Title: Sustainable Sunlight-Driven Water Treatment with a Choreographic Lens

Abstract: Overcoming current challenges in global access to clean water will require substantial advancements in both treatment technologies and communication strategies. In this interdisciplinary project, we blend research into new materials for sunlight-driven water treatment with a choreographic performance designed to powerfully communicate this research and its broader implications. Students will collaborate to study the experiences of communities who lack access to clean water, investigate the chemical mechanisms driving this new water treatment technology, and communicate this work in an original dance performance film.

Team Members: Dr. Jody Weber (Dance) and Dr. Alyssa Deline (Chemical Sciences)

Background and Objectives. Access to safe and affordable water is a universal human right. We currently face an urgent global crisis in water security, with 1 in 3 people lacking reliable access to safe drinking water. It is vital that we develop sustainable water treatment technologies that are effective in low-resource settings, and that we effectively communicate the impact of this problem. Therefore, in this interdisciplinary project, we combine an investigation of novel materials for water treatment with the development of an original artistic work that integrates this research with its broader implications. As a professional choreographer, Dr. Jody Weber takes inspiration from scientific discovery and issues surrounding sustainability, engaging data with social context. Dr. Alyssa Deline's chemistry research laboratory has developed a new hybrid system for sunlight-driven water treatment. Here, carbon nanotubes (CNTs) are used as a strong and reactive support structure for titanium dioxide (TiO_2) particles, which then absorb sunlight and use it to break down waterborne contaminants. Just like our proposed collaboration integrating dance and chemistry, this hybrid system integrating CNTs with TiO_2 particles is far more impactful than the sum of its parts.

Our objectives for this project are to: 1) Research fundamental issues surrounding access to clean water and sustainable practices from a holistic, interdisciplinary perspective. 2) Investigate the mechanism by which CNTs and TiO_2 particles work synergistically to enhance water treatment performance. 3) Develop an original artistic work that fuses research on CNT/TiO_2 water treatment technologies with its broader implications for communities.

Interdisciplinarity of Project. This unique collaboration will involve 3 students and 2 mentors, working together to research and communicate the broader impacts of water insecurity, and the mechanisms by which we can sustainably treat water worldwide.

Methods. *Objective 1.* As an interdisciplinary team, 3 students and 2 mentors will research the impact of water resources on communities who lack access to clean water. Mentors will facilitate discussions about broader implications of this issue, and the team will identify personal stories with the potential to inspire our creative work. *Objective 2.* The entire team will discuss the structure and function of the CNT/TiO_2 purification system and its interaction with light. As the "chemistry working group," Dr. Deline and 1 student will perform experiments to probe the way that the two materials work in tandem, testing the system's performance with different light intensities and quenching materials to identify the primary mechanisms contributing to water treatment. The entire team will then discuss what has been elucidated. *Objective 3.* As the "dance

working group," Dr. Weber and 2 students will begin the choreographic process to develop a movement language based on our team's theme. This language will create through lines based on the experiences of communities facing water insecurity and the water treatment research. Finally, the entire team will create a short film based on the research and choreographic investigation.

Role of Students. We envision this project being carried out by a group of 3 students. 2 of these students would be closely mentored by Dr. Weber, with the responsibility of developing original choreography for the final performance piece. 1 student would be closely mentored by Dr. Deline, with the responsibility of completing experiments to investigate the mechanism for the CNT/TiO_2 water treatment system. All 3 students would collaborate on background research into water insecurity, and on the final short film based on their collective work. Students would be assisted by alumni Derek Taylor, who has created a number of dance films for BSU.

Anticipated Project Activities and Timeline.

February: The team will conduct research into larger issues surrounding water access.

March: The team will research communities who face challenges in water access and identify personal stories that can inspire the work. Chemistry student will be trained in lab techniques.

April: Dance students will create base choreographic phrase material and select music/sound. Chemistry student will complete experimentation with light intensity.

May: Team will discuss current progress and exchange ideas. Dance students will develop full structural timeline for work and plan video elements. Chemistry student will complete experimentation with quenching agents.

June: All components of the choreography will be filmed, and the final film will be edited. Video interviews will be conducted of students' reflective experiences with this project.

Dissemination of Results. This work will be disseminated through undergraduate research symposia at BSU (e.g., StARS). We will also publish the final film on the websites for the Departments of Dance and Chemical Sciences. Dr. Deline's research will be submitted to scientific journals when the project is complete, and visual elements of the collaboration could be incorporated into these manuscripts as accompanying figures or a visual abstract.

Relevant Experience. Dr. Jody Weber is a professional choreographer interested in how artistic investigation can provide additional perspectives on what science reveals and can also consider the human impact of data. She has brought this kind of artistic work to students at BSU through two projects: an investigation of the use of fracking and its impact on community, and a collaborative choreographic study of the chemical interactions between trees and the human body. Dr. Alyssa Deline is a chemist and environmental engineer experienced in mentoring new undergraduate researchers through a variety of formats. Her research laboratory, nicknamed "Team S.W.E.A.T." ("Solving Worldwide Environmental Atrocities Today") by her students, is focused on the development of sustainable materials to address global challenges in food and water security. Her project investigating sunlight-driven water treatment with CNT/TiO_2 systems was awarded a BSU CARS Faculty Librarian Research Grant for 2021.