

C-STES

Center for Science, Technology,
Ethics, and Society

3 Years
supporting interdisciplinary research
collaboration

M

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Center for Science,
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Photos featuring people by Chatanika Stoop



C-STES: 3 Years of Community-Focused Research and Engagement

2020-2021

C-STES approved as MSU Center

Awarded Grants:

- Covid LAMP grant
- NSF-RED STREAM grant
- USDA Sustainable Crop Production grant

Hosted Events:

- Virtual speaker series
- Science Matters lecture series
- Interdisciplinary Grant Writing Boot Camp

2022-2023

Awarded Grants:

- Institute for Museum and Library Science grant on Responsible AI
- NSF EFRI-ELiS Grant: Engineered Living Infrastructure
- NSF EPSCoR Track I
- NSF Engines Type-1 award

Hosted Events:

- Water in the West Workshop

Supported Research:

- Research Incubator Awards

2021-2022

Awarded Grants:

- Humanities MT, SHARP Grant: Social Media Project grant
- Department of Energy Grant: Industrial-scale Geothermal Energy

Hosted Events:

- Engineering Ethics Symposium



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Kristen Intemann
C-STES Director



John Sheppard
C-STES Incoming Interim
Director



**Center for Science,
Technology, Ethics & Society**

Message from the Director

C-STES is a university-wide center for interdisciplinary research focusing on the social, ethical, and policy dimensions of science, technology, and medicine. We were approved by the MUS Board of Regents in 2020 just as the COVID-19 pandemic was gripping Montana and the world. In our first three years as a center, we have contributed to nine external grants awarded totaling over \$25.5 million.

Through grant activity, we have been able to support six Ph.D. students, one M.S. student, and one undergraduate student. These students are all contributing to projects that provide them the opportunity to work with faculty and graduate students from other disciplines and advance their own research in ways that make interdisciplinary connections and address the needs of Montana communities.

In our first three years, C-STES also hosted multiple events and public speakers, including an Engineering Ethics Symposium in honor of the late Allan McDonald and a highly successful interdisciplinary workshop on water security in May 2022, that hosted 50 researchers, scholars, and representatives from government agencies, tribal nations, and non-profit organizations. Participants came to Bozeman from states including Arizona, California, Colorado, Idaho, Illinois, Massachusetts, Montana, Nebraska, Pennsylvania, Texas, and Wyoming. That workshop resulted in a variety of collaborations (especially between MSU faculty and those working for NPS, USGS, and NRDC) and some new ideas for research directions that we hope will continue to be fruitful in the future.

Earlier this year, we also started a new program, Research Incubator Awards to help support interdisciplinary teams working on new research ideas or grant proposals. We look forward to continuing to support interdisciplinary research in the future.

Please also join me in welcoming Dr. John Sheppard who will be serving as the Interim Director for C-STES beginning July 2023. Dr. Sheppard is a Professor in the Gianforte School of Computing with expertise in machine learning, probabilistic models, population-based algorithms, and has worked on how these can be applied in health management, precision agriculture, and defense. He also specializes in the ethics in AI and serves on the IEEE Committee IEEE Computational Intelligence Society Ethics in Autonomous and Intelligent Systems Committee.

Dr. Kristen Intemann
C-STES Director 2018-2023

When the Covid-19 Pandemic closed campus, C-STES got to work conducting community research and engaging the public through a speaker series.



Plowright

* Author David Quammen and Dr. Raina Plowright (Microbiology & Immunology) discussed how pandemics originate.

* Dr. Blake Wiedenheft and Dr. Seth Walk (both Microbiology & Immunology) discussed strategies for detecting the virus and monitoring its spread.



Wiedenheft

* Dr. Cailin O'Connor (Logic & Philosophy of Science, UC Irvine) and Dr. Eric Raile (Political Science) covered polarization caused by the pandemic.



Quammen

* Dr. Maya Goldenberg (Philosophy, University of Guelph) and Matt Kelley (Gallatin County Public Health Officer) spoke about vaccine hesitancy.



Walk



O'Connor



Raile



Goldenberg



Kelley

Expanding Screening Capacity to Enhance Montana's COVID-19 Response Capabilities

Agency: State of Montana, Office of the Governor & Office of the Commissioner of Higher Education, CARES Act.

Investigators: Connie Chang (PI), with Co-PIs: Alexandra Adams, Selena Ahmed, Matthew Fields, Kristen Intemann, Raina Plowright, Seth Walk

Amount: \$776,000

Dates: 09/2020-12/2020

C-STES collaborated with the Center for American Indian and Rural Health Equity (CAIHRE) and Salish Kootenai College to co-produce culturally centered outreach and education materials about COVID-19 testing and public health recommendations for rural and Native communities.



Sustainable Transformation of Environmental engineering Education for Modern society (STREEM)

Agency: National Science Foundation, Division of Engineering Education and Centers

Award Number: 2021608

Investigators: Craig Woolard (PI), with Co-PIs: Ellen Lauchnor, Adrienne Phillips, Catherine Kirkland, and Kathryn Plymesser and C-STES senior personnel Eric Austin, Paul Gannon, Kristen Intemann, and Michelle Miley

Amount: \$995,828

Dates: 12/2020 - 11/2025

This project transforms environmental engineering education by replacing current topic-focused course model with a four-year thematic thread curriculum that integrates technical, social, and economic competencies and provides students with repeated opportunities to address ill-defined, complex problems like those they will face as professionals. The project is aligned with the NSF's Revolutionizing Engineering Departments (RED) program mission to catalyze revolutionary approaches to engineering education. As an Adaptation and Implementation (A&I) project, it builds off evidence-based organizational change strategies employed at other institutions, applies ground-breaking pedagogical methods in the project's local context, and propagates the transformation of engineering education.

Improving the Economic and Ecological Sustainability of US Crop Production through On-Farm Precision Experimentation

Agency: USDA, University of Illinois

Subaward Number: ILLUNI002

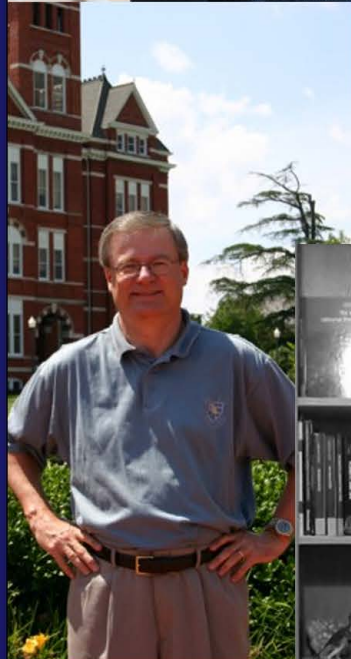
Investigators: John Sheppard, Bruce Maxwell

Amount: \$222,375.49

Dates: 01/01/21 - 03/30/24

This project examines ways in which machine learning in precision agriculture can be improved so as to enhance economic and ecological sustainability of agriculture practices. Part of this project involved C-STES collaboration to consider whether environmental or economic constraints could be built into multi-objective algorithms to have results more attentive to ethical aims in addition to crop yield.

Science Matters Lecture Series



Counterclockwise from left:
Science Matters Speakers
Kate Brown, Charles M.
Falco, Sarah Johnson,
Carol Cleland, James R.
Hansen

This lecture series features distinguished scholars and researchers sharing their work, its significance, and how they arrived at their conclusions. Prof. Kate Brown (MIT) discussed “The Great Chernobyl Acceleration” and Prof. Charles M. Falco (University of Arizona, Tucson) presented “The Science of Optics; The History of Art.” Dr. Sarah Johnson (Georgetown University) and Dr. Carol Cleland (University of Colorado, Boulder) discussed the search for life on Mars. Dr. James R. Hansen (University of Auburn) honored MSU alumnus Allan J. McDonald by discussing his efforts to prevent the Space Shuttle Challenger explosion and that disaster’s influence on engineering.



Critical Thinking About Social Media: Philosophy Curriculum for Montana High Schools

Agency: Humanities Montana, SHARP Grant

Award Number: 21C052

Investigators: Kristen Intemann (PI) Bonnie Sheehey, Preston Stovall

Undergraduate Research Assistant: Brin Purdy

Amount: \$8,300

Dates: 9/30/21-11/30/21

This project co-produced online and virtual curriculum resources for Montana High School teachers addressing ethical, social, and technical themes about social media platforms and their use. Topics included disinformation and media bias, reliable sources, polarization and social media, ethics of artificial intelligence and algorithms, and friendship and bullying online.

Thermally Induced Calcite Precipitation (TICP) as a Method to Control Hydraulic Properties in Enhanced Geothermal Systems

Agency: U.S. Department of Energy

Award Number: 4212028

Investigators: Adrienne Phillips (PI), Al Cunningham, Robin Gerlach, Lee Spangler, Kristen Intemann

Graduate Research Assistant: Angus Cummings

Graduate GIS Mapping Fellow: Maggie Althaus

Amount: \$437,363

Dates: 05/01/22-4/30/25

C-STES is working on the Diversity, Equity, and Inclusion portion of this grant by conducting an ethical impacts analysis of the development of geothermal energy potential in the Western U.S. (and particularly in Tribal Nations).

Engineering Courage: Ethics and Professionalism in a Complicated World



**Dr. James R. Hansen, 2021
Science Matters lecturer**

In honor of MSU alumnus Allan McDonald's prominent role in practical ethics education for engineers, C-STES held a special symposium during the Fall '21 semester.

McDonald worked as manager of the solid rocket motor program for Morton Thiokol. He refused to sign the launch order for the Space Shuttle Challenger in 1986 because of the concerns about the effect of cold weather on the performance of the joints connecting segments of the solid rocket motors. After the tragedy, McDonald was one of the few people involved with the courage to set the record straight about the circumstances leading up to the accident.

The purpose of the Allan J. McDonald symposium was to examine how professionals understand their obligation to speak up and stand their ground when they have knowledge and experience that gives them special insight into ethical matters. Participants at the symposium considered how professionals develop the courage to sidestep political pressure, conflicts of interest, and threats to one's career, when faced with ethical matters in a professional role.

The various presentations and panel discussions comprising the symposium led to a better understanding of how professionals in science and engineering can develop the obligation—and the professional courage—to use their specialized knowledge and experience to assist decision-making by those who might not have the same level of knowledge and experience. The symposium featured a Science Matters lecture given by Dr. James R. Hansen, an Auburn University historian who co-wrote “Truth, Lies, and O-rings” with McDonald.



Responsible AI: Tools for values-driven artificial intelligence in libraries and archives

Agency: Institute of Museum and Library Services

Investigators: Sara Mannheimer (PI), Co-PIs: Bonnie Sheehey, Scott Young, Jason Clark and Doralyn Rossmann

Amount: \$250,000

Dates: 09/2022-08/2025

AI is becoming more common across all sectors, and many libraries and archives are using AI to improve services. In order to use AI while also upholding library values and protecting the communities we serve from harm, it is imperative to develop practical resources that support responsible use of AI in library and archives contexts. Our project team views libraries and archives as uniquely positioned to act as community advocates for measured and deliberate adoption of new technologies. Responsible AI provides strategies for methodical consideration of potential harms of AI projects, with a goal of supporting decision-making. Project deliverables will help practitioners consider ethical implications as they embark on AI projects that support increased impact and new uses of library resources. Responsible AI provides new data, new resources, and new strategies that will prepare the library and archives profession for the methodical consideration of potential harms of AI projects.

Biofilm-functionalized and -maintained, living infrastructure systems

Agency: National Science Foundation, Emerging Frontiers in Research and Innovation

Award Number: 2223756

Investigators: Robin Gerlach (PI), Co-PIs: Matthew Fields, Kristen Intemann, Michael Berry, Adrienne Phillips

Amount: \$1,997,499

Dates: 1/2023-12/2026

This collaboration between the Center for Biofilm Engineering and C-STES will advance innovation of functionalized, self-repairing, sustainable building materials, while also examining how to increase trust in and public acceptance of such materials and living infrastructure systems.

Water in the West: Toward Convergent Solutions to Water Security

Interdisciplinary Regional Workshop

50
Scholars

11
States,
including Montana

3
Public Events



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C-STES, together with the Montana Water Center and the Ivan Doig Center, hosted a three-day workshop in May 2022. Participants' interest in water issues varied, and the conference explored ways convergent research might help address issues of water quality and scarcity in the West. Participants identified the environmental and social threats to our water systems and key gaps in knowledge that would be required to address them.

The workshop featured public events, including a keynote speech from Dr. Kelsey Leonard, Canada Research Chair in Indigenous Waters, Climate and Sustainability and an Assistant Professor in the Faculty of Environment at the University of Waterloo. Filmmakers Lara Tomov and Lailani Upham also screened their documentary film series, *Life In The Land*, which explores the interaction between Montana's land, water, and people.



Photo by Chatanika Stoop



SMART FireS (Sensors, Machine Learning, and Artificial Intelligence in Real Time for Fire Science)

Agency: NSF EPSCoR Track I

Award Number: 2242802

Investigators: Robert Walker (PI), Libby Metcalf and Joe Shaw (Co-PIs); Additional investigators include John Sheppard and Kristen Intemann

Amount: \$20M

Dates: 7/2023-6/2028

The Western U.S. is under increasing wildfire threat. This statewide project will transform the understanding of prescribed fire dynamics and the impact of prescribed fire on Montana's communities and public lands. C-STES will contribute to this project through interdisciplinary research that will examine the factors that influence decision maker trust in information and predictive models in decision making.

Advancing quantum and supporting technologies in the Northern Intermountain States (MT, WY, ID)

Agency: NSF Engines Type-1 Award

Award Number: 2304014

Investigators: Lee Spangler (PI), with additional investigators and partners including: Jackie Hines, Yves Idzerda, Kristen Intemann, Daniel Juliano, Li Lan, Luke Mauritsen, Barb Stiffarm and Suzi Taylor

Amount: \$1M

Dates: 6/2023-5/2025

This planning grant will allow us to assess regional capacity and strengthen partnerships with the goal of establishing a quantum supply chain in the region by creating an innovation ecosystem, and promoting workforce and economic development necessary for quantum materials. C-STES will be particularly involved in promoting diversity, equity, and inclusivity in workforce development and building equitable partnerships.

C-STES Research Incubator Awards

Research Incubator Awards (RIAs) support interdisciplinary collaborations that will lead to the development or submission of a competitive external grant proposal aligned with MSU grand challenges (research that will have significant social benefit, particularly for underserved populations).

2023 RIA Recipients



Sheehey



Whitaker

Understanding the Impacts of Tech Layoffs on Minority Workers and Students

Recipients:

Dr. Bonnie Sheehey (History and Philosophy) and
Dr. Bradley Whitaker (Electrical & Computer Engineering)

This project will identify limitations in current data and evaluate alternatives for generating better data about obstacles facing women, ethnic minorities, and people with disabilities in undergraduate and graduate STEM programs and employees in STEM industries. Improved data will increase understanding of how to broaden participation, inclusivity, and equity in STEM education and employment.



Cao



Johnson

3D Printed Multiplex Microfluidic Electrochemical Biosensors for Early Cancer Diagnosis

Recipients:

Dr. Yang Cao (Mechanical and Industrial Engineering),
Dr. Elizabeth Johnson (Mark and Robyn Jones College of Nursing), and
Dr. Stephanie McCalla (Chemical and Biological Engineering)

Cancer is the second leading cause of death worldwide and Montana (like other rural areas) has an increased mortality rate because of limited accessibility to expensive diagnosis equipment (e.g., CT scan, laboratory tests). This project aims to develop low-cost high-sensitivity electrochemical biosensors for early cancer diagnosis and work with local hospitals to meet this need.



McCalla



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