# **MOVING TOWARD A MECHANISTIC UNDERSTANDING OF THE HEALTH CONSEQUENCES OF CHILDHOOD POVERTY**

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# A PARTIAL LIST OF HEALTH PROBLEMS ASSOCIATED WITH GROWING UP IN A LOWER-SES HOUSEHOLD

- Perinatal: More preterm birth, fetal growth restriction, infant mortality, neonatal mortality
- <u>Childhood</u>: Higher rates of obesity, NIDDM, more CVD risk factors, worse control of asthma and more activity limitations
- Adulthood: Higher risks of MetS, AMI, CHF, stroke, COPD, URI, multiple cancers, and premature mortality from any cause
- Next Generation: Offspring more likely to be PTB and SGA; have asthma and worse control of it; more CVD risk factors
- In general, these associations are independent of achieved SES, and upward economic mobility has fairly modest offsetting effects

# **RESEARCH GOALS**

- Identify the biological mechanisms that link childhood SES with risk for health problems across the lifespan
- Identify protective and vulnerability factors for low-SES youth, and clarify how, when, and where they operate
- **\*** Use these results to inform better policy and practice

# **NON-RESOLVING INFLAMMATION AS COMMON PATHWAY**



From Nathan and Ding. Cell 2010;140:871-882

# **PART 1: IDENTIFYING MECHANISMS**



## INFLAMMATION



# **SYSTEMIC REGULATION OF INFLAMMATION**

<u>MO/M</u> More P/DAMP reactive Less GC sensitive More inflammation

**Phenotypic Plasticity** 

#### Disadvantaged

<u>MO/Mø</u> Less P/DAMP reactive More GC sensitive Less inflammation

#### Advantaged

# **SIMPLIFIED FRAMEWORK**

#### **Poly I:C via TLR3**



## Flagellin via TLR5



Miller et al. PNAS 2009; 106:14716-14721

**YOUNG ADULTS IL-6 RESPONSE BY EARLY SES** 



Miller et al. PNAS 2009;106:14716-14721

## **TRANSCRIPTIONAL PROFILING OF PBMC**

# **MAPPING DEVELOPMENTAL TIMELINE**



![](_page_9_Picture_2.jpeg)

#### Images from Kim et al. AJOG 2015; 213:S53-69

# **INFLAMMATION AT THE MATERNAL-FETAL INTERFACE**

![](_page_10_Figure_0.jpeg)

Keenan-Devlin et al. Am J Perinatol 2017; 34:1003-1010

## **MATERNAL INCOME AND PLACENTA INFLAMMATION**

# MORE IMMUNE ACTIVATION LESS TISSUE MATURATION

![](_page_11_Figure_1.jpeg)

Miller et al, Brain Behav Immun 2017; 64:276-84

# **TRANSCRIPTIONAL PROFILE OF CHORIONIC VILLI**

# WHO GETS SICK? WHO STAYS HEALTHY?

![](_page_12_Picture_1.jpeg)

![](_page_12_Picture_2.jpeg)

**Photos by Stephen Shames** 

# **PART 2: PROTECTIVE & VULNERABILITY FACTORS**

# **PROTECTIVE FACTORS FOR LOW-SES YOUTH**

- \* Nurturant caregiving engaged, responsive, trustworthy adult
- **\* Good self-control keeping focused on distal, abstract goals**

## **METABOLIC SYNDROME AT MIDLIFE: MIDUS (N=1205)**

![](_page_14_Figure_1.jpeg)

Miller et al. Psychol Sci 2011; 22:1591-99

## **MATERNAL NURTURANCE AS BUFFER OF LOW CHILDHOOD SES?**

# **CAN WE LEVERAGE PARENTING TO IMPROVE HEALTH?**

- \* Family-oriented intervention (N=272)
- \* 11-year olds and caregivers
- \* African-Americans in rural South
- \* 8 weekly sessions led by community facilitators
- \* Parents: Engaged, vigilant, supportive parenting
- \* Youth: Goal setting, coping with peer stress, importance of rules
- \* Circulating inflammatory cytokines at age 19 (IL1, IL6, IL8, TNF, IL10, IFNg)

![](_page_16_Figure_0.jpeg)

#### **RURAL AFRICAN AMERICAN MIDDLE-SCHOOLERS**

# **SAAF INTERVENTION REDUCES LOW-GRADE INFLAMMATION**

Miller et al. PNAS 2014; 111:11287-92

![](_page_17_Figure_2.jpeg)

# **INCREASES NURTURANT/INVOLVED PARENTING** & DECREASES HARSH/INCONSISTENT PARENTING

![](_page_18_Figure_1.jpeg)

Miller et al. PNAS 2014; 111:11287-92

## **PARTLY WORKS VIA PARENTING**

# CAN WE LEVERAGE SOCIAL RELATIONSHIPS TO IMPROVE PREGNANCY OUTCOMES?

- Small, preliminary, observational study
- \* Low-income community in SC; 95% Medicaid
- **\* 20 women who received traditional prenatal care**
- \* 20 women who participated in group-based prenatal care
- **\*** Groups of 8-10 women, met for 10 sessions across T2/T3
- \* Focus on transcripts associated with disadvantage in earlier study

# **CENTERING AND TRANSCRIPTION PROFILES RELATED TO SES**

#### Miller et al, Brain Behav Immun 2017; 64:276-84

![](_page_20_Figure_2.jpeg)

# **FOLLOW-UP RCT: HD092446**

- **\* 3000 pregnant women from same community in SC**
- **\*** Randomized to GPNC vs. TPNC
- **\*** Primary endpoints:
  - \* Placental inflammatory lesions by histology
  - **\*** Placental gene expression profiles
- **\* Other hypotheses:** 
  - \* Stress reduction vs. behavior change
  - **\* GPNC to placenta to PTB/SGA**

# **PROTECTIVE FACTORS FOR LOW-SES YOUTH**

- **\*** Nurturant caregiving
- **Good self-control maintaining focus on distal, abstract goals**

#### SHAPE - From Early to Late Adolescence (N=489) Psychosocial Outcomes (19) by Family SES and Self Control (11-13)

![](_page_23_Figure_1.jpeg)

![](_page_23_Figure_2.jpeg)

#### Brody et al. Psych Science 2013; 24:1285-93

#### **AFRICAN-AMERICAN YOUTH IN RURAL SOUTH**

#### Allostatic Load (19) by Family SES & Self Control (11-13)

![](_page_24_Figure_1.jpeg)

Brody et al. Psych Science 2013; 24:1285-93

# **DO HEALTH BENEFITS FOLLOW?**

#### Allostatic Load (19) by Family SES & Self Control (11-13)

![](_page_25_Figure_1.jpeg)

Brody et al. Psych Science 2013; 24:1285-93

# **DO HEALTH BENEFITS FOLLOW?**

#### AIM: From Late Adolescence to Early Adulthood (N=292) Psychosocial Outcomes (17-20) by Family SES & Self Control (17-19)

![](_page_26_Figure_1.jpeg)

Miller et al. PNAS 2015; 112:10325-30

## **NEW COHORT OF RURAL AFRICAN-AMERICANS**

#### **AIM - From Late Adolescence to Early Adulthood:** Cellular Aging (22) by Family SES & Self Control (17-19)

![](_page_27_Figure_1.jpeg)

**AGING OF IMMUNE CELLS, INDEXED BY DNA METHYLATION** 

Miller et al. PNAS 2015; 112:10325-30

#### Black - White Gap in Life Expectancy

![](_page_28_Figure_1.jpeg)

From Braveman et al. AJPH 2010; 100:S186-96

# **HIDDEN COSTS OF MOBILITY FOR BLACK AMERICANS?**

![](_page_29_Figure_0.jpeg)

NPR/Robert Wood Johnson Foundation/Harvard T.H. Chan School of Public Health, Discrimination in America: Experiences and Views of African Americans, January 26 – April 9, 2017. Q63a/Q64a, Q63b/Q64b, Q63c/Q64c. Based on half-sample. Total N=802 African-American U.S. adults.

# **HIGHER-SES BLACKS EXPERIENCE MORE DISCRIMINATION**

# Add Health (N = 13,009) Depressive Symptoms (24-32) by Childhood Disadvantage (13-18) and College Degree (Ever)

![](_page_30_Figure_1.jpeg)

Gaydosh, Schorpp, Chen, Miller, & Harris. PNAS 2018; 115:109-14

#### ARE THERE HEALTH COSTS OF MOBILITY? IF SO, FOR WHOM?

# Add Health (N = 10,772) Metabolic Syndrome (24-32) by Childhood Disadvantage (13-18) and College Degree (Ever)

![](_page_31_Figure_1.jpeg)

Gaydosh, Schorpp, Chen, Miller, & Harris. PNAS 2018; 115:109-14

#### ARE THERE HEALTH COSTS OF MOBILITY? IF SO, FOR WHOM?

# **EXPLANATIONS**

#### **COSTS OF STRIVING**

- \* Constant hard driving efforts "John Henryism"
- \* Limited time for restorative activities, health behaviors
- Competing demands and obligations in family life
- \* COSTS OF ARRIVING
  - \* Juggling multiple identities and social networks
  - Never quite "arriving" because of wealth gap
  - \* Alienation/discrimination in school/workplace

#### The New Hork Times

#### The Opinion Pages

THE GREAT DIVIDE

Can Upward Mobility Cost You Your Health? By GREGORY E. MILLER, EDITH CHEN and GENE H. BRODY

January 4, 2014 2:30 pm

The Great Divide is a series about inequality.

Americans love a good rags-to-riches story. Even in an age of soaring inequality, we like to think that people can still make it big here if they work hard and stay out of trouble. The socioeconomic reality of most of the last four decades — stagnant wages, soaring income and wealth inequality, and reduced equality of opportunity — have dented, but not destroyed, the appeal of the American dream.

Those who do climb the ladder, against the odds, often pay a little-known price: Success at school and in the workplace can exact a toll on the body that may have long-term repercussions for health.

Among American children there are wide socioeconomic gaps on many dimensions of well-being: school achievement, mental health, drug use, teenage pregnancy and juvenile incarceration, to name just a few. Despite the risks that lower-income children face, we also know that a significant minority beat the odds. They perform admirably in school, avoid drugs and go on to college.

Psychologists refer to these children as resilient, because they achieve positive outcomes in adverse circumstances. They do so in part by cultivating a kind of determined persistence. Often with nurturing from a parent, relative or mentor, they set goals for the future, work diligently toward them, navigate setbacks, stay focused on the long term and resist temptations that might knock them off the ladder to success.

# **COSTS OF MOBILITY?**

#### COLLABORATORS

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![](_page_34_Picture_4.jpeg)

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