BIOGRAPHICAL SKETCH

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NAME: Brininger, Christian M.

eRA COMMONS USER NAME (credential, e.g., agency login): https://orcid.org/0000-0001-7278-4252

POSITION TITLE: Postdoctoral Researcher, University of Wisconsin-Madison, Department of Biochemistry

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Idaho State University, Pocatello, ID	BS/MS	05/2019	Biochemistry/ Chemistry
University of Colorado, Boulder, CO	PhD	05/2024	Biochemistry
University of Wisconsin, Madison, WI	Postdoc	In Progress	Biochemistry

A. Personal Statement

As a postdoctoral researcher, I am dedicated to unraveling the mechanisms of photosynthesis across diverse organisms and environments. My primary interest lies in understanding how these organisms acclimate to their unique growth conditions, with the aim of unlocking new bioengineering applications in the food and fuel technology sectors.

In my previous work, I employed light microscopy techniques, particularly live growth microscopy, to observe cell behaviors during active growth phases. This experience deepened my appreciation for the power of direct observation in research. This has driven me towards cryo-electron microscopy due to its increased resolution into protein level behaviors of systems. I am particularly drawn to both single particle and tomographic electron microscopy as methods to achieve high-resolution insights into the intricacies of photosynthesis—exploring not just protein structure, but also protein targeting and organization. This will be a cornerstone of my future research, as I aim to shed light on how photosynthetic organisms acclimate to varying light conditions.

My background includes multidisciplinary projects that merge fundamental scientific investigation with mechanical engineering expertise, fostering a collaborative environment that bridges research and application. I firmly believe that the best scientific advancements arise from diverse perspectives. Throughout my career, I have engaged with individuals from various fields, and I intend to continue this trend, enhancing the collaborative nature of my work and broadening my own understanding.

B. Positions, Scientific Appointments, and Honors

Positions and Employment

2024 -	Postdoctoral Research Associate, University of Wisconsin-Madison, Madison, WI
2024	Postdoctoral Research Associate, University of Colorado-Boulder, Boulder, CO
2019 - 2024	Graduate Research Assistant, University of Colorado-Boulder, Boulder, CO
2016	Research Intern, Institute of Surgical Research at Joint Base San Antonio, San Antonio, TX
2015 - 2019	Undergraduate Research Assistant, Idaho State University, Pocatello, ID

Other Experience and Professional Memberships
Ad hoc journal reviewer: Biomolecules
University of Colorado Boulder Faculty Liaison Council President
SCOPE (Science Community Outreach Program and Education) Volunteer and Team Lead

Honors

2024	Best Postdoctoral Researcher Talk – CARE Workshop
2020 - 2022	NIH Biophysics Training Grant T32
2024	ACS Inorganic Chemistry Award – Branch, Idaho State University

C. Contributions to Science

1. Biocementation is the process through which microbiologically induced calcium carbonate precipitation (MICP) is used to cement together a substrate, such as sand, and functions as an alternative to Portland Cement. In this manuscript, I utilize live growth microscopy and other techniques to identify two mechanisms of MICP in nitrogen-fixing cyanobacteria. These mechanisms offer reduced resource cost options for existing biocementation methods and provide biogeological insight into historical and modern MICP. These findings are: the nitrogen fixing cyanobacteria *Anabaena* sp. ATCC 33047 (*Ana* 33047) induces calcite nucleation and growth upon vegetative cell lysis, and that *Ana* 33047 heterocysts (specialized nitrogen fixing cells) induce calcium carbonate crystal growth upon contact. These results reveal a novel mechanism of MICP and open the doors to future discoveries of related MICP mechanisms. In addition, this work has potential industrial and evolutionary implications, and its future directions are currently under way for engineering new biocementation systems and products which would allow for the sequestration of atmospheric carbon within building materials. I was the primary source for experimental design, data collection, data analysis, writing, and editing of this manuscript. I collected all the data included in the final draft, performed all the analysis (with discussions and input from other authors), wrote the drafts (with input and discussion), and was responsible for final editing/ submission. In addition, due to the tragic situation surrounding my advisor, I have become a corresponding author and have taken on the responsibilities such as cover letter drafting, submission, etc.

    a. **Brininger CM**, Tay JW, Johnson EB, Espelie E, Cameron JC. Calcite Precipitation by a Nitrogen-Fixing Cyanobacterium. (2025) doi: https://doi.org/10.1101/2025.02.17.638518

2. Cell segmentation is one of the most time-consuming and important components of rigorous analysis of live growth microscopy data. There are many tool-sets which strive to offer cell segmentation algorithms for mammalian or small bacterial cells. However, the field was lacking in methods optimized for cyanobacterial systems. Cyanobacteria are important model organisms for studying photosynthesis and many green energy/ product synthesis applications. In this manuscript, we used an existing machine learning cell segmentation algorithm and optimized it for cyanobacteria. This work will provide an open source method for cell segmentation of cyanobacteria in live growth microscopy systems, a technique which is currently somewhat limited due to bottlenecks such as this but could quickly grow to become a major method. In this manuscript, it was found that use of this machine learning system improved cell segmentation of both single-celled and filamentous cyanobacteria. However, it also emphasizes the need for specialized training data to ensure the accuracy of the segmentation for your particular system. I was involved with the initial idea and discussion, data collection/ validation (especially related to the filamentous cyanobacteria segmentation data), writing (especially of the filamentous cyanobacteria sections), and late stage editing.

    a. Huffine, C.A., Maas, Z.L., Avramov, A., **Brininger, C.M**., Cameron, J.C., Tay, J.W., Machine learning models for segmentation and classification of cyanobacterial cells. (2025). PMID: 39713310

3. Volumetric muscle loss (VML) refers to the condition in which a significant portion of a muscle is lost due to traumatic injury or surgical removal. It has previously been observed that VML can result in disproportionate loss of function, attributed both to loss of tissue and to disruption of the neuromuscular

unit. In this manuscript, we quantified muscle axotomy of rat tibialis anterior muscles which received a ~20% muscle ablation to induce VML injury. We found that significant axotomy was observed (57-79%) through the final time points of these experiments (21 days post-injury), and that this was coupled with significant (45-90%) maximal torque deficit (indicating function loss). These findings establish important context for VML in rat models and provide understanding into the injury model which is found in humans. This provides the groundwork for further studies which explore treatment options and work to repair both the loss of tissue and muscle axotomy. I was involved with the data acquisition, specifically related to sample preparation and imaging of samples. I was involved with early data analysis regarding these samples and muscle fiber counts and contributed to editing/ review of the final article.

   a. Corona BT, Flanagan KE, **Brininger CM**, Goldman SM, Call JA, Greising SM. Impact of volumetric muscle loss injury on persistent motoneuron axotomy. (2018) PMID: 29144551

4. Halophiles are a type of extremophile bacteria or archaea which are known for growing in extremely high concentrations of salts. As a part of this adaptation, these organism express proteins which are extremely tolerant or dependent on high levels of salt to fold/ function. During my Master's degree, I wrote a research document revealing how I used a known folding motif from the halophilic protein HhCysRS, obtained from halophilic archaea, to design a peptide FRET sensor which folded in a salt dependent manner. This was designed to work as a proof of concept for engineering of salt sensitivity using motifs from halophilic proteins and was part of a larger scope to investigate the use of halophilic proteins or artificially designed proteins to act as a salt capture/ filtering system. This work is available from Idaho State University. Additionally, I authored two review articles during this time, in which I detailed the current state of the field regarding extremophile adaptations to their environments.

   a. **Brininger C.1,** Spradlin S.1, Cobani L., & Evilia C. (2017). The more adaptive to change, the more likely you are to survive: Protein adaptation in extremophiles. Seminars in Cell and Decelopmental Biology. DOI: https://doi.org/10.1016/j.semcdb.2017.12.016
   b. Spradlin S., Cobani L., **Brininger C.,** Evilia C. (2017) Archaea Were Trailblazers in Signaling Evolution: Protein Adaptation and Structural Fluidity as a Form of Intracellular Communication. In: Witzany G. (eds) Biocommunication of Archaea. Springer, Cham DOI: https://doi.org/10.1007/978-3-319-65536-9_12

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