UW College of Agriculture and Natural Resources

Global Perspectives Grant Program

Project Report Instructions

A brief written report must be submitted electronically to the AES office **within one month of returning from your trip**. Photographs supplementing the report are encouraged and are appreciated by the donor. Failure to submit a report may jeopardize future funding from AES.

In addition to forwarding these reports to our benefactor, reports will also be published on the AES website—do not include any photos that require permission to post to our webpage. Reports must be written in a style **understandable by the lay person** and may be edited for readability before being published to the AES website or the University of Wyoming Foundation report.

Format: Use 12 point type, single line spacing, and one inch margins. Submit your report to aes@uwyo.edu as a single PDF file.

Include the following information:

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1. COVER PAGE

Trip Date: **April 2023**

Principle Investigator(s) **Boothby** **Department:** **MOLB**
Email: **tboothby@uwyo.edu**

Project Title from Application: The role of intrinsically disordered proteins in desiccation tolerance

Non-technical summary (max 1500 characters plus spaces): Provide a one paragraph non-technical summary that most people can understand.

Water is considered essential to life since it is required for all metabolism (life processes). However, despite this there are a handful of animals, many plants, as well as microbes that are able to survive long-term and severe drying. These 'desiccation-tolerant' organisms are a biological mystery as the tricks they use to survive in the dry state are largely unknown. Recently, we have found that a very hardy group of animals, known as tardigrades or water bears, rely on a class of proteins known as intrinsically disordered proteins to survive in the dry state. The purpose of this trip was to visit the laboratory of Prof. Cesar Cuevas in Mexico City. Prof. Cuevas is a world expert in intrinsically disordered proteins and our intention was to combine expertise to better understand the role of these proteins in allowing tardigrades to survive drying.

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2. REPORT: Maximum of two pages of text; in addition, please also include **photos**. Must be written in a style understandable by a general audience.

Include:

1. Main results of activities planned in the proposal**.**

Intrinsically disordered proteins, unlike many other proteins, lack a stable three-dimensional structure. Because of this they are very sensitive to changes in their chemical environment. This is of interest, since during drying the chemical environment inside of a tardigrade changes dramatically.

We hypothesized that changes in the chemical environment inside of cells during drying would elicit changes to the conformation and potentially function of tardigrade disordered proteins. To this end, coordinated with Prof. Cuevas to generate modified versions of our proteins that would report on their expansion or compact (using a technique known as FRET). Prof. Cuevas's lab is an ideal setting to carry out this work, as he has refined techniques for doing this in living cells.

We found that upon changes to the chemical environment that are concomitant with drying, there was a general compaction of our tardigrade proteins. Using different proteins, we were able to see that some compacted more than others under the same conditions. We were then able to measure how protective these proteins were during drying. We found that generally the more responsive an IDP was the changes in the chemical environment brought on by drying the more protective it was.

This is a major step forward in connecting the biophysical sensitivity of disordered proteins to their protective function during drying.

2. Describe any future plans

We are currently analyzing results from a different technique (small angle X-ray scattering) to confirm what we saw with FRET. Generally the two approaches agree. We are writing a manuscript for publication on these results and aim to submit the manuscript within the next month or two.

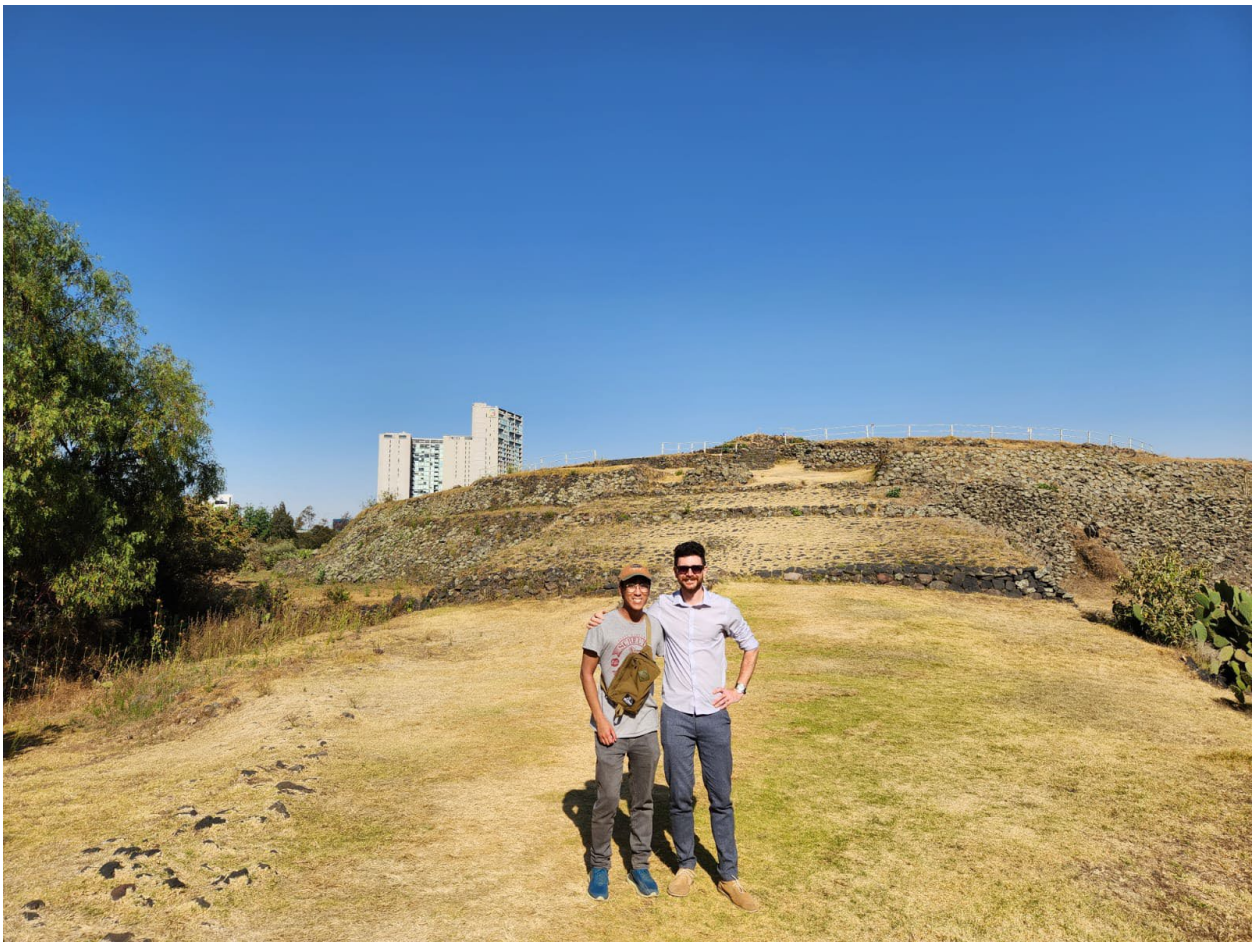
3. Outline potential impacts to a) the College of Agriculture, Life Sciences and Natural Resources, b) the University of Wyoming, and c) the State of Wyoming

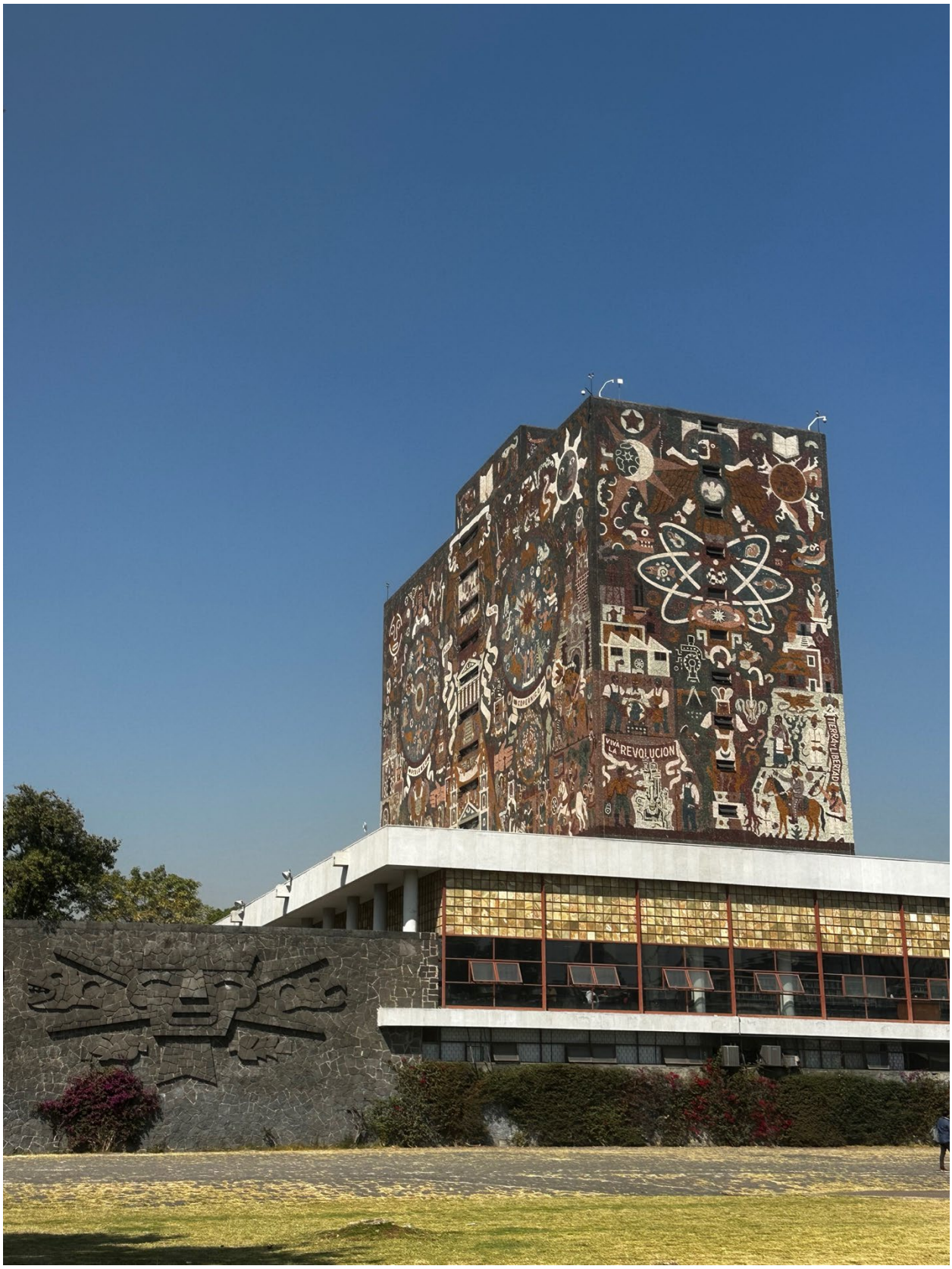
The potential impacts of these finds are myriad. Desiccation and desertification are major trends in global climates. Hotter and drier climates will affect many important industries including the energy and agricultural sector and has the potential to negatively impact health both domestically and globally.

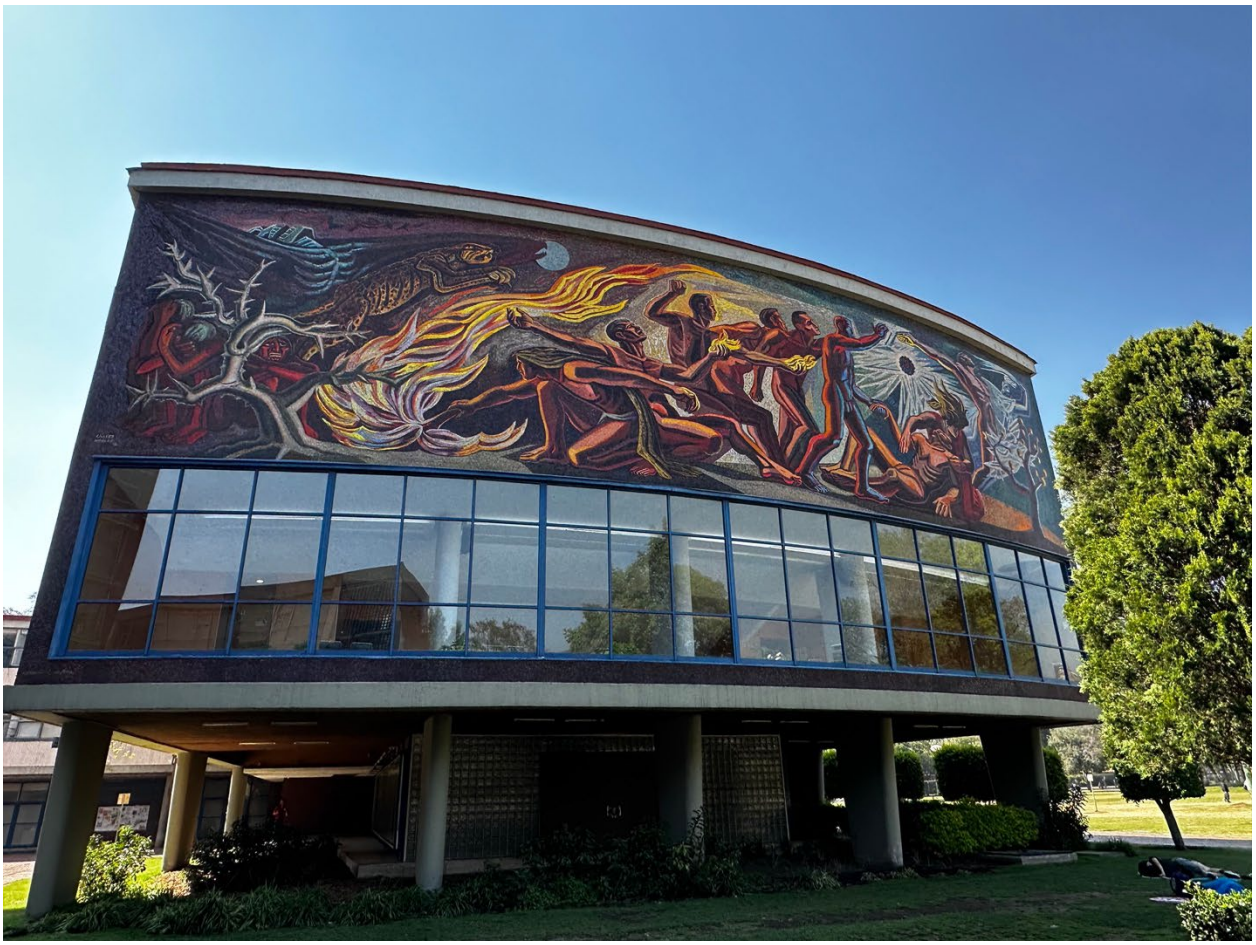
Identifying mediators of desiccation tolerance and understanding how they work promises to provide avenues for the generation of more stress tolerant crops. We are also working to translate these fundamental findings into biotechnologies for the storage of gametes from endangered and agriculturally important animals. Finally, these findings have helped us secure additional federal funding from the newly formed ARPA-H. This grant will allow us to explore the use of disordered proteins from tardigrades as stabilizers for important pharmacueticals.

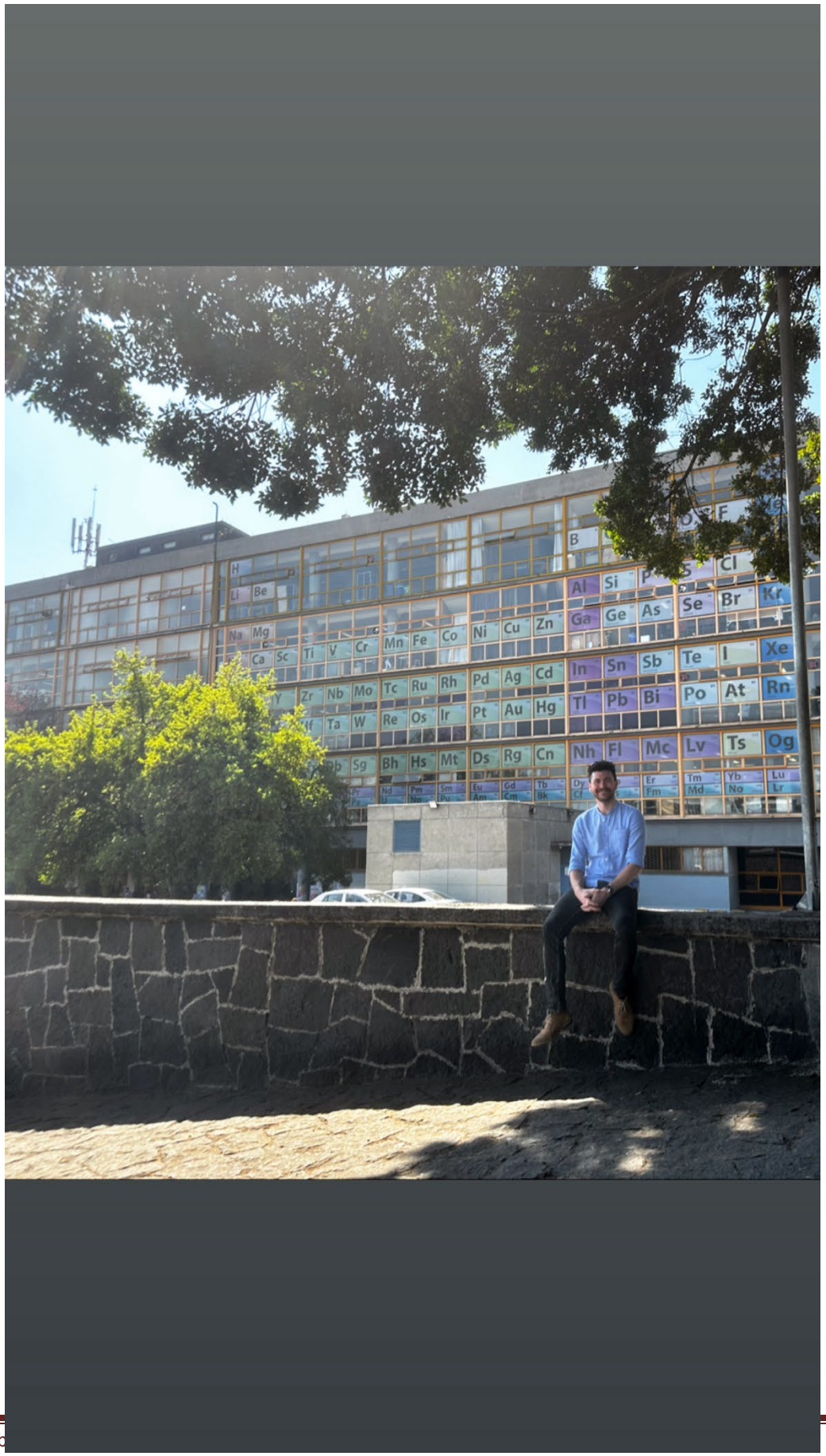
4.

Photos




VIVA LA REVOLUCION
TIERRA Y LIBERTAD

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Al Si P S Cl
Ga Ge As Se Br Kr
In Sn Sb Te I Xe
Tl Pb Bi Po At Rn
Nh Fl Mc Lv Ts Og

QUESTIONS? Contact Joanne Newcomb in the Agricultural Experiment Station office at aes@uwyo.edu or (307) 766-3667.