

## NNCI Annual Meeting

27 October 2023

Trevor Thornton (Arizona State University), Mitsu Murayama (Virginia Tech)  
David Dickensheets and David Mogk (Montana State University)

## nano-EES bears upon several national priorities

- NNI Signature Initiative - *Water Sustainability through Nanotechnology*
- NAE Grand Challenge - *Providing Access to Clean Water*
- NSF 10 Big Ideas - *Growing Convergence Research*



## nano-EES goals

- Develop research tools and infrastructure to provide us with the capacity to approach more complex questions than ever before.
- Train the next generation of researchers to approach scientific inquiry in a way that crosses scales and scientific disciplines.
- Foster collaboration and convergent research across the network and beyond by helping us to consider multiple levels of organization and complexity in addressing key trans-disciplinary questions.

# Nanoscience in the Earth and Environmental Sciences Research Community

## *nano-EES*

- 1<sup>st</sup> nano-EES workshop hosted by MONT May 24-26, 2021



**MONTANA STATE UNIVERSITY**  
Montana Nanotechnology Facility  
Nanotechnology in STEM > NNCI 2021

**Nanotechnology in STEM**  
Nanotechnology: an Emerging Science  
Needs and Opportunities  
An Emerging Teaching Opportunity  
Evidence-based Teaching Practices  
Background Nanoscience Resources for Instructors  
Nanoscience

**NNCI Nanoscience Earth and Environmental Science Research Community Virtual Workshop**  
May 24–25, with optional 'Office Hours with Experts' on May 26, 2021  
Days begin at: 11 am ET/ 10am CT/ 9am MT/ 8am PT (Duration: 4 hours each day)  
Workshop Overview  
Nanoscience is a frontier area of research that provides abundant opportunities in many different scientific and engineering disciplines. Currently, the Earth and environmental sciences are underrepresented in their participation in this revolutionary field of study, which currently contributes to nano-enabled products worth roughly \$2 trillion annually! There is currently an amazing arsenal of analytical methods that are available to characterize the identity, morphology, composition (bulk and surface).



[https://serc.carleton.edu/msu\\_nanotech/nnci\\_spring2021/index.html](https://serc.carleton.edu/msu_nanotech/nnci_spring2021/index.html)

- 2<sup>nd</sup> nano-EES workshop hosted by NanoEarth May 16-18, 2022



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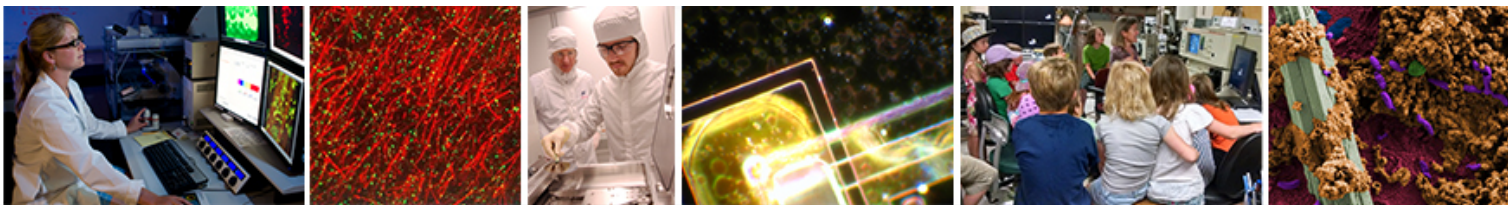
**NNCI Nanoscience in the Earth and Environmental Sciences Research Community Virtual Workshop**  
May 16–17, 2022, with optional 'Office Hours with Experts' on May 18  
Days begin at: 11 am Eastern (Duration: ~4.5 hours each day)  
Hosted by NanoEarth (The Virginia Tech National Center for Earth and Environmental Nanotechnology Infrastructure) in coordination with MONT, NCI-SW, and nano@stanford.

[https://serc.carleton.edu/msu\\_nanotech/nnci\\_spring2022/index.html](https://serc.carleton.edu/msu_nanotech/nnci_spring2022/index.html)

# Nanoscience in the Earth and Environmental Sciences Research Community

*nano-EES*

## 3<sup>rd</sup> nano-EES workshop hosted by NCI-SW April 5-6, 2023



Nanotechnology in STEM > NNCI Workshop Spring 2023

### Nanotechnology in STEM

MONT Fall 2022  
Virtual Event

MONT Users  
Meeting 2017

Goldschmidt  
Conference  
Workshop 2017

Goldschmidt  
Conference

## NNCI Nanoscience in the Earth and Environmental Sciences Research Community Virtual Workshop

April 5–6, 2023, including optional 'Office Hours with Experts'

Days begin at: 1pm Eastern Wednesday and 12pm Eastern Thursday (Duration: ~4 hours each day)

Hosted by NCI-SW, in coordination with NanoEarth (The Virginia Tech National Center for Earth and Environmental Nanotechnology Infrastructure), MONT, and nano@stanford.

[https://serc.carleton.edu/msu\\_nanotech/nnci\\_spring2023/index.html](https://serc.carleton.edu/msu_nanotech/nnci_spring2023/index.html)



nano@stanford

3<sup>rd</sup> nano-EES workshop hosted by NCI-SW April 5-6, 2023  
coordinated by Paul Westerhoff from ASU

## Workshop Goals

The goal of Day 1 is to introduce the audience to environmental nanoscience research using examples from water and agricultural research. There will be a panel discussion on airborne ultrafine nano-scale particles (Outdoor air pollution relative to Indoor Workplace EHS)

The goal of Day 2 is to discuss how sustainable nanotechnology topics, and hear about new directions in federal nanotechnology. The optional 'Office Hours with Experts' sessions on Day 2 will allow participants to sign up for 15-30 minute sessions with experts in topics of interest. Participants will be able to talk directly about their research interests and to solicit advice and feedback

## Day 1: Wednesday, April 5

Day 1 Theme: Frontiers of Nanoscience in Earth and Environmental Sciences & Engineering

### **Emerging Nanoscience Research for Water Purification: Nano-Enabled Treatment Processes versus Nano/Microplastics**

- Nanotechnology Enabled Water Treatment: Impacts from a NSF ERC  
Pedro Alvarez, Rice University
- Nano/Micro-plastic pollution: Weathering and Implications  
Francois Perreault, ASU

### **Emerging Nanoscience Research for Agriculture and Elemental Cycling**

- Detection and significance of nanomaterials in plants and agricultural systems  
Jorge Gardea-Torresdey, UTEP
- Measurement of Indoor and outdoor airborne particles  
Pierre Herckes (ASU)

## Day 2: Thursday, April 6

Day 2 Theme: Keynote Lecture & Office hours with Expert Session

- [Keynote lecture: Sustainable Nanotechnology](#) Julie Zimmerman, Yale University
- National Update: Nano4EARTH - Branden Brough, followed by Q&A

### Office Hours with Experts

- Emmanuel Soignard – Raman for nano-geology (ASU)
- Rick Hervig and Maitrayee Bose – SIMS and Nano-SIMS (ASU)
- David Mogk – TOF-SIMS, Auger Electron Spectroscopy, (MT State)
- Marc Michel – X-ray equipment; Sample prep (VT)



## 3<sup>rd</sup> nano-EES workshop hosted by NCI-SW April 5-6, 2023

### Workshop Summary

- 80 registrants
- 44 participants on day 1 and 27 on day 2
- Average 9.4/10, where 10 is extremely satisfied and 1 is extremely dissatisfied

*“I am new to the nanoscience field. Although I have been practicing for 35 years this is bring a deeper understanding of emerging ideas and implications”*

*“The videos from the workshops are very helpful to share with potential facility users and colleagues. This year having the pre-recorded talks makes them even easier to share”*

*“All topics were interesting and very well presented. The most valuable for my immediate needs were the ones dealing with advanced analytical techniques”*

## The Convergence of Biology and Earth Sciences

“Rules of Life” and “Nano EES” RC Joint Event

November 1, 2022

Montana State University  
Montana Nanotechnology Facility

nanotechnology in STEM > MONT Fall 2022 Virtual Event

### Nanotechnology in STEM

- Nanotechnology: an Emerging Science
- Needs and Opportunities
- An Emerging Teaching Opportunity
- Evidence-based Teaching Practices
- Background Nanoscience Resources for Instructors
- Nanoscience Literature for Earth and Environmental Science
- Instruments and Analytical Methods Common to Nano
- Registry of Analytical Equipment
- Ethics
- National Nanotechnology Coordinated Infrastructure
- Workshops and Events
  - NNCI Workshop Spring 2023
  - NNCI Workshop Spring 2022
  - NNCI Workshop Spring 2021

## MONT Fall 2022 Virtual Event

### The Convergence of Biology and Earth Sciences

Tuesday, November 1, 12–3 PM (Mountain Time), Online

*This event has already taken place. See Program below for related resources.*

### Description

This virtual event explores the intersection between biology and geological sciences. The speakers will discuss how microbial communities interact with and shape their environment, and how we can use tools from nanoscience to better understand these interactions.

This event is open to all, but will be of particular interest to anyone curious about how nanoscale technologies can help us probe microbial communities in the environment. Participants across the geosciences, biological sciences, physics, and engineering are encouraged to attend!

### Goals and Objectives

- Provide examples of the interface between biology and the geosciences.
- Provide an interdisciplinary networking opportunity.
- Introduce participants to research, tools, and services that can be used to explore the interface between biology and geosciences.

### Format

The event will take place virtually, using Zoom. Instructions for joining the event will be emailed to registered participants a day or two before the event takes place. Contact Stephanie McCalla (stephanie.mccalla at montana.edu) if you have questions about the event. Contact Monica Bruckner (mbruckne at carleton.edu) if you have questions about the connection information.



Gilkey Glacier, Alaska. Inset showing cryoconite sediments on glacier surface and confocal microscopy image of biofilm on the sediment surface. Image credits: C. Foreman and H. Smith, Montana State University.

[https://serc.carleton.edu/msu\\_nanotech/mont\\_fall2022/index.html](https://serc.carleton.edu/msu_nanotech/mont_fall2022/index.html)

## The Convergence of Biology and Earth Sciences

### Workshop Summary

- 60 Registrants
- 38 participants

### Gender

Female	18
Male	12
Prefer not to Answer	3
No Response	3

### Race

American Indian	1
Asian	2
Black	1
White	24
Prefer not to Answer	5
No Response	3

### Role

Academic Faculty	14
Government Employee	0
Industrial User	0
Industrial User - Small business (<500 employees)	0
Undergraduate Student	0
Graduate Student	6
Student (other than graduate or undergraduate)	1
Other (please specify)	14
No response	1

### Ethnicity

Hispanic	2
Not Hispanic	28
Prefer not to Answer	3
No Response	3

### Students' (only) Major Field of Study

- Earth and Environmental Science (1)
- Bioengineering (1)
- Electrical Engineering (2)
- Engineering (1)
- Geomicrobiology (1)
- Mechanical engineering, nanomaterials (1)
- Microbial Ecology (1)
- Physics (1)

### Institution Type

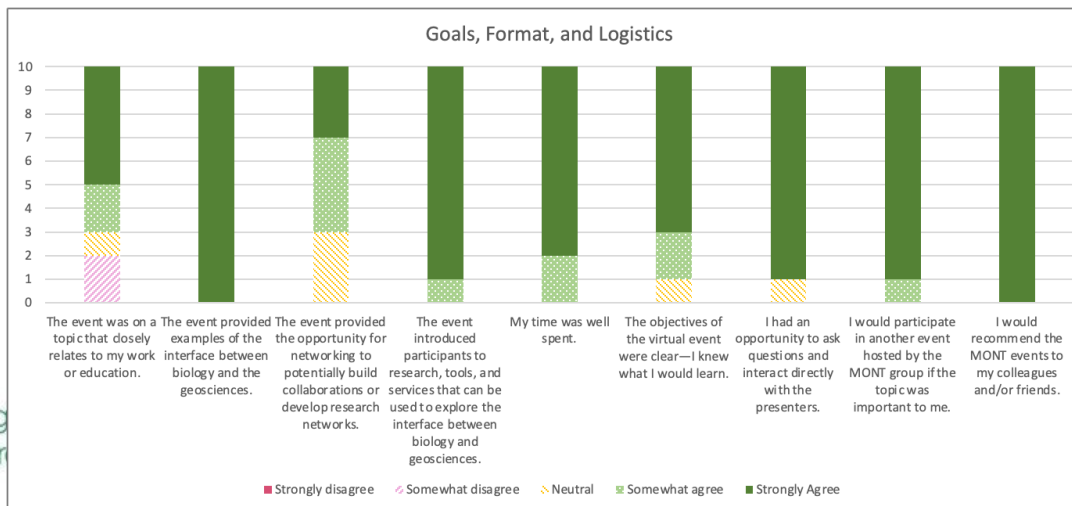
Academic	34
Government Lab	0
Commercial	1
No Response	1

### Workshop Program

## The Convergence of Biology and Earth Sciences Program

- Rachel Spietz (Dept. Microbiology and Cell Biology):  
**Reductive biomining of pyrite by methanogens**
- Christine Foreman (Dept. Chemical and Biological Engineering):  
**Exploration of microbes in icy environments.**
- Stephan Warnat (Dept. Mechanical and Industrial Engineering):  
**Detection of Microbes in Ice Using Microfabricated Impedance Spectroscopy Sensors**
- Chelsea Heveran ( Dept. Mechanical and Industrial Engineering):  
**From bones to stones: engineering living building materials**

## Feedback



## Next steps for 2024

4<sup>th</sup> nano-EES Workshop

Joint workshop between Nanotechnology  
Convergence RC and nano-EES RC

# Q&A