# 2023 NIEHS EHSCC MEETING: Disaster Research Response & Climate Change & Health

We are inviting members of the NIEHS P30 Centers to present their disaster research response-themed or climate change-themed work at the October 2023 NIEHS EHSCC MEETING in Houston, Texas.

The leadership of each P30 Center is encouraged to nominate a member of their center to present at the October meeting. To participate, the nominated member should send an abstract of their work to the 2023 NIEHS EHSCC MEETING planning committee by completing this online questionnaire.

Up to four abstract authors will be invited as plenary speakers. Others will be invited to share their work during poster sessions.

Please submit your abstract by July 24, 2023. Plenary speakers will be notified by August 7, 2023.

Thank you - 2023 NIEHS EHSCC MEETING planning committee.

Response was added on 07/21/2023 12:41pm.

## ABSTRACT AUTHOR'S CONTACT INFORMATION

| | |
|---|---|
| Author's name (first name last name): | Elizabeth A. Stone<br>(The abstract author is the prospective presenter) |
| Author's contact email address | betsy-stone@uiowa.edu |
| Author's title | Professor |
| Author's primary department & institution | Department of Chemistry, University of Iowa |
| P30 Center where the author is a member: | EHSRC (Iowa) |
| The project PI/Lead | ⊗ Same as abstract author<br>◯ Different from abstract author, if so, specify |

## PROJECT FOCUS

The primary focus of the project (you may select more than one option, if applicable)

☒ Disaster Research Response (DR2)
☒ Climate Change and Health (CCH)
☐ Other, please specify

The type of DR2 issues (being) studied

☒ Natural - cause not traceable to a single action by identifiable persons
☐ Industrial - cause traceable to an industry, usually due to business activities
☐ Individual/group - cause traceable to one or more persons (intentional act or accidental)
☐ Other, please specify

The climate change and health issues (being) studied

☒ Exposure pathways (extreme heat, air quality, water quality/quantity, vector ecology, etc.)
☐ Vulnerability factors (demographic, biological, social determinants, geographic, etc.)
☐ Health system capacity & resilience - (governance, EHS workforce, health information systems, etc.)
☐ Stress response (pathways, psychosocial stress, eco-anxiety)
☐ Climate and geospatial modeling
☐ Other, please specify

## PROJECT DETAILS - DR2/CCH AND HEALTH GAPS, PROJECT OBJECTIVES, FINDINGS, & LESSONS LEARNED

Study Title

Field observations of pollen fragments in thunderstorms

DR2- or CCH-specific research gaps that the project addressed/is addressing

This presentation addresses the environmental concentrations of aeroallergens in response to severe weather events, particularly thunderstorms. Pollen fragments carrying allergens can trigger bronchoconstriction in allergic individuals and are associated with "thunderstorm asthma" epidemics. Pollen fragments can be released from pollen grains that rupture following exposure to humidity or water, a process that is expected to be enhanced during thunderstorms by deep convection. Despite the importance of pollen fragments in human exposures to aeroallergens, there is a lack of environmental measurements of these particles, such that their abundance, size-resolved properties, and conditions that cause pollen rupturing are largely unknown. Climate change is predicted to increase pollen allergenicity, abundance, and duration of pollen season in response to increasing carbon dioxide levels and global temperatures. Concurrently, the frequency and strength of thunderstorms are predicted to increase, suggesting that pollen rupturing will become a larger source of particles in the atmosphere.

Project goals and objectives

The objectives of this study were to:
1) Characterize the size-resolved concentrations and chemical, biological, and physical properties of pollen fragments in atmospheric aerosols through field measurements in the Midwestern United States
2) Determine the meteorological, seasonal, and environmental conditions that induce pollen rupturing
3) Characterize the co-occurrence of pollen fragments with other potentially allergenic particles, including bacterial endotoxin and fungal spores

Research methods/approaches used

☐ Community-engaged research methods
☐ Communications research methods
☐ Field epidemiological methods
☒ Fundamental/basic science methods
☐ Other, please specify

Project stage/status:

◯ Project is ongoing - process findings available to present; no primary outcomes findings available yet
◯ Project is ongoing - process findings and/or primary outcomes findings available to present
⊗ Project completed - process findings and/or primary outcomes findings available to present
◯ No stage/status to report
◯ Other, please specify

Describe the process/primary outcomes findings from the project.

While falling rain washes pollen grains from the atmosphere, rain can also induce pollen rupturing into submicron pollen fragments. Compared to intact pollen grains, pollen fragments can penetrate deeper into the human respiratory system and persist longer in the atmosphere. Herein we provide the first online characterization of pollen fragments during thunderstorms and rain events, through a combination of single-particle fluorescence spectroscopy and offline measurements of chemical tracers. We show a significant increase in pollen fragments with diameters 0.25-1.0 µm coincident with convective and stratiform precipitation. Pollen fragment concentrations peak during convective thunderstorms with strong downdrafts, high rates of rainfall, and numerous lightning strikes, although lightning is not required for the fragments' release. After storms, pollen fragments persist in the atmosphere for several hours. Our results show that while intact pollen grains decrease substantially during rain, peak concentrations of submicron pollen fragments occur during rain events and then persist for up to 11 hours. Complementary laboratory measurements revealed the formation of pollen fragments from giant ragweed pollen, a prevalent late-summer allergen. A new method was developed to estimate the number of pollen fragments generated per pollen grain, and its application to giant ragweed revealed that at least 1400 pollen fragments per pollen grain.

Describe key challenges or lessons learned.

This study provides new information on the abundance, size-distribution, and meteorological drivers of pollen fragments in the atmosphere.  While major pollen fragmentation events are rare, low levels were observed throughout springtime on rainy days and did not require lightning for their occurrence. The observed size of pollen fragments, with diameters ranging 0.25 to 2.5 µm, indicates their potential to be inhaled and deposit in the lung at a much higher probability than intact pollen grains. Airborne bacteria were also elevated by thunderstorms, indicating co-exposures to these potentially allergenic atmospheric particles.

## PROJECT SPONSORSHIP/SUPPORT

Project sponsorship (choose all that apply)?

- ☐ P30 inter-center collaborative pilot funding (via NIEHS)
- ☒ Other NIEHS - (NOT inter-center collaborative funding)
- ☐ NIH - other institutes (NOT NIEHS)
- ☒ Any other federal agency (NOT NIH)
- ☐ Non-federal government agency (state, local, etc.)
- ☐ Non-government, non-profit entity
- ☐ For-profit entity
- ☐ Insitutional (intramural) funding
- ☐ Project not sponsored
- ☐ Other, please specify