (FFCWS)

Broader adversity is filtered through proximal experience



Bioecological Model (Uri Bronfenbrenner)



Family Stress Model (Rand Conger)

Broader adversity is filtered through proximal experience

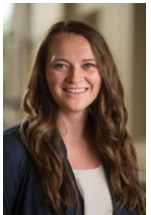
□ Including for brain outcomes:

- ▣ Amygdala (threat; left)
- ▣ Ventral striatum (reward; right)

Sample:
708 Twins (age 7- 18) from
disadvantaged Michigan neighborhoods



Gabby
Suarez



Heidi
Westerman



Relationships can buffer these effects



□ Warm & involved parents

- ▣ Buffer impact of exposure to community violence on amygdala reactivity

Suarez et al., 2024 *Dev Psych*

□ Neighbors

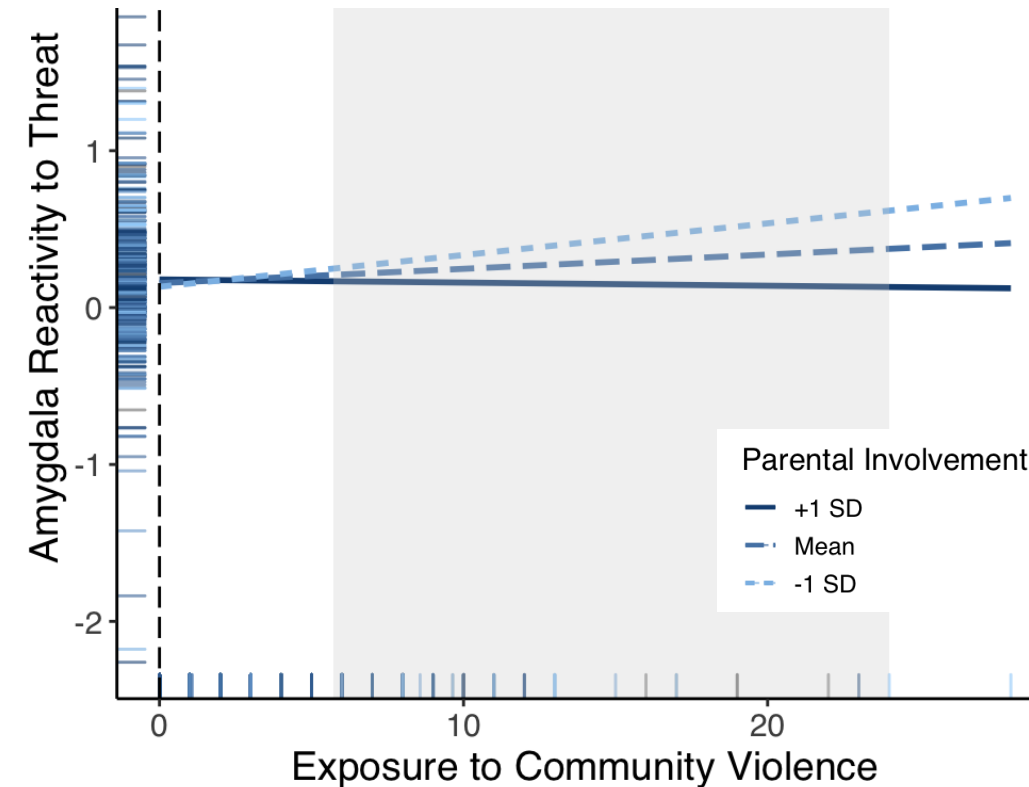
- ▣ Strong neighborhood norms
 - Exposure to community violence on amygdala reactivity

Suarez et al., 2022, *Dev Cog Neuro*

▣ Neighbor collective efficacy

- Exposure to deadly gun violence within 500 m
 - Externalizing and internalizing mental health problems
 - Amygdala-prefrontal cortex connectivity

Gard et al., 2022, *PNAS Nexus*



Samples:

708 Twins (age 7- 18) from disadvantaged Michigan neighborhoods

237 youth (age 15) low-income (FFCWS)

Positive parents also buffer genetic risk



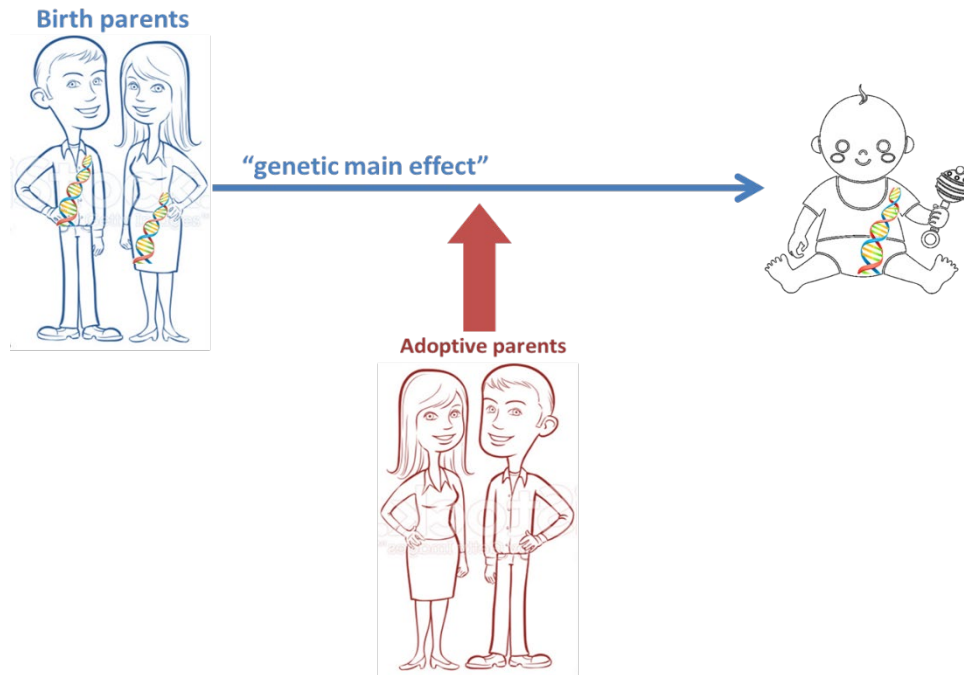
Leslie
Leve



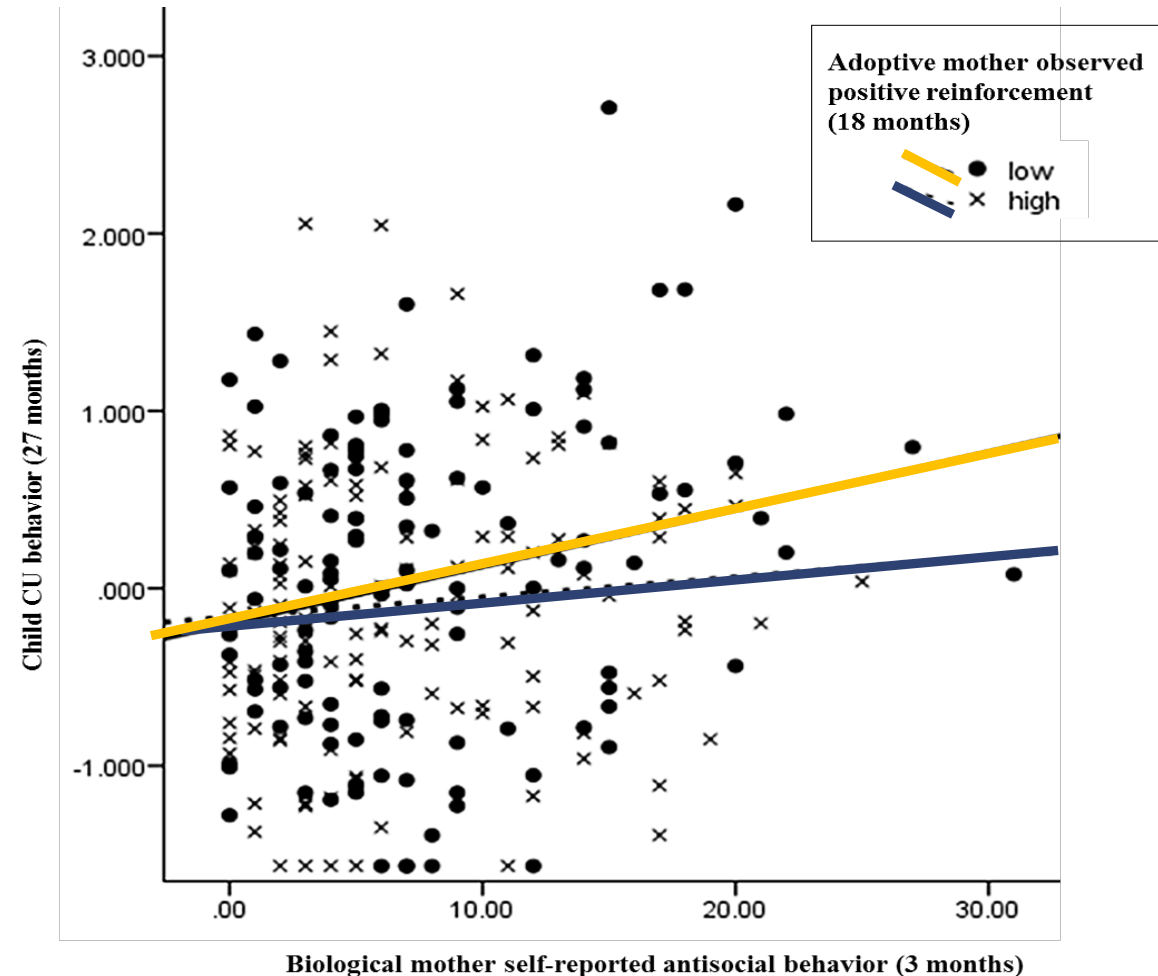
Jenae
Neiderhiser



Becky
Waller



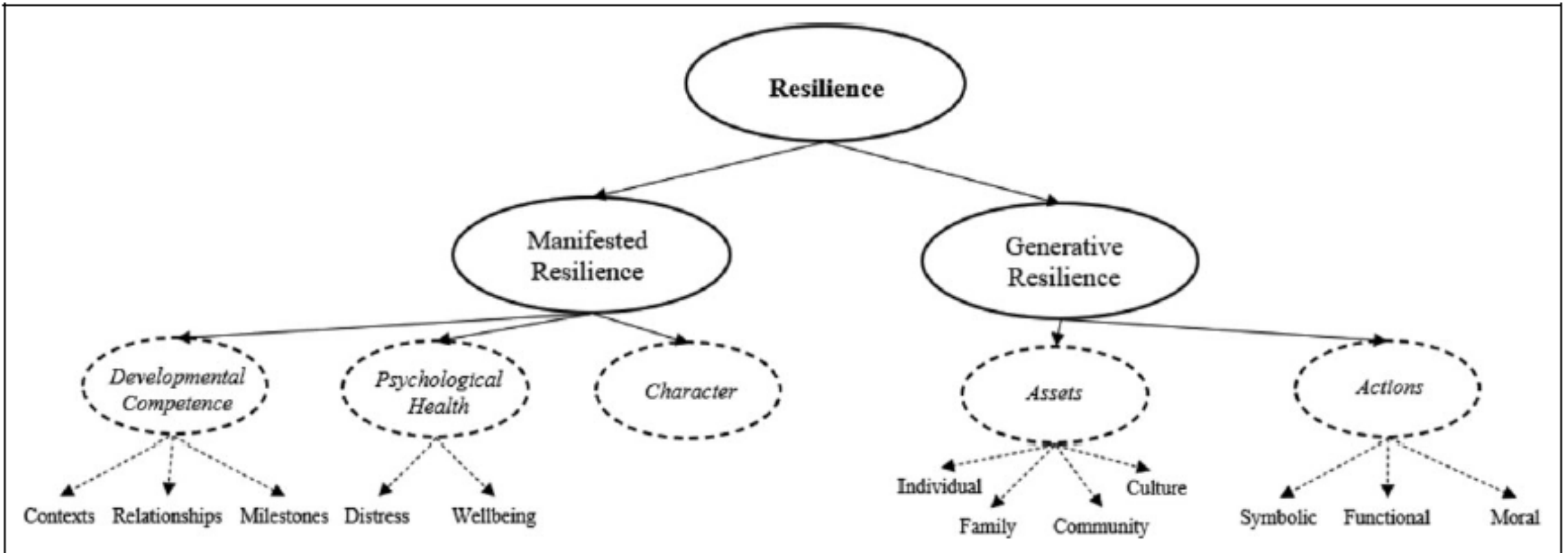
Sample: Early Growth and Development Study
506 Adopted children and their adoptive
parents and birth parents



Resilience

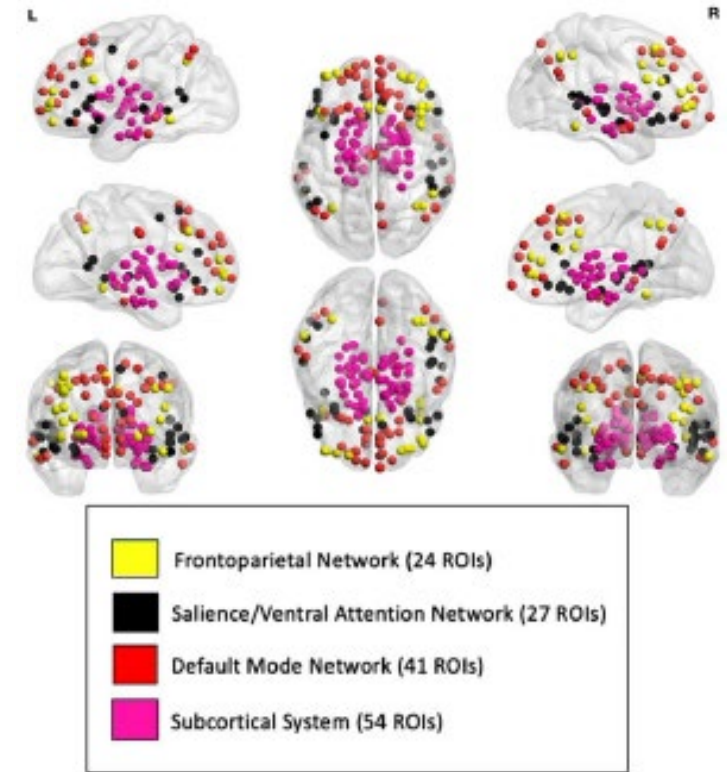
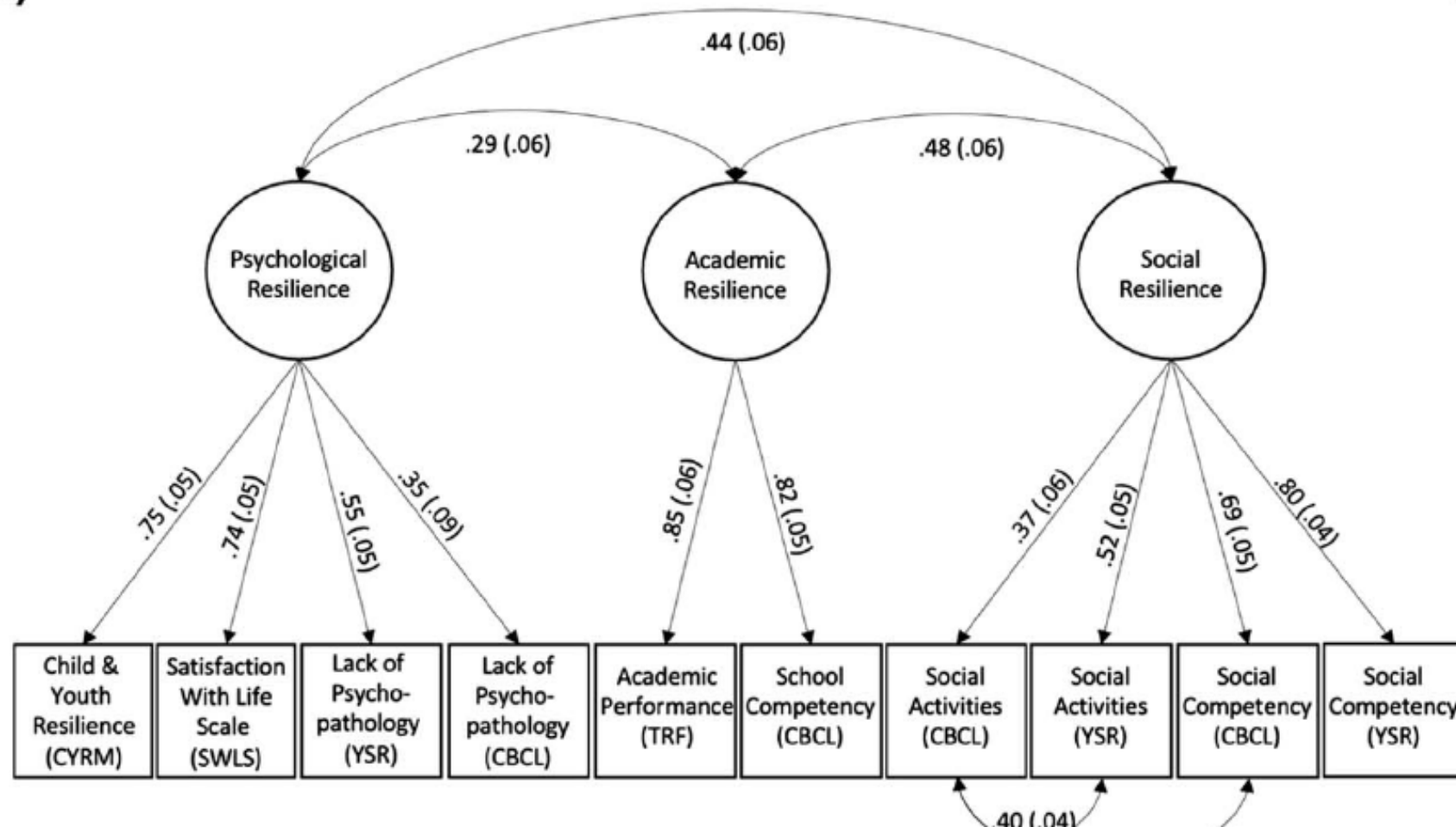
- Multi-domain, including positive functioning

From: Miller-Graff, 2022; *Trauma, Violence, & Abuse*



Neural correlates of manifested resilience

Resilience to neighborhood disadvantage

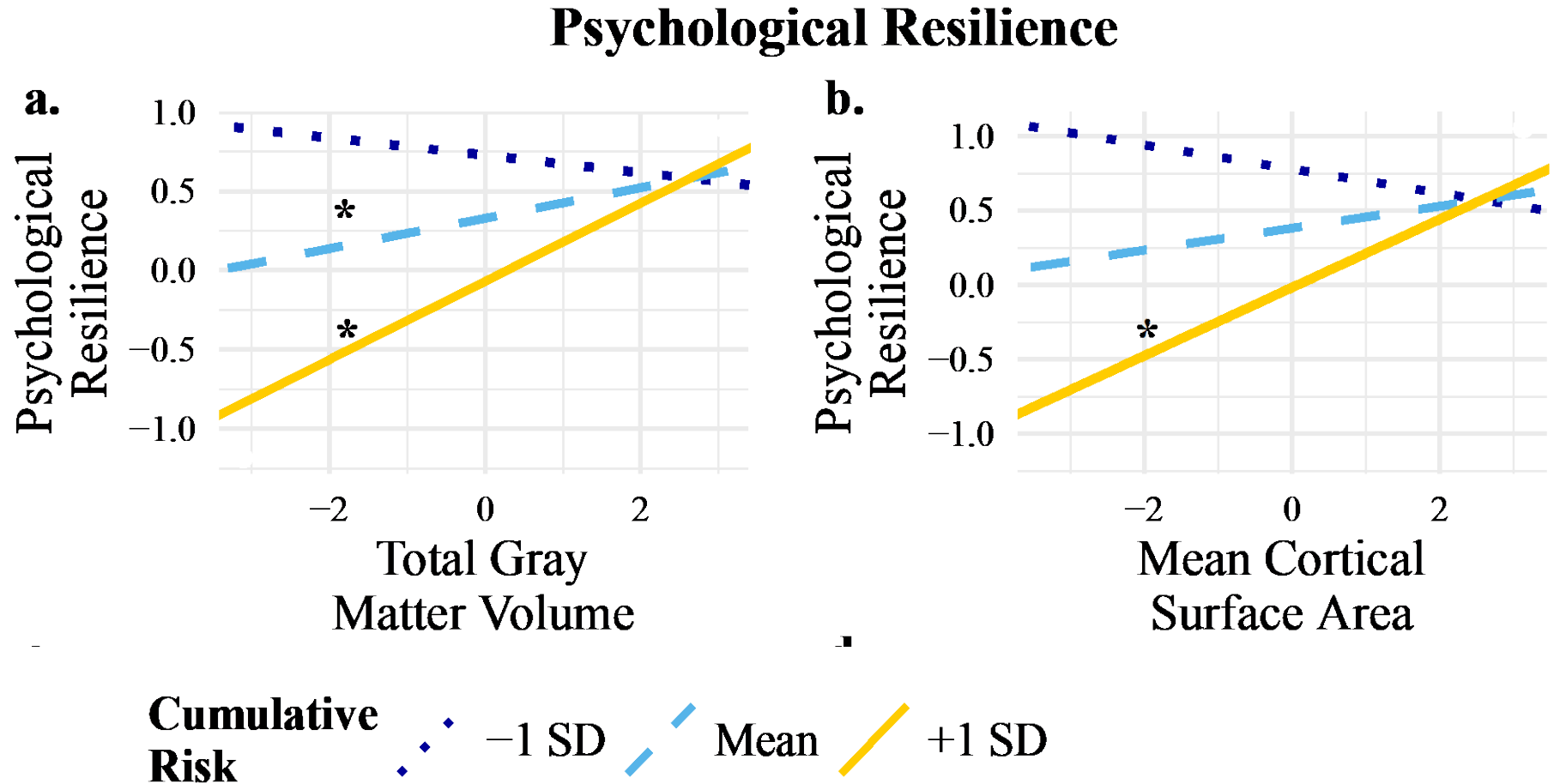


Sample: 708 twins (age 7 – 18) from disadvantaged neighborhoods (MTwiNS)

Neural correlates depend on exposure

Cumulative Risk:

Community violence
Abuse/neglect
Harsh parenting
Intimate partner violence
Parent-child conflict
Stressful life events



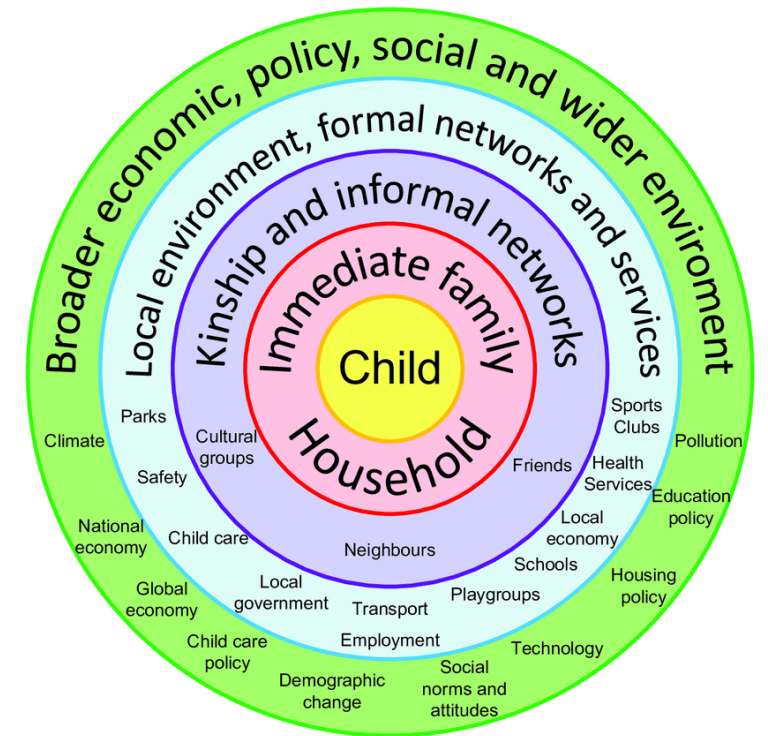
Gabby
Suarez



Jess Bezek

Challenges and Intervention

- Resilience
 - ▣ in response to....?
 - ▣ Is multi-domain
 - Challenge in translation
 - ▣ Is more than lack of negative outcomes
 - How do we measure positive outcomes?
- How much adversity is needed?
 - ▣ How much is too much?
- Interventions to promote resilience
 - ▣ Target social relationships – parents, neighbors
 - ▣ Conditions to undermine development also undermine these promotive factors
 - Poverty, concentrated disadvantage
 - Onus is then on the people themselves?
 - May also need structural changes



Take Away Points

- The brain links stress and adversity to behavior/outcomes
 - ▣ The timing of adversity exposure shapes how/where the brain is impacted
 - ▣ Distal risk is filtered through proximal experience
 - ▣ Relationships can buffer the impacts of adversity on the brain
- Resilience in multiple domains:
 - ▣ Neural correlates emerge only at higher levels of risk
 - ▣ Promoted by positive social relationships
 - But these relationships are undermined by adversity
 - ▣ Interventions can support important social relationships, but may also need to contend with higher level challenges

Thank you!



Pitt Mother and Child Project

Funding: NIMH & NIDA

PIs – Daniel S. Shaw

Erika Forbes



S. Alexandra Burt

MTwiNS

Funding: NIMH, NICHD, Avielle Foundation,
Brain and Behavior Foundation;

PIs – Luke Hyde, Alex Burt



Leslie Leve & Jenae Neiderhiser

Early Growth and Development Study

Funding: NICHD, NIDA, NIMH, NIH, U.S. PHS

Grant PIs: Leve, Neiderhiser

Study of Adolescent Neural Development

Funding: NIMH

PIs – Chris Monk, Colter Mitchel, Luke Hyde



Chris Monk Colter Mitchel



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