



# Climate Justice in Biology, Exposure Science, and Epidemiology

"Coronavirus COVID-19 pandemic" by <https://www.vperemen.com> is licensed under CC BY 2.0.



# What's in this module?

## Activities

4 readings  
1 activity option

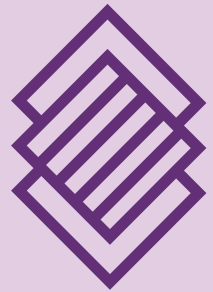
## Contents

This module demonstrates how biology can inform climate justice and how climate justice can help create more inclusive biologists. Case studies span from general biology to microbiology and epidemiology and the broader field of exposure science.

## **Key Resources**

- An applied environmental justice framework for exposure science
- Conducting Culturally Responsive Research Across Borders
- Pervasive structural racism in environmental epidemiology.

# Agenda and Learning Objectives



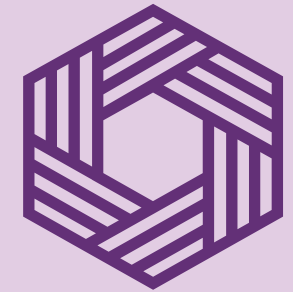
**Recognize**  
how climate  
justice can  
influence  
biology



**Understand**  
the CJ  
approach to  
biological  
research



**Identify** the  
importance of  
microbiology  
in climate  
science



**Discover** how  
you can  
address  
inequalities  
with biology

# What is climate justice?



"Flooding in Cedar Rapids, IA" by U.S. Geological Survey is marked with CC0 1.0.

Climate justice is both a term and a movement which recognizes that climate change has unequal social, economic, health, and other negative impacts on people, with an emphasis on its impacts on underprivileged populations



"Flood Water Measurement" by U.S. Geological Survey is marked with CC0 1.0.

# Discuss the following questions with a partner:

1. Do you think this definition is complete? What would you add?
2. Can you think of examples of climate justice in your community, country, or the world?
3. How do you think biology can help the climate justice movement?

# Climate justice through biology

- Understanding the biological impacts of climate change is important for creating appropriate, holistic responses using:
  - Soil science
  - Microbiology
  - Public health and epidemiology
  - Animal and plant responses to heat and extreme weather



"Micro-Canyonlands formed by Cyanobacterial soil" by National Park Service is marked with CC0 1.0.

**What is your  
reaction to this  
quote?**

**“the field of science itself will  
have to reconcile its shameful  
past and revisit the  
reprehensible displays of racially  
driven confirmation bias that  
form its foundations”**

- Ayana Elizabeth Johnson, *All We Can Save: Truth, Courage, and Solutions for the Climate Crisis*




A close-up photograph of several petri dishes in a laboratory. The dishes are arranged in a row, with the one in the foreground being the most prominent. The agar surface is visible, and the lighting creates a warm, golden glow. The text is overlaid on the image in a bold, white font with a black outline.

# **A climate justice approach to biology research**

# Optional reading: An applied environmental justice framework for exposure science

“Exposure science is a multidisciplinary field that brings together researchers from various interdisciplinary areas that include risk assessment, epidemiology, public health, toxicology, environmental chemistry, public policy, and engineering”

## An applied environmental justice framework for exposure science

[Yoshira Ornelas Van Horne](#) , [Cecilia S. Alcala](#), [Richard E. Peltier](#), [Penelope J. E. Quintana](#), [Edmund Seto](#), [Melissa Gonzales](#), [Jill E. Johnston](#), [Lupita D. Montoya](#), [Lesliam Quirós-Alcalá](#) & [Paloma I. Beamer](#)

*Journal of Exposure Science & Environmental Epidemiology* **33**, 1–11 (2023) | [Cite this article](#)

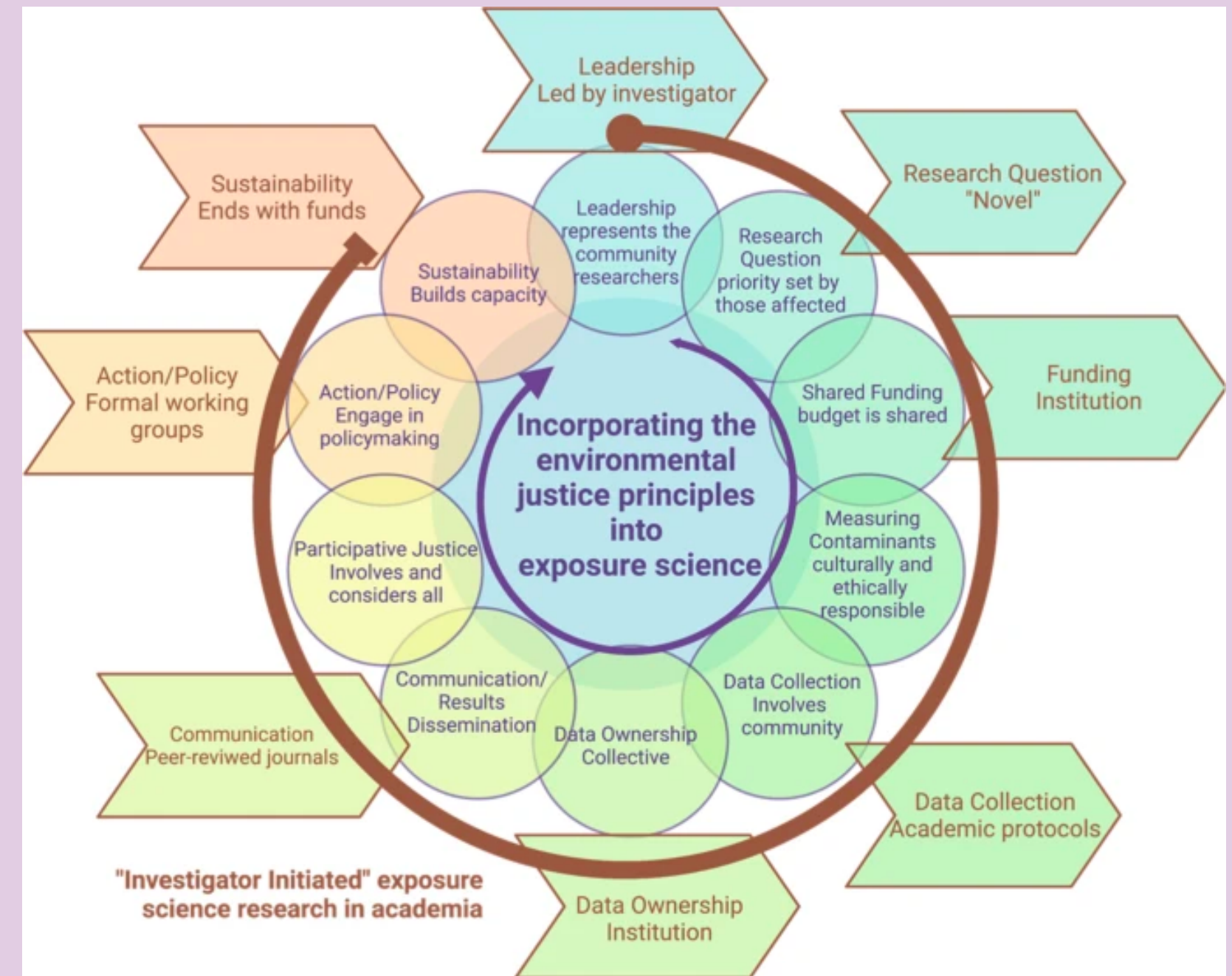
10k Accesses | 12 Citations | 96 Altmetric | [Metrics](#)

### Abstract

On the 30th anniversary of the Principles of Environmental Justice established at the First National People of Color Environmental Leadership Summit in 1991 (Principles of Environmental Justice), we continue to call for these principles to be more widely adopted. We propose an environmental justice framework for exposure science to be implemented by all researchers. This framework should be the standard and not an afterthought or trend dismissed by those who believe that science should not be politicized. Most notably, this framework should be centered on the community it seeks to serve. Researchers should meet with community members and stakeholders to learn more about the community, involve them in the research process, collectively determine the environmental exposure issues of highest concern for the community, and develop sustainable interventions and implementation strategies to address them. Incorporating community “funds of knowledge” will also inform the study design by incorporating the knowledge about the issue that community members have based on their lived experiences. Institutional and funding agency funds should also be directed to supporting community needs both during the “active” research phase and at the

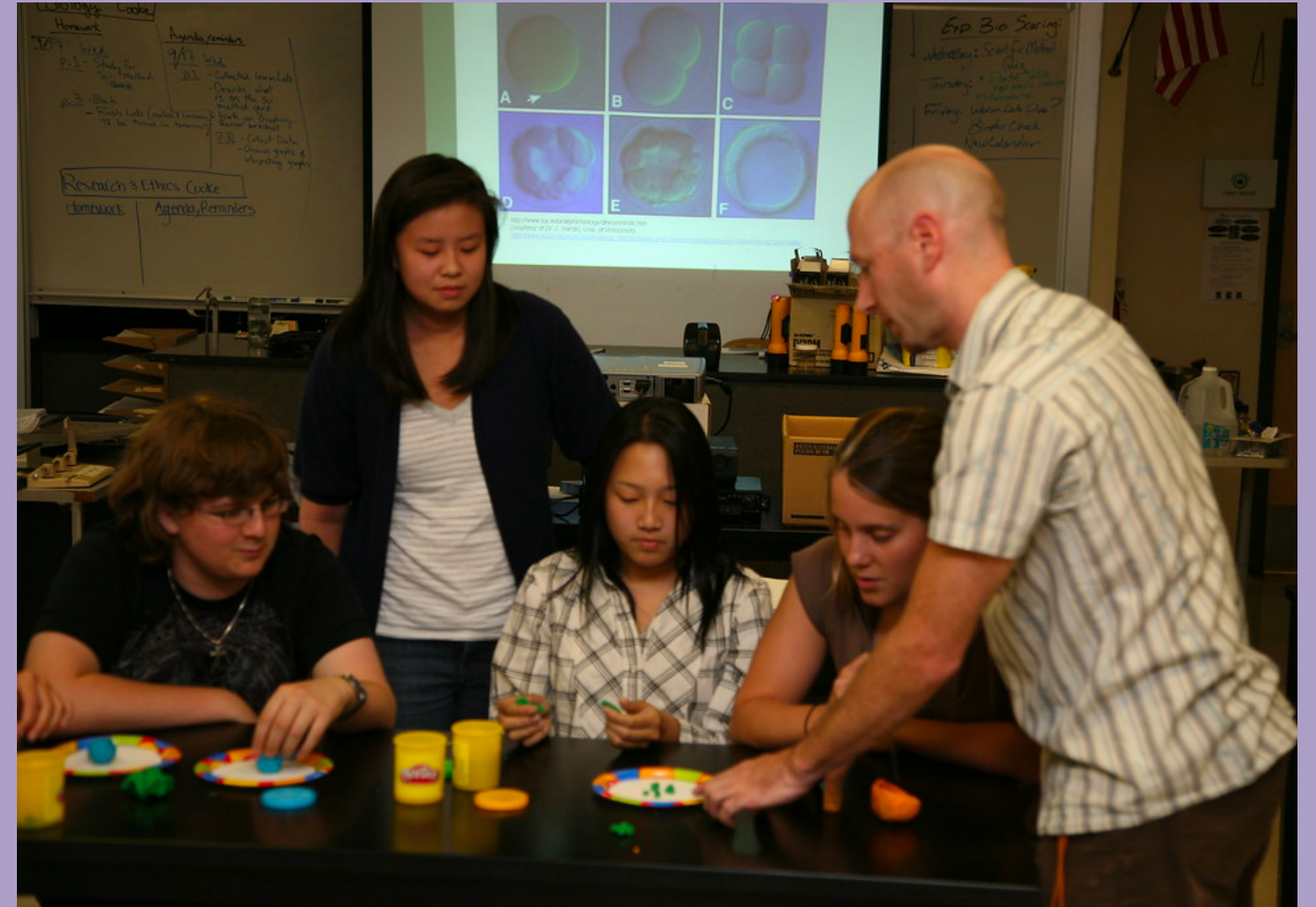
# Advancing biology (and exposure science) with climate justice

- Culturally and ethically responsible research methods
- Data and knowledge sharing
- Input from many perspectives
- Including different types of knowledge
- Respecting community's rights
- prioritize research questions to benefit those most affected



# Discussion questions:

- Why is this framework important for biologists?
- How does this framework better prepare biologists for working with marginalized communities?
- Why is conscious science important for communities?
- How can we include communities in the research process?



"Stem Cell Research Curriculum Field Testing" by NWABR is licensed under CC BY 2.0.



# Culturally responsive field biology

"Biology students get great field experience through ecology, aquatic microbiology, labs, internships, and more!" by UNH Manchester is licensed under CC BY 2.0.

# Optional reading: Conducting Culturally Responsive Research Across Borders

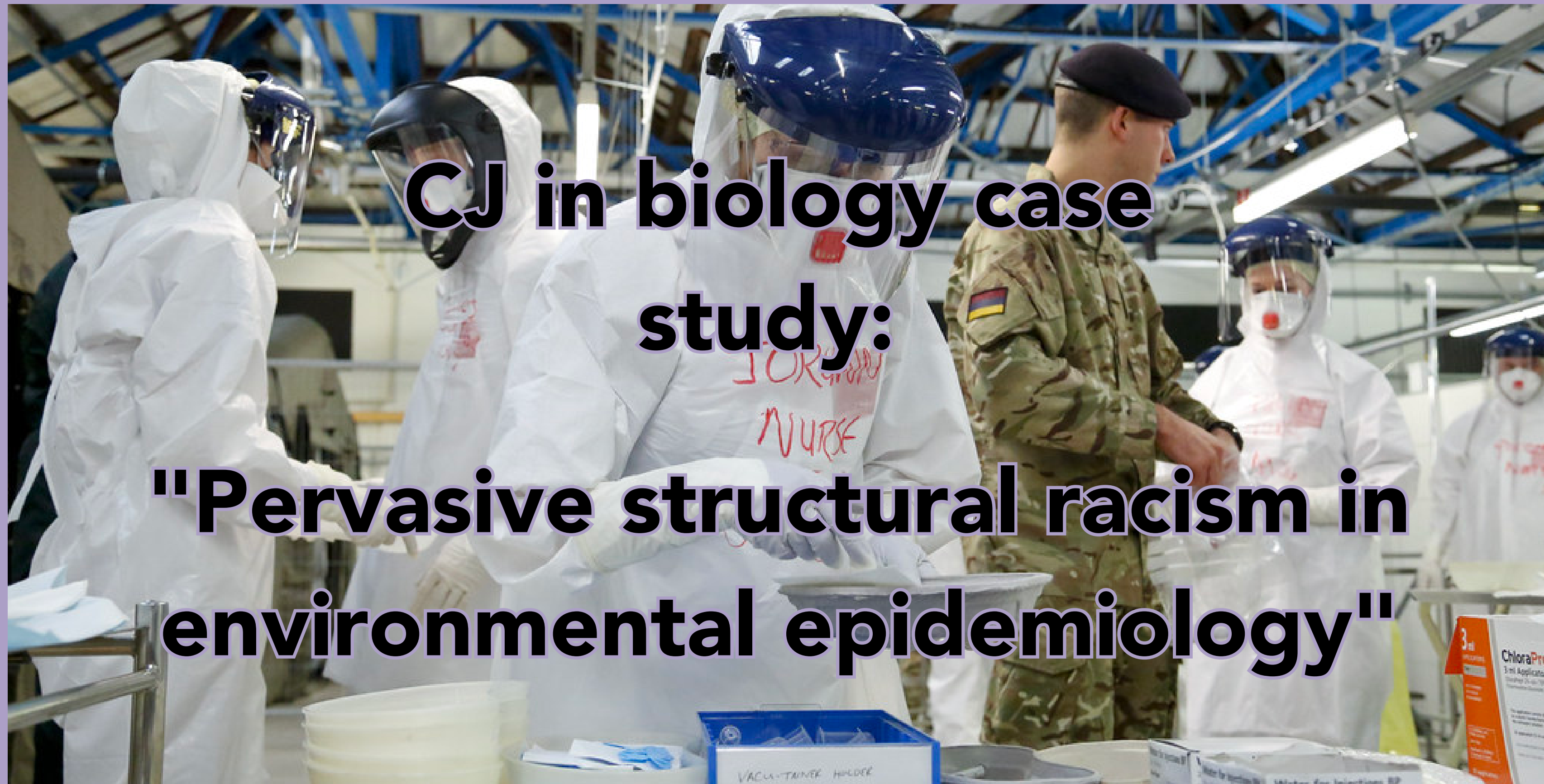
Culturally responsive research includes the:

- Explicit recognition, valuing, and discussion of cultural differences
- Validation of the worldviews of participants
- Explicit discussion of power differentials
- Acknowledgment that nontraditional research methods may work better with participants of differing cultural values



# Discussion questions:

- How can you be a more culturally responsive researcher?
- Do you think there are other guidelines not mentioned in the article?
- What is the importance of culturally responsive research?
- How is the framework for ethical exposure science similar and/or different to the guidelines to be a culturally responsive researcher?



**CJ in biology case study:**

**"Pervasive structural racism in environmental epidemiology"**

"NHS doctors and nurses practise medical care in full protective Ebola gear" by DFID - UK Department for International Development is licensed under CC BY 2.0.



# Research review

"Pervasive structural racism in environmental epidemiology." (Perry et al., 2021)


- Meta-analysis of studies of male infertility and environmental health to demonstrate how environmental epidemiology ignores racism in research and medical practice
- Paper illustrates "how failing to address racism neglects the health of entire populations"

Perry, M. J., Arrington, S., Freisthler, M. S., Ibe, I. N., McCray, N. L., Neumann, L. M., Tajanlangit, P., & Rosas, B. M. T. (2021, November 17). Pervasive structural racism in environmental epidemiology. *Environmental Health*.  
<https://ehjournal.biomedcentral.com/articles/10.1186/s12940-021-00801-3>

Perry et al. *Environmental Health* (2021) 20:119  
<https://doi.org/10.1186/s12940-021-00801-3>

Environmental Health

COMMENTARY Open Access

 Pervasive structural racism in environmental epidemiology

Melissa J. Perry<sup>\*</sup>, Suzanne Arrington, Marlaina S. Freisthler, Ifeoma N. Ibe, Nathan L. McCray, Laura M. Neumann, Patrick Tajanlangit and Brenda M. Trejo Rosas


**Abstract**  
**Background:** Epistemological biases in environmental epidemiology prevent the full understanding of how racism's societal impacts directly influence health outcomes. With the ability to focus on "place" and the totality of environmental exposures, environmental epidemiologists have an important opportunity to advance the field by proactively investigating the structural racist forces that drive disparities in health.  
**Objective:** This commentary illustrates how environmental epidemiology has ignored racism for too long. Some examples from environmental health and male infertility are used to illustrate how failing to address racism neglects the health of entire populations.  
**Discussion:** While research on environmental justice has attended to the structural sources of environmental racism, this work has not been fully integrated into the mainstream of environmental epidemiology. Epidemiology's dominant paradigm that reduces race to a mere data point avoids the social dimensions of health and thus fails to improve population health for all. Failing to include populations who are Black, Indigenous, and people of color (BIPOC) in health research means researchers actually know very little about the effect of environmental contaminants on a range of population health outcomes. This commentary offers different practical solutions, such as naming racism in research, including BIPOC in leadership positions, mandating requirements for discussing "race", conducting far more holistic analyses, increasing community participation in research, and improving racism training, to address the myriad of ways in which structural racism permeates environmental epidemiology questions, methods, results and impacts.  
**Keywords:** Environmental health, Environmental epidemiology, Environmental justice, Racism, Structural racism, Male reproductive health, Solutions

**Introduction**  
Currently, epistemological biases in environmental epidemiology prevent the full understanding of how racism's societal impacts directly influence health outcomes. The field continues to parameterize conditions of communities of color [1] without recognizing that these social forces are in fact root causes of many disease etiologies.

If public health researchers seek to achieve health equity for persons of all backgrounds, the impact of racism on health outcomes needs to be acknowledged, quantified, and addressed. This will require advancing paradigms that identify how racism affects both population health and the health research enterprise. To address racism in public health, our own racist structures need to be examined and dismantled.

Leading medical and public health institutions have long recognized that racism perpetuates health disparities [2, 3]; numerous calls have been made over the last several decades to reform how race and racism are

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"Failing to include populations who are Black, Indigenous, and people of color (BIPOC) in health research means researchers actually know very little about the effect of environmental contaminants on a range of population health outcomes"

# Analysis: cis-male fertility studies

Sperm counts are indicative of both fertility and general health. For decades, declines in Western sperm counts have been observed.

However almost all that is known about population sperm health comes from White men only, very little has been recorded about sperm counts among people of color.

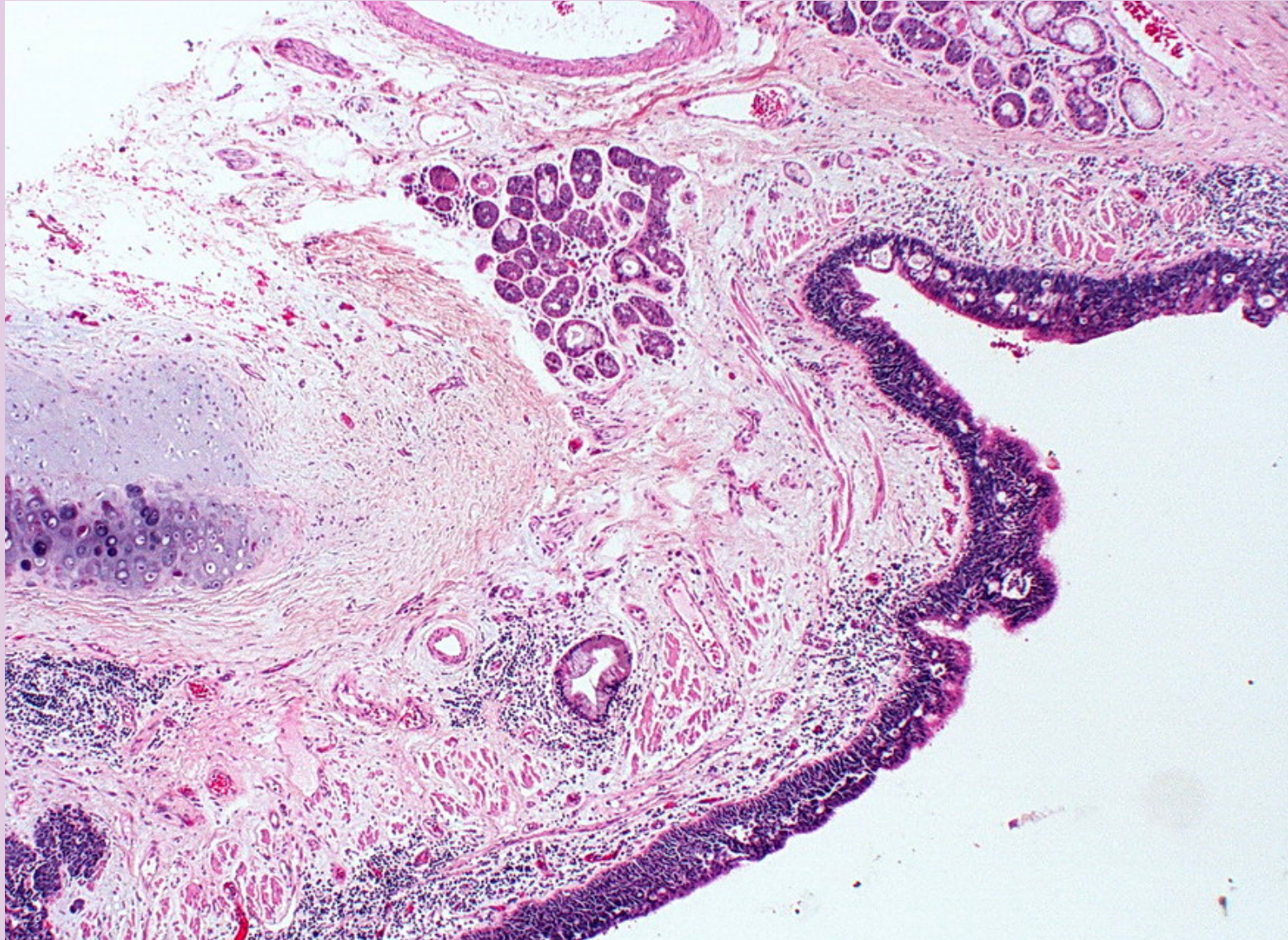
The few studies including POCs have recorded lower semen values among Black men compared to other groups.

Environmental toxins including lead, pesticides, air pollution and plasticizers are affect sperm counts, yet there is little data from POC participants in reproductive health studies despite often bearing the greatest pollutants.

# Solutions

1. Acknowledge racism in public health research
  - a. Address how racism has affected research findings in the past and how systemic racism still impacts research today
2. Include affected communities in decision-making
  - a. BIPOC scholars must hold leadership positions in science
3. Develop requirements and standards for discussing race in research
  - a. Create guidelines for how race and ethnicity can be used in research
4. Embrace a more holistic approach to analysis
  - a. Work beyond internal discipline boundaries
5. Partner with community members to conduct research
  - a. Empower study participants by giving them a say in how and what research is conducted
6. Improve training for researchers and students
  - a. Antiracism literacy can help researchers/professionals identify and analyze racism

# Discuss with a partner/small group



"Combined small cell lung carcinoma with extensive mucosal involvement; possible SCLC in situ Case 271" by Pulmonary Pathology is licensed under CC BY-SA 2.0.

## Guiding Questions:

- How can we address racism in epidemiological research?
- What is missing in current research?
- How can climate change exacerbate the inequalities in research representation?
- Who is suffering as a result?
- What do you think of the conclusions do the researchers come to?
- Do you agree with the proposed solutions?

# Partner activity: Short reading + discussion



# Climate justice through microbiology

- **Read** the op-ed "[Microbiologists as Experts in Climate Change Conversations](#)"
- **Discuss** the article with a partner:
  - How can microbiologists advance the climate change discussion?
  - What can microbiologists contribute to the fight for climate justice?

## Microbiologists as Experts in Climate Change Conversations

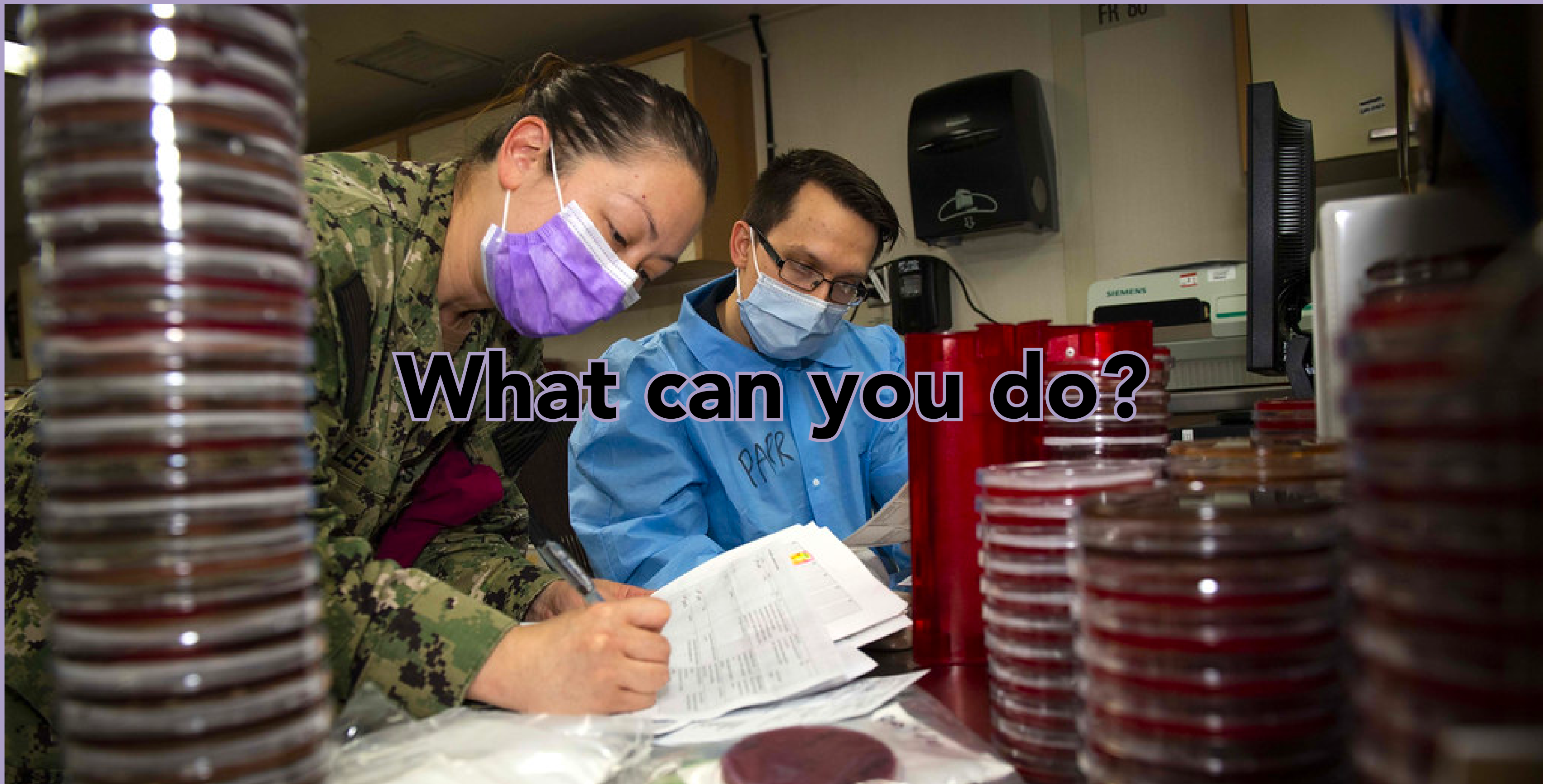
July 11, 2022

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[Climate change-induced variations](#) in temperature, humidity or atmospheric composition can have large impacts on microbial community structure, and subsequent effects on ecosystems, agriculture and human health. Despite their important roles, microbes, and the contributions of microbiologists, have long been overlooked in conversations and publications about climate change processes.

"This is a major problem, because the great elemental flows in this planet are [carried out] by microbes, and we worry that climate models and climate mitigation cannot be done effectively unless there is involvement [and use] of microbiology," said [American Academy of Microbiology](#) Board of Governors Chair Dr. Arturo Casadevall, a professor at Johns Hopkins Bloomberg School of Public Health.

The American Academy of Microbiology's 5-year [Climate Change and Microbes Scientific Portfolio](#) seeks to position microbiologists as thought leaders who actively participate in climate change discussions.



**What can you do?**

"Lt. Cmdr. Tida Lee, left, confers with Hospital Corpsman 3rd Class Jeremy Parr regarding a patient's cultured results in the microbiology lab aboard USNS Comfort (T-AH 20)." by Official U.S. Navy Imagery is licensed under CC BY 2.0.



# Project Option:

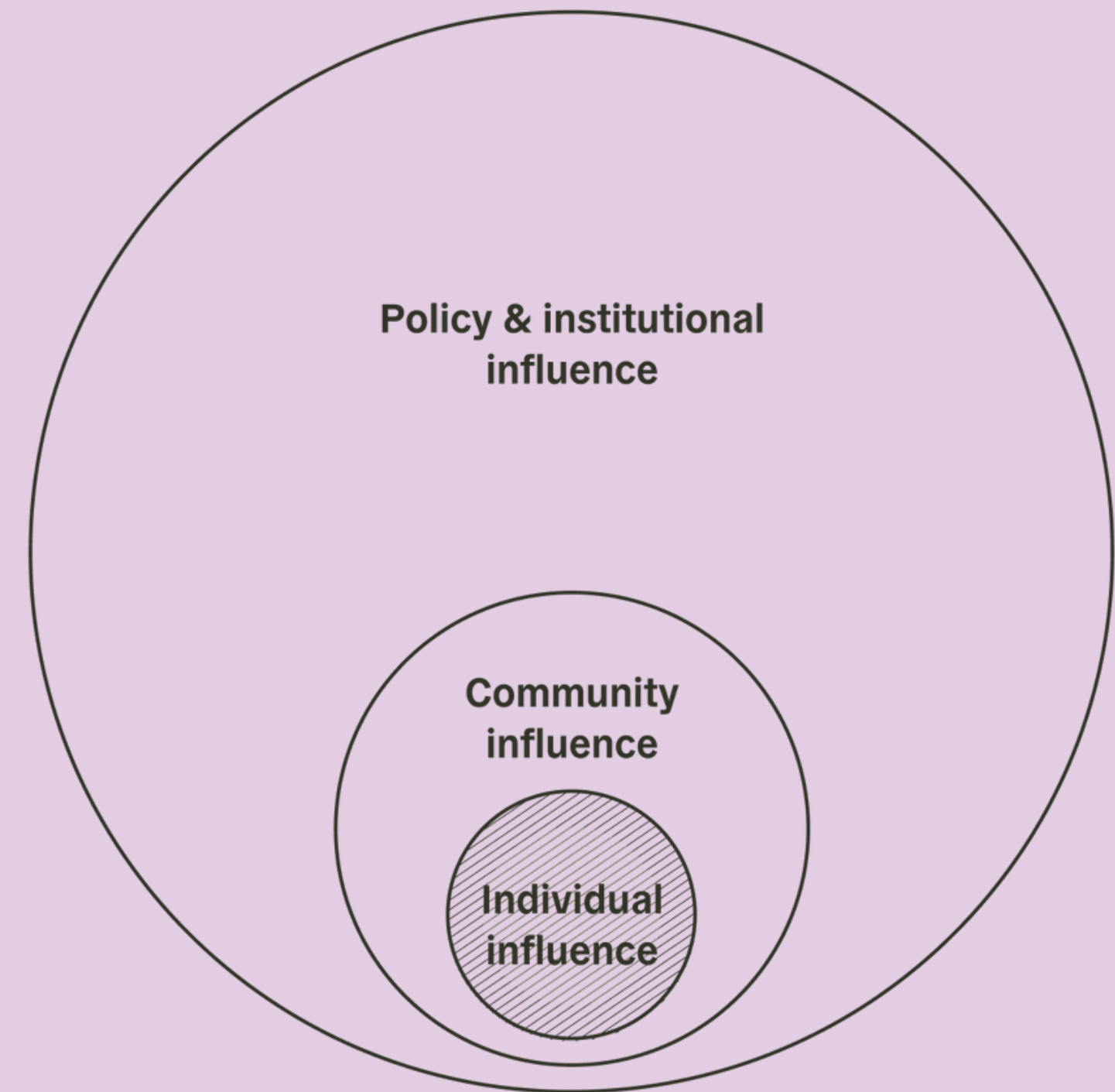
## Integrate biology into climate action:

Use these "Circles" template from the All We Can Save Project.

Identify ways you can include biology in climate justice policy, research, and personal actions.

Write a report detailing the steps that can be taken to integrate climate justice more deeply within Biology, Epidemiology or Exposure Science research or study.

How could this impact the widening circles of influence shown at right.



*Widening circles of influence  
for climate action*

*As formulated by  
Dr. Leah Stokes*

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