Enlisting Historically Excluded Undergraduates in the Effort to Extend Knowledge of West Antarctica's Bedrock, Through Course-based Undergraduate Research Experiences (CUREs) and Art-Science Initiatives

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An enormous reserve of information about the subglacial bedrock, tectonic and topographic evolution of Marie Byrd Land (MBL) exists within glaciomarine sediments of the Amundsen Sea shelf, slope and deep sea, and MBL marine shelf. Investigators of the NSF ICI-Hot and NSF Linchpin projects partnered with Arizona Laserchron Center to provide course-based undergraduate research experiences (CUREs) for members of groups who do not ordinarily find access points to Antarctic science. Our courses enlist BIPOC and gender-expansive undergraduates in studies of ice-rafted debris (IRD) and bedrock samples, in order to impart skills, train in the use of research instrumentation, help students to develop confidence in their scientific abilities, and collaboratively address WAIS research questions at an early academic stage. CUREs afford benefits to graduate researchers and postdoctoral scientists, also, who join in as instructional faculty: CUREs allow GRs and PDs to engage in teaching that closely aligns with their active research, while providing practical experience to strengthen the academic portfolio (Cascella & Jez, 2018). Members of our project also create and lead art-science initiatives that engage students and community members who may not ordinarily engage with science, forging connections that make science relatable. Re-casting science topics through art centers personal connections and humanizes science, to promote understanding that goes beyond the purely analytical.

Academic research shows that diverse undergraduates gain markedly from the convergence of art and science, and from involvement in collaborative research conducted within a CURE cohort, rather than as an individualized experience (e.g. Shanahan et al. 2022). The CUREs are offered as regular courses for credit, making access equitable via course enrollment. The course designation carries a legitimacy that is sought by students who balance academics with part-time employment. Course information is disseminated via STEM Bridge programs and/or an academic advising hub that reaches students from groups that are insufficiently represented within STEM and cryosphere science.

CURE investigation of Amundsen Sea and WAIS problems is worthy objective because: 1) A variety of sample preparation, geochemical methods, and scientific best-practices can be imparted, while educating students about Antarctica's geological configuration and role in the Earth climate system. 2) Individual projects that are narrowly defined can readily scaffold into collaborative science at the time of data synthesis and interpretation. 3) There is a high likelihood of scientific discovery that contributes to research award objectives. 4) Enrolled students will experience ambiguity and instrumentation setbacks alongside their faculty and instructors, and will likely have an opportunity to withstand/overcome challenges in a manner that trains students in complex problem solving and imparts resilience (St John et al., 2019). Based on our experiences, we consider CUREs as a means to create more inclusive and equitable spaces for learning to do research, and a basis for a broadening the future WAIS community. Our groups have yet to assess student learning gains and STEM entry in a robust way, but we can report that two presenters at WAIS 2022 came from our 2021 CURE, and four polar science graduate researchers gained teaching experience through CURE.