

Studying the neurobiological embedding of socioeconomic circumstances

Examining motivations and addressing sociopolitical
context & structural inequities

Radically reframing studies on neurobiology and socioeconomic circumstances: A call for social- justice oriented neuroscience

E. Kate Webb, Carlos Cardenas-Iniguez, and Robyn Douglas

WHAT ARE THE GOALS OF STUDYING THE EFFECTS OF SOCIOECONOMIC CIRCUMSTANCES ON THE BRAIN?

Lower socioeconomic position and neighborhood disadvantage have been associated with:

- Greater exposure to stress
- Increased risk for most mental health conditions
- Poorer physical health (heart disease, stroke, diabetes)
- Lower scores on tests of cognitive function (EF, language)
- Lower socioeconomic achievement (e.g., earnings and educational attainment)

WHAT ARE THE GOALS OF STUDYING THE EFFECTS OF SOCIOECONOMIC CIRCUMSTANCES ON THE BRAIN?

I. To inform interventions.

- **Example finding:** Children growing up in worse socioeconomic circumstances exhibit faster myelination of association cortex. This reduces plasticity, interfering with experience-dependent refinement of neural circuits and learning. **Potential intervention:** After school environmental enrichment programs (instead of tutoring/rote memorization)

2. To inform policy.

- It is (should be) obvious that giving children (and their caregivers) access to resources, healthcare, education, nutrition, and psychological safety is beneficial. But showing that this helps “healthy brain development” can instigate change.

WHAT ARE THE GOALS OF STUDYING THE EFFECTS OF SOCIOECONOMIC CIRCUMSTANCES ON THE BRAIN?

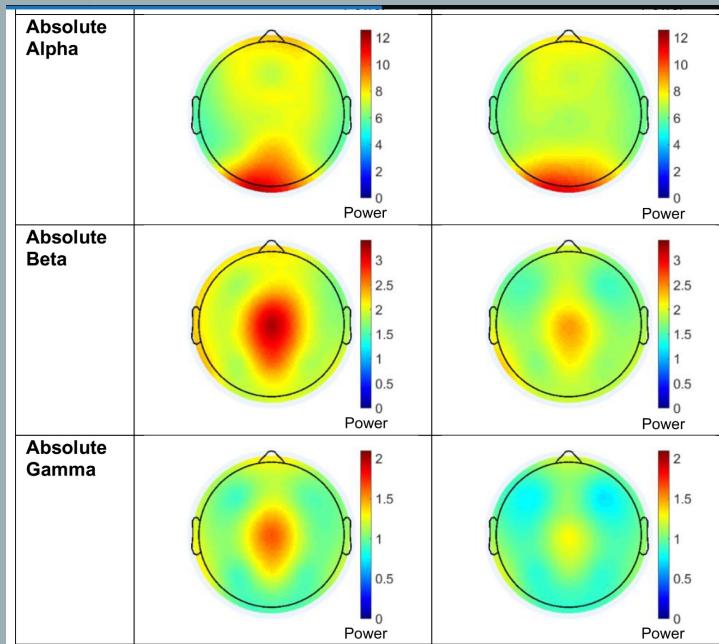
“ But that work also underscores how consumers of research, policymakers among them, are prone to give more weight to brain data than to other findings, as other [studies show](#). When Professor Nelson presents these findings to government or development agency officials, “I think they find it the strongest ammunition to implement policy changes,” he said. ”

The impact of a poverty reduction intervention on infant brain activity

Sonya V. Troller-Renfree , Molly A. Costanzo, Greg J. Duncan  ,  , and Kimberly G. Noble  [Authors Info &](#)

Does poverty cause early differences in brain development or is it associated with other factors that are the true cause of these differences?

AKA, *do we intervene on poverty directly or another factor (nutrition, pollution, education, crime, stress)*



The New York Times

TheUpshot

A Novel Effort to See How Poverty Affects Young Brains

An emerging branch of neuroscience asks a question long on the minds of researchers. Recent stimulus payments make the study more relevant.

Early deprivation alters structural brain development from middle childhood to adolescence

MARGARET A. SHERIDAN , CORA E. MUKERJI , MARK WADE, KATHRYN L. HUMPHREYS , KATHRYN GARRISI , SRISHTI GOEL , KINJAL PATEL , NATHAN A. FOX, CHARLES H. ZEANAH, [...] KATIE A. MC LAUGHLIN  +2 authors [Authors Info & Affiliations](#)

⤠ Katie Insel Retweeted



Cora Mukerji @cora_mukerji 2h
Ultimately, the validity and usefulness of neuroscience for ...
understanding SES is an empirical issue, and the proof ...
New paper! We provide experimental evidence that placement into high-quality, family-based care early in life positively impacts how brain structure develops over the course of adolescence in previously-institutionalized youth. Children need nurturing families to thrive!



Margaret Sheridan @masherid · 18h

💡 new paper in Science Advances today! [science.org/doi/10.1126/sc...](https://science.org/doi/10.1126/science.add3333)
In collaboration with @CharlesaNelson1 @cora_mukerji
@K_L_Humphreys Nathan Fox, Kate McLaughlin, Charley Zeanah, and
an ARMY of incredible research assistants!

[Show this thread](#)

Ultimately, the validity and usefulness of neuroscience for understanding SES is an empirical issue, and the proof will be in the pudding.

WHAT ARE THE POTENTIAL HARMS OF STUDYING THE EFFECTS OF SOCIOECONOMIC CIRCUMSTANCES ON THE BRAIN?

1. Reinforce deficit perspective
 1. *Variability, compensatory mechanisms, hidden talents?*
2. Incorrect interpretation or framing by media
3. Improper attribution of findings to low parental income/education/engagement when the real problems are structural and societal: wealth inequality, racism, trauma
 1. *Ignoring social, political, historical perspectives; being apolitical*
4. Performing research at institutions that are actively harming the individuals or neighborhoods you are studying (e.g., Penn and West Philly)

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SOCIOECONOMIC STATUS

SOCIOECONOMIC POSITION

SOCIOECONOMIC CIRCUMSTANCES

- Individual-level SEP
- Household SEP
- Neighborhood SEC

“While research on physical health has increasingly built upon social determinants of health and disease ([Krieger, 2011, 1994](#)), the dominant narrative in mental health research embraced biological models of disease.”

“In a similar vein, the association between neurobiology and neighborhood socioeconomic factors (e.g., neighborhood disadvantage) has received even less attention than associations with individual-level variables (e.g., income or education)”

Studies of neighborhood disadvantage inherently emphasize *place* and *context* rather than the *individual*. Acknowledges that societal inequities exist and are relevant to the understanding of brain structure and function.

FREEDOM MODEL

The **Freedom Model of Health**: suggests people are solely responsible for their health and related behaviors i.e., individual-oriented theories of disease causation.

- Perpetuates harmful stereotypes of genetic inferiority and pathologizes those living amongst poor socioeconomic conditions
- Attributes health disparities along sociodemographic categories to the individual
- Exonerates the oppressive structures which maintain inequities

FREEDOM MODEL

Research Letter

September 10, 2020

Racial/Ethnic Variation in Nasal Gene Expression of Transmembrane Serine Protease 2 (*TMPRSS2*)

In many areas of the US, infection and death rates for COVID-19 are 2 to 3 times higher in Black individuals than their proportion of the population.^{1,2} Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is spread by airway contact and uses transmembrane serine protease 2 (*TMPRSS2*) to facilitate viral entry and spread.³

This study of nasal epithelial gene expression in a racially/ethnically diverse cohort showed significantly higher expression of *TMPRSS2* in Black individuals compared with other self-identified races/ethnicities. Given the essential role of *TMPRSS2* in SARS-CoV-2 entry,³ higher nasal expression of *TMPRSS2* may contribute to the higher burden of COVID-19 among Black individuals.

HOW TO STUDY “MACRO FACTORS” AS WELL AS PROXIMATE MECHANISMS?

A **proximate cause** is an event which is *closest to, or immediately responsible for causing some observed result.* This exists in contrast to a higher-level **ultimate cause** (or *distal cause*) which is usually thought of as the "real" reason something occurred.

Children from lower SEP households have faster myelination

Earlier increase in cortisol and sex hormones

More stress, earlier puberty

Racism, resource scarcity, nutrition

Neighborhood, resources/money

Wealth inequality, structural racism



HOW TO STUDY “MACRO FACTORS” AS WELL AS PROXIMATE MECHANISMS?

- Work should try to capture the interaction of social and political systems, the environment, individual SEP, and the brain, rather than considering them in isolation.
- “By including variables at multiple levels that better capture the forces and dynamics related to SEP in human neuroscience experiments, researchers acknowledge that some of the variability in individual differences—whether in biological functioning, behavioral task performance, or clinical symptoms—is attributable to the sociopolitical stratification in society.”
- “In our work as neuroscientists, we must recognize that people live within environmental contexts shaped by sociopolitical stratification.”

HOW TO STUDY “MACRO FACTORS” AS WELL AS PROXIMATE MECHANISMS?

Time for caregiving	Trauma	Environmental toxins
Crime	Chronic Stress	
Need for vigilance		Experiences of racism
Parental education		Pre- and post-natal nutrition
Home cognitive enrichment (books, toys, reading)	Resource availability	
Education	Structural racism	Access to nature
Non-educational enrichment (e.g., sports, girl scouts)		Environmental enrichment

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Should emphasize study of neighborhood disadvantage and broader socioeconomic disparities.

Critical to frame the study of any individual-level factors and individual biological outcomes *in a sociopolitical context*.

Acknowledge the role of structural inequity and racism and societal determinates of differences in socioeconomic circumstances and their neurobiological outcomes.

NAMING STRUCTURAL RACISM AS A ROOT CAUSE

“Socioeconomic inequities influence health independent of race and ethnicity, however, both individual and neighborhood socioeconomic indicators are ethnoracialized

The socioeconomic inequities discussed in studies on neighborhood disadvantage and neurobiology are undergirding and intersecting with other forms of oppression

Human neuroscience research has been reluctant to confront structural racism

In essence, this perspective is a call for the radicalization of human neuroscience work—a necessary paradigm shift that grasps at the roots of the issue rather than dodging them. When we name structural racism, we direct attention to the laws, processes, and practices which produce and maintain health inequities.”

For racially minoritized communities, such as Black, Indigenous, Latinx, Asian, and Pacific Islanders, acute stressors coupled with historical stressors and trauma (e.g., discrimination) have been linked to long-term adverse health outcomes

SPECIFIC SUGGESTIONS

- **Acknowledging the role of structural racism**
- **Include environmental and structural factors**
- **Report inequities and acknowledge diversity in research samples**
- **Fund research on sociopolitical factors**
- **Explore resilience factors**
- **Engage in community-based participatory and community-engaged research**

SPECIFIC SUGGESTIONS

- **Acknowledging the role of structural racism**
 - We call for future studies to name structural racism, define neighborhood disadvantage as an institutionalized form of racial inequity, and interpret how the effects of racism are captured in methods and manifest in results

SPECIFIC SUGGESTIONS

- **Acknowledging the role of structural racism**
- **Include environmental and structural factors**

SPECIFIC SUGGESTIONS

- **Acknowledging the role of structural racism**
- **Include environmental and structural factors**
- **Report inequities and acknowledge diversity in research samples**
 - Report complete demographic variables (race and ethnicity often not reported)
 - Report race and ethnicity in the presence of other sociodemographic factors and social determinants to acknowledge inequities
 - Flanagin et al., 2021 “Updated guidance on the reporting of race and ethnicity in medical and science journals”, JAMA

SPECIFIC SUGGESTIONS

- **Acknowledging the role of structural racism**
- **Include environmental and structural factors**
- **Report inequities and acknowledge diversity in research samples**
- **Fund research on sociopolitical factors**
 - Given that many researchers exploring these topics tend to be members of racialized and historically minoritized groups, the lack of funding to pursue these avenues of research has also been associated with the attrition of diverse scholars

SPECIFIC SUGGESTIONS

- **Acknowledging the role of structural racism**
- **Include environmental and structural factors**
- **Report inequities and acknowledge diversity in research samples**
- **Fund research on sociopolitical factors**
- **Explore resilience factors**
 - Deficit-only perspectives, which minimize the strengths of ethnically and racially minoritized groups/individuals, are harmful. Theoretically, risk-only models are incomplete; and practically, they may further stigmatize marginalized populations.
 - There is ample room and need for resilience modeling. In the field of neuroscience, exploring the effects of individual, familial, and community factors that are known to mitigate risk of poor mental health outcomes, such as social support/engagement, civic action, critical consciousness, neighborhood cohesion, and racial-ethnic identity, may be extraordinarily beneficial

SPECIFIC SUGGESTIONS



Hidden talents in harsh environments

Published online by Cambridge University Press: **16 July 2020**

Bruce J. Ellis , Laura S. Abrams, Ann S. Masten, Robert J. Sternberg,
Nim Tottenham and Willem E. Frankenhus

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Deficit perspectives are central in prominent theories of stress and development such as cumulative risk, diathesis stress, allostatic load, and the dimensional model of adversity.

Deficit-based assumptions about the harmful effects of early adversity have guided social policy and practice toward *mitigating risk* (e.g., poverty reduction, improving the quality of parent–child relationships in stressful contexts, providing safe places for children such as Boys & Girls Clubs), and/or *ameliorating deficits* (e.g., fostering executive function skills, improving literacy and numeracy skills, enhancing social and emotional learning).

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Despite this achievement, deficit-based approaches to research and intervention are imbalanced with respect to recognizing strengths as well as weaknesses that may arise in the context of adversity.

As one community stakeholder noted, “there is a tendency to look at people from underserved communities as somehow inferior” .

SPECIFIC SUGGESTIONS



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The scientific goal of the hidden talents research program is to uncover a high-resolution map of the intact, or even enhanced, skills that emerge in harsh, unpredictable environments (i.e., *stress-adapted skills*).

Thus, the applied goal of the hidden talents approach is to work with positive stress-adapted skills to inform efforts and programs that potentiate success in education, employment, and civic life among adversity-exposed people.

SPECIFIC SUGGESTIONS



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- Enhanced abilities for detecting threat and anger
- Greater skill at detecting subtly changing visual information
- More loss-avoidant (choosing safe options on a risky decision-making task, making risky choices to avoid losses)
- Greater attunement to other people and social information/relationships; greater empathic accuracy, compassion, and attentiveness to others
- Better at working collaboratively to achieve collective outcomes
- Enhanced abilities for flexibly switching between tasks or mental sets and for tracking novel environmental information

SPECIFIC SUGGESTIONS

- **Engage in community-based participatory and community-engaged research**
 - The power (i.e., decision-making, funding, control over dissemination process, etc.) rests entirely with the study team. Although those researched provide data, they are not consulted to ensure the research question(s) or outcomes align with their experiential knowledge or the community's needs.
 - Furthermore, conducting research without developing proper relationships with the community and necessary scientific experts contributes to “health equity tourism”
 - CPBR and CEnR entail community-building (which takes time) as well as sharing wealth and final products (which requires funding and time; [Wallerstein and Duran, 2010, 2017](#); [Collins et al., 2018](#); [Wallerstein, 2021](#)) and prioritizing research questions that are important to communities, not researchers.