

Lucas Busta

Assistant Professor, University of Minnesota Duluth. ORCID: 0000-0002-0102-9986

308 HCAMS · 1038 University Drive · Duluth, MN 55812

✉ bust0037@d.umn.edu 🌐 thebustalab.github.io | *Updated:* Jan. 6, 2026

Appointments

UNIVERSITY OF MINNESOTA DULUTH

2020-present Assistant Professor Department of Chemistry and Biochemistry

UNIVERSITY OF NEBRASKA LINCOLN

2018-2020 NSF Plant Genome Postdoctoral Research Fellow Advisor: Edgar B. Cahoon

2016-2018 Postdoctoral Research Associate Advisor: Edgar B. Cahoon

Education

UNIVERSITY OF BRITISH COLUMBIA

2011-2016 Ph.D. Chemistry Advisor: Reinhard Jetter

UNIVERSITY OF MINNESOTA DULUTH

2007-2011 B.S. Chemistry, Biochemistry & Molecular Biology Advisor: John F. Evans

Selected Honors and Awards

2025 Cottrell Scholar Award Research Corporation for Science Advancement

2024 Paul K. Stumpf Early Career Research Award International Society of Plant Lipids

2024 James P. Reihl Young Teacher Award .. UMD Swenson College of Science and Engineering

2020 Early Career Award The Plant Journal-Phytochemical Society of North America

2019 SciFinder Future Leader Award American Chemical Society CAS

2018 Postdoctoral Research Fellowship in Biology National Science Foundation

Funding

PENDING, AS PRINCIPAL INVESTIGATOR (TOTAL: \$1,800,000)

[1] Kingdom-Scale Integration of Plant Genomic and Chemical Data Using Artificial Intelligence. NSF PLANT GENOME RESEARCH PROGRAM \$1,800,000

FUNDED, AS PRINCIPAL INVESTIGATOR (TOTAL: \$1,351,000)

2026-present [8] Fundamental Insights into Paraffin Wax Permeability: Structure–Function Relationships in Hydrocarbon Films. ACS PETROLEUM RESEARCH FUND \$55,000

2025-present [7] UMD PRISM: a team for Place-based Recruitment, Instruction, Storytelling, and Messaging. UNIVERSITY OF MINNESOTA DULUTH \$25,000

2025-present [6] Sorghum Grain: A Domestic Source Of High-Value Natural Waxes To Increase Harvest Value And Supply Chain Security. USDA NATIONAL INSTITUTE OF FOOD AND AGRICULTURE \$650,000

2025-present [5] Using Artificial Intelligence to Predict Enzyme Products and Enhance Chemical Education. RESEARCH CORPORATION FOR SCIENCE ADVANCEMENT (COTTRELL SCHOLAR) \$120,000

2023-2024 [4] Bioengineered Yeast Strains To Produce Unique Flavors In Brewed Beverages. UNIVERSITY OF MINNESOTA \$10,000

2023-2024 [3] Community-Engaged Phytoremediation to Remove Toxic Mercury from the St. Louis River. UNIVERSITY OF MINNESOTA \$25,000

2020-2025 [2] Assistant Professor Start-Up Funds. UNIVERSITY OF MINNESOTA \$250,000

2018-2020 [1] Genes Controlling Wax Biosynthesis In Sorghum Bicolor: Potential For Improving Crop Performance And Value. NSF PLANT GENOME RESEARCH PROGRAM \$216,000

Publications

Bold indicates a Busta lab member or mentee.

PREPRINTS AND MANUSCRIPTS UNDER PEER REVIEW

[2] Davis Mathieu, Nicholas Schlecht, Marvin van Aalst, Kevin M. Shebek, **Lucas Busta**, **Nicole Babineau**, Oliver Ebenhoh, Bjoern Hamberger. “Rule-Based Deconstruction and Reconstruction of Diterpene Libraries: Categorizing Foundational Patterns & Unravelling the Structural Landscape”. BIORXIV, *preprint*, DOI: <https://doi.org/10.1101/2024.12.20.629783>

[1] Caitlin Hughes-Perry, Elizabeth Boileau, Jennifer Moore, Carter Meland, Ian Halpaus, **Rory Westerman**, Chanda Blesi, Ella Schoeberl, Aubrie Ecker, Jessica Sieber, **Lucas Busta**. “Land With A Capital L: Doing Interdisciplinary Research in the St. Louis River Watershed”. OPEN RIVERS JOURNAL, *under peer review*, DOI: TBD

PEER-REVIEWED JOURNAL ARTICLES

2025 [38] Makenzie Gibson, Willian Thives Santos, Alan R. Oyler, **Lucas Busta**, Craig A. Schenck. “A New Spin On Chemotaxonomy Using Non-Proteogenic Amino Acids As A Test Case”. APPLICATIONS IN PLANT SCIENCE, 13 (4) e70006, DOI: <https://doi.org/10.1002/aps3.70006>

2025 [37] **Rachel Knapp**, **Braidon Johnson**, **Lucas Busta**. “Advancing Plant Metabolic Research By Using Large Language Models To Expand Databases And Extract Labelled Data”. APPLICATIONS IN PLANT SCIENCE, 13 (4) e70007, DOI: <https://doi.org/10.1002/aps3.70007>

2025 [36] **Nicole Babineau**, **Le Thanh Dien Nguyen**, Davis Mathieu, **Clint McCue**, Nicholas Schlecht, **Taylor Abrahamson**, Bjoern Hamberger, **Lucas Busta**. “A Molecular Representation System With A Common Reference Frame For Natural Products Pathway Discovery And Structural Diversity Tasks”. PLANT COMMUNICATIONS, 6 (5) 101320, DOI: <https://doi.org/10.1016/j.xplc.2025.101320>

2025 [35] **Lucas Busta**, Alan R. Oyler. “Small Language Model Enhances Literature Processing Workflow: An Example With Plants And Their Secondary Metabolites”. QUANTITATIVE PLANT BIOLOGY, 6 (e26) NA, DOI: <https://doi.org/10.1017/qpb.2025.10021>

2025 [34] **Madison Larson**, Marshall Hampton, **Lucas Busta**. “Wax Bloom Dynamics On Sorghum Bicolor Under Different Environmental Stresses Reveal Signaling Modules Associated With Wax Production”. PHYSIOLOGIA PLANTARUM, 177 (3) e70349, DOI: <https://doi.org/10.1111/ppl.70349>

2024 [33] **Le Thanh Dien Nguyen**, **Nicole Groth**, **Kylie Mondloch**, Edgar B. Cahoon, Keith Jones, **Lucas Busta**. “Project ChemicalBlooms: Collaborating with Citizen Scientists to Survey the Chemical Diversity and Phylogenetic Distribution of Plant Epicuticular Wax Blooms”. PLANT DIRECT, 8 (5) e588, DOI: <https://doi.org/10.1002/pld3.588>

2024 [32] Guillaume Chomicki, Gustavo Burin, **Lucas Busta**, Jędrzej Gozdzik, Reinhard Jetter, Beth Mortimer, Ulrike Bauer. “Convergence In Carnivorous Pitcher Plants Reveals A Mechanism For Composite Trait Evolution”. SCIENCE, 383 (6678) 108-113, DOI: <https://doi.org/10.1126/science.ade0529>

2024 [31] **Emma Fitzgibbons**, **Jacob Lastovich**, **Samuel Scott**, **Nicole Groth**, **Amanda L Grusz**,

Lucas Busta. "Herbarium Specimens As Tools For Exploring The Evolution Of Fatty Acid-Derived Natural Products In Plants". THE PLANT JOURNAL, 120 (1) 9-18, DOI: <https://doi.org/10.1111/tpj.16989>

2024 [30] Lucas Busta, Drew Hall, **Braidon Johnson,** Madelyn Schaut, Caroline M Hanson, Anika Gupta, Megan Gundrum, Yuer Wang, Hiroshi A Maeda. "Mapping Of Specialized Metabolite Terms Onto A Plant Phylogeny Using Text Mining And Large Language Models". THE PLANT JOURNAL, 120 (1) 406-419, DOI: <https://doi.org/10.1111/tpj.16906>

2024 [29] Alex H. Crum, Lisa Philander, **Lucas Busta,** Ya Yang. "Traditional Medicinal Use Is Linked With Apparency, Not Specialized Metabolite Profiles In The Order Caryophyllales". AMERICAN JOURNAL OF BOTANY, 111 (4) e16308, DOI: <https://doi.org/10.1002/ajb2.16308>

2023 [28] Yang Jianfeng, **Lucas Busta,** Reinhard Jetter, Sun Yingpeng, Wang Tianyu, Zhang Wenlan, Ni Yu, Guo Yanjun. "Diversified Chemical Profiles Of Cuticular Wax On Alpine Meadow Plants Of The Qinghai-tibet Plateau". PLANTA, 257 (4) 74, DOI: <https://doi.org/10.1007/s00425-023-04107-1>

2023 [27] Jędrzej Gozdziak, **Lucas Busta,** Reinhard Jetter. "Leaf Cuticular Waxes Of Wild-Type Welsh Onion (*Allium fistulosum* L.) And A Wax-Deficient Mutant: Compounds With Terminal And Mid-Chain Functionalities". PLANT PHYSIOLOGY AND BIOCHEMISTRY, 198 (1) 107679, DOI: <https://doi.org/10.1016/j.plaphy.2023.107679>

2023 [26] Juan Betancurt Cardona, Sajjan Grover, **Lucas Busta,** Scott E Sattler, Joe Louis. "Sorghum Cuticular Waxes Influence Host Plant Selection By Aphids". PLANTA, 257 (22) pp. 1-7, DOI: <https://doi.org/10.1007/s00425-022-04046-3>

2023 [25] Juan Betancurt Cardona, Sajjan Grover, Michael J Bowman, **Lucas Busta,** Gautam Sarath, Scott E Sattler, Joe Louis. "Sugars And Cuticular Waxes Impact Sugarcane Aphid (*Melanaphis sacchari*) Colonization On Two Different Developmental Stages Of Sorghum". PLANT SCIENCE, 330 (0168-9452) 111646, DOI: <https://doi.org/10.1016/j.plantsci.2023.111646>

2022 [24] Lucas Busta, Kent D Chapman, Edgar B Cahoon. "Better Together: Protein Partnerships for Lineage-Specific Oil Accumulation". CURRENT OPINION IN PLANT BIOLOGY, 66 (1) pp. 102191, DOI: <https://doi.org/10.1016/j.pbi.2022.102191>

2022 [23] Lucas Busta, Ismail Dweikat, Shirley J Sato, Haolin Qu, Yong Xue, Bangjun Zhou, Lu Gan, Bin Yu, Thomas E Clemente, Edgar B Cahoon, Chi Zhang. "Chemical And Genetic Variation In Feral Cannabis Sativa Populations Across The Nebraska Climate Gradient". PHYTOCHEMISTRY, 200 (1) pp. 113206, DOI: <https://doi.org/10.1016/j.phytochem.2022.113206>

2022 [22] Patricia Santos, **Lucas Busta,** Won Cheol Yim, Edgar B Cahoon, Dylan K Kosma. "Structural Diversity, Biosynthesis, and Function of Plant Falcarin-type Polyacetylenic Lipids". JOURNAL OF EXPERIMENTAL BOTANY, 11 (1) pp. 1-12, DOI: <https://doi.org/10.1093/jxb/erac006>

2022 [21] Samuel Scott, Edgar Cahoon, **Lucas Busta.** "Variation on a Theme: The Structures and Biosynthesis of Specialized Fatty Acid Natural Products in Plants". THE PLANT JOURNAL, 11 (4) pp. 954-965, DOI: <https://doi.org/10.1111/tpj.15878>

- 2021 [20] **Lucas Busta**, Elizabeth Schmitz, Dylan K Kosma, James C Schnable, Edgar B Cahoon. "A Co-opted Steroid Synthesis Gene, Maintained In Sorghum But Not Maize, Is Associated With A Divergence In Leaf Wax Chemistry". PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, 118 (12) pp. 1–12, DOI: <https://doi.org/10.1073/pnas.2022982118>
- 2021 [19] Xuefeng Zhang, Yu Ni, Daixiang Xu, **Lucas Busta**, Yu Xiao, Reinhard Jetter, Yanjun Guo. "Integrative Analysis Of The Cuticular Lipidome And Transcriptome Of Sorghum Bicolor Reveals Cultivar Differences In Drought Tolerance". PLANT PHYSIOLOGY AND BIOCHEMISTRY, 163 (6) pp. 285–295, DOI: <https://doi.org/10.1016/j.plaphy.2021.04.007>
- 2021 [18] Craig Schenck, **Lucas Busta**. "Using Interdisciplinary, Phylogeny-guided Approaches To Understand The Evolution Of Plant Metabolism". PLANT MOLECULAR BIOLOGY, 109 (1) pp. 1–13, DOI: <https://doi.org/10.1007/s11103-021-01220-1>
- 2020 [17] **Lucas Busta**, Sabrina E Russo. "Enhancing Interdisciplinary And Systems Thinking With An Integrative Plant Chemistry Module Applied In Diverse Undergraduate Course Settings". JOURNAL OF CHEMICAL EDUCATION, 97 (12) pp. 4406–4413, DOI: <https://doi.org/10.1021/acs.jchemed.0c00395>
- 2020 [16] Henry V Jakubowski, Nicholas Bock, **Lucas Busta**, Matthew Pearce, Rebecca L Roston, Zachery D Shomo, Cassidy R Terrell. "Introducing Climate Change Into The Biochemistry And Molecular Biology Curriculum". BIOCHEMISTRY AND MOLECULAR BIOLOGY EDUCATION, 49 (2) pp. 167–188, DOI: <https://doi.org/10.1002/bmb.21422>
- 2020 [15] **Lucas Busta**, Olga Serra, Ok Tae Kim, Marisa Molinas, Irene Pere-Fossoul, Merce Figueras, Reinhard Jetter. "Oxidosqualene Cyclases Involved In The Biosynthesis Of Triterpenoids In Quercus Suber Cork". SCIENTIFIC REPORTS, 10 (1) pp. 1–12, DOI: <https://doi.org/10.1038/s41598-020-64913-5>
- 2019 [14] Tao Feng, Ya Yang, **Lucas Busta**, Edgar B Cahoon, Hengchang Wang. "FAD2 Gene Radiation And Positive Selection Contributed To Polyacetylene Metabolism Evolution In Campanulids". PLANT PHYSIOLOGY, 181 (2) pp. 714–728, DOI: <https://doi.org/10.1104/pp.19.00800>
- 2019 [13] Gianfranco Diretto, Sarah Frusciante, Claudia Fabbri, Nicolas Schauer, **Lucas Busta**, Zhonghua Wang, Antonio J Matas, Alessia Fiore, Jocelyn KC Rose, Alisdair R Fernie. "Manipulation Of β -Carotene Levels In Tomato Fruits Results In Increased ABA Content And Extended Shelf Life". PLANT BIOTECHNOLOGY JOURNAL, 18 (5) pp. 1185 - 1199, DOI: <https://doi.org/10.1111/pbi.13283>
- 2018 [12] Ok Tae Kim, Yurry Um, Mei Lan Jin, Jang Uk Kim, Daniela Hegebarth, **Lucas Busta**, Radu C Racovita, Reinhard Jetter. "A Novel Multifunctional C-23 Oxidase, CYP714E19, Is Involved In Asiaticoside Biosynthesis". PLANT AND CELL PHYSIOLOGY, 59 (6) pp. 1200–1213, DOI: <https://doi.org/10.1093/pcp/pcy055>
- 2018 [11] Yanjun Guo, Jia Jun Li, **Lucas Busta**, Reinhard Jetter. "Coverage And Composition Of Cuticular Waxes On The Fronds Of The Temperate Ferns Pteridium aquilinum, Cryptogramma crispa, Polypodium glycyrrhiza, Polystichum munitum And Gymnocarpium dryopteris". ANNALS OF BOTANY, 122 (4) pp. 555–568, DOI: <https://doi.org/10.1093/aob/mcy078>
- 2018 [10] Xiangjun Li, Alicen M Teitgen, Asghar Shirani, Juan Ling, **Lucas Busta**, Rebecca E

Cahoon, Wei Zhang, Zaiyun Li, Kent D Chapman, Diana Berman. "Discontinuous Fatty Acid Elongation Yields Hydroxylated Seed Oil With Improved Function". NATURE PLANTS, 4 (9) pp. 711–720, DOI: <https://doi.org/10.1038/s41477-018-0225-7>

2018 [9] **Lucas Busta**, Won Cheol Yim, Evan William LaBrant, Peng Wang, Lindsey Grimes, Kiah Malyszka, John C Cushman, Patricia Santos, Dylan K Kosma, Edgar B Cahoon. "Identification Of Genes Encoding Enzymes Catalyzing The Early Steps Of Carrot Polyacetylene Biosynthesis". PLANT PHYSIOLOGY, 178 (4) pp. 1507–1521, DOI: <https://doi.org/10.1104/pp.18.01195>

2018 [8] **Lucas Busta**, Reinhard Jetter. "Moving Beyond The Ubiquitous: The Diversity And Biosynthesis Of Specialty Compounds In Plant Cuticular Waxes". PHYTOCHEMISTRY REVIEWS, 17 (6) pp. 1275–1304, DOI: <https://doi.org/10.1007/s11101-017-9542-0>

2018 [7] Tongjun Sun, **Lucas Busta**, Qian Zhang, Pingtao Ding, Reinhard Jetter, Yuelin Zhang. "TGACG-BINDING FACTOR 1 (TGA 1) And TGA 4 Regulate Salicylic Acid And Pipelicolic Acid Biosynthesis By Modulating The Expression Of SYSTEMIC ACQUIRED RESISTANCE DEFICIENT 1 (sard 1) And CALMODULIN-BINDING PROTEIN 60g (CBP 60g)". NEW PHYTOLOGIST, 217 (1) pp. 344–354, DOI: <https://doi.org/10.1111/nph.14780>

2017 [6] **Lucas Busta**, Daniela Hegebarth, Edward Kroc, Reinhard Jetter. "Changes In Cuticular Wax Coverage And Composition On Developing Arabidopsis Leaves Are Influenced By Wax Biosynthesis Gene Expression Levels And Trichome Density". PLANTA, 245 (2) pp. 297–311, DOI: <https://doi.org/10.1007/s00425-016-2603-6>

2017 [5] Yanjun Guo, **Lucas Busta**, Reinhard Jetter. "Cuticular Wax Coverage And Composition Differ Among Organs Of Taraxacum officinale". PLANT PHYSIOLOGY AND BIOCHEMISTRY, 115 (1) pp. 372–379, DOI: <https://doi.org/10.1016/j.plaphy.2017.04.004>

2017 [4] **Lucas Busta**, Reinhard Jetter. "Structure And Biosynthesis Of Branched Wax Compounds On Wild Type And Wax Biosynthesis Mutants Of Arabidopsis Thaliana". PLANT AND CELL PHYSIOLOGY, 58 (6) pp. 1059–1074, DOI: <https://doi.org/10.1093/pcp/pcx051>

2016 [3] Pingtao Ding, Dmitrij Rekhter, Yuli Ding, Kirstin Feussner, **Lucas Busta**, Sven Haroth, Shaohua Xu, Xin Li, Reinhard Jetter, Ivo Feussner. "Characterization Of A Pipelicolic Acid Biosynthesis Pathway Required For Systemic Acquired Resistance". THE PLANT CELL, 28 (10) pp. 2603–2615, DOI: <https://doi.org/10.1105/tpc.16.00486>

2016 [2] **Lucas Busta**, Jessica M Budke, Reinhard Jetter. "Identification Of β -Hydroxy Fatty Acid Esters And Primary, Secondary-Alkanediol Esters In Cuticular Waxes Of The Moss Funaria hygrometrica". PHYTOCHEMISTRY, 121 (1) pp. 38–49, DOI: <https://doi.org/10.1016/j.phytochem.2015.10.007>

2016 [1] **Lucas Busta**, Jessica M Budke, Reinhard Jetter. "The Moss Funaria hygrometrica Has Cuticular Wax Similar To Vascular Plants, With Distinct Composition On Leafy Gametophyte, Calyptra And Sporophyte Capsule Surfaces". ANNALS OF BOTANY, 118 (3) pp. 511–522, DOI: <https://doi.org/10.1093/aob/mcw131>

Presentations

INVITED PRESENTATIONS

- 2025 [25]** “Leveraging Community Science and Language Models to Study the Chemistry of Plants”, Calvin University Chemistry and Biochemistry Seminar Series. Grand Rapids, Michigan. Host: Herb Fynewever 50 minutes
- 2025 [24]** “Citizen Science-Assisted Exploration Of Lineage-Specific Epicuticular Wax Blooms”, Department of Chemistry. Marquette, Michigan. Host: Lesley Putman 50 minutes
- 2025 [23]** “Citizen Science-Assisted Exploration Of Lineage-Specific Epicuticular Wax Blooms”, Gordon Reserach Seminar on Plant Lipids. Pamona, California. Host: Cailin Smith . 35 minutes
- 2025 [22]** “Leveraging Community Science and Language Models to Study the Chemistry of Plants”, Hope College Chemistry and Biochemistry Seminar Series. Holland, Michigan. Host: Meagan Elinski50 minutes
- 2025 [21]** “Leveraging Community Science and Language Models to Study the Chemistry of Plants”, University of Minnesota Duluth Chemistry and Biochemistry Seminar Series. Duluth, Minnesota. Host: Kathryn Schreiner 50 minutes
- 2024 [20]** “Citizen Science-Assisted Exploration of Lineage-Specific Epicuticular Wax Blooms”, Center for Precision Plant Genomics, University of Minnesota. St. Paul, Minnesota. Host: Michael Smanski 50 minutes
- 2024 [19]** “Citizen Science-Assisted Exploration Of Lineage-Specific Epicuticular Wax Blooms”, International Symposium on Plant Lipids. Lincoln, Nebraska. Host: Edgar B. Cahoon 20 minutes
- 2023 [18]** “Preserved Plant Specimens As Tools For Exploring The Evolution Of Biosynthetic Pathways To Fatty Acid-derived Natural Products”, Department of Biochemistry and Molecular Biology, Michigan State University. East Lansing. Host: Lucas Reist 50 minutes
- 2023 [17]** “Wax Bloom Dynamics in Sorghum Bicolor”, Department of Horticulture, University of Minnesota. Virtual. Host: Matt Gullickson50 minutes
- 2022 [16]** “Using Citizen Science To Communicate And Catalyze Plant Chemical And Genomic Research”, Departments of Biology and Chemistry, College of St. Scholastica. Duluth. Host: Asst. Prof. Heather Brown50 minutes
- 2022 [15]** “Chemical And Genetic Variation In Feral Cannabis Sativa Populations Across The Nebraska Climate Gradient”, Polyphenols Applications. Valencia. Host: Fred Stephens 25 minutes
- 2021 [14]** “A Co-opted Steroid Synthesis Gene, Maintained In Sorghum But Not Maize, Is Associated With A Divergence In Leaf Wax Chemistry”, Department of Biochemistry, North Carolina State University. Virtual Conference. Host: Josh Strable 50 minutes
- 2021 [13]** “Using Citizen Science To Communicate And Catalyze Plant Chemical And Genomic Research”, Department of Biological Sciences, East Tennessee State University. Virtual Seminar.

Host: Prof. Dhirendra Kumar 50 minutes

2021 [12] “A Co-opted Steroid Synthesis Gene, Maintained In Sorghum But Not Maize, Is Associated With A Divergence In Leaf Wax Chemistry”, Meeting of the Botanical Society of America. Virtual Conference.15 minutes

2021 [11] “A Co-opted Steroid Synthesis Gene, Maintained In Sorghum But Not Maize, Is Associated With A Divergence In Leaf Wax Chemistry”, Plant Apoplastic Diffusion Barriers (mini session). Virtual Conference. Host: Sarah McKim 50 minutes

2021 [10] “A Co-opted Steroid Synthesis Gene, Maintained In Sorghum But Not Maize, Is Associated With A Divergence In Leaf Wax Chemistry”, UMN Plant Breeding Seminar Series. Virtual Seminar. Host: Prof. Eric Watkins50 minutes

2020 [9] “Integrated Bioanalytical Chemistry: Quantitative And Structural Analyses Of Biomolecules Large And Small To Understand Metabolism”, Department of Chemistry and Biochemistry, University of MN Duluth. Duluth, Minnesota. Host: Prof. Erin Sheets 50 minutes

2020 [8] “Integrated Bioanalytical Chemistry: Quantitative And Structural Analyses Of Biomolecules Large And Small To Understand Metabolism”, Department of Chemistry, Northern Michigan University. Marquette, Michigan. Host: Prof. Mark Paulsen 50 minutes

2020 [7] “Using Citizen Science To Communicate And Catalyze Plant Chemical And Genomic Research”, Plant and Animal Genome Conference XXVIII. San Diego, California. Host: Diane Okamuro (NSF Program Officer) 25 minutes

2020 [6] “Using Citizen Science To Communicate And Catalyze Plant Chemical And Genomic Research”, University of Minnesota Duluth Departmental Seminar. Duluth. Host: Venkatram Mereddy 50 minutes

2019 [5] “Fatty Acids: A Metabolic Starting Point For Plant Chemicals With Diverse Functions Both Above And Below Ground”, Department of Biochemistry, The University of Nebraska Lincoln. Lincoln, Nebraska. Host: Prof. Edgar Cahoon 50 minutes

2019 [4] “Analytical Chemistry In The Age Of Genomics: Quantitative And Structural Analyses To Understand Metabolism And Fuel A Bio-Based Economy”, Departments of Biology and Chemistry Joint Seminar, The University Of Minnesota Duluth. Duluth, Minnesota. Hosts: Prof. Steve Berry and Prof. Jennifer Liang 50 minutes

2018 [3] “Phytochemical Structures And Occurrence Across Plant Diversity As A Tool For Biosynthetic Pathway Discovery”, Department of Biochemistry, The University of Nevada Reno. Reno, Nevada. Host: Prof. Dylan Kosma 50 minutes

2016 [2] “The Diversity And Biosynthesis Of Cuticular Waxes”, The Boyce Thompson Institute. Ithaca, New York. Host: Prof. James Giovannoni 50 minutes

2016 [1] “The Diversity And Biosynthesis Of Waxes”, The Center For Plant Science Innovation. Lincoln, Nebraska. Host: Prof. Edgar Cahoon 50 minutes

Teaching and Mentorship

COURSES TAUGHT

Fall 2025	CHEM4725 Data Analysis & Communication	Enrollment: 23
Fall 2025	CHEM2223 Quantitative Analysis Lecture Laboratory	Enrollment: 54
Spring 2025	CHEM4725 Data Analysis & Communication	Enrollment: 26
Spring 2025	CHEM4242 Instrumental Analysis Lecture	Enrollment: 25
Fall 2024	CHEM4725 Data Analysis & Communication	Enrollment: 25
Fall 2024	CHEM2222 Quantitative Analysis Lecture	Enrollment: 72
Spring 2024	CHEM4720 Modern Mass Spectrometry	Enrollment: 12
Spring 2024	CHEM4242 Instrumental Analysis Lecture	Enrollment: 37
Fall 2023	CHEM5725 Advanced Analytical Chemistry I	Enrollment: 6
Fall 2023	CHEM2222 Quantitative Analysis Lecture	Enrollment: 49
Spring 2023	CHEM4242 Instrumental Analysis Lecture	Enrollment: 28
Fall 2022	CHEM5725 Advanced Analytical Chemistry I	Enrollment: 12
Fall 2022	CHEM2222 Quantitative Analysis Lecture	Enrollment: 78
Spring 2022	CHEM4242 Instrumental Analysis Lecture	Enrollment: 25
Spring 2022	CHEM2223 Quantitative Analysis Lecture Laboratory	Enrollment: 63
Fall 2021	CHEM5725 Advanced Analytical Chemistry I	Enrollment: 12
Fall 2021	CHEM2223 Quantitative Analysis Lecture Laboratory	Enrollment: 82
Spring 2021	CHEM8720 Modern Mass Spectrometry	Enrollment: 7
Spring 2021	CHEM2223 Quantitative Analysis Lecture Laboratory	Enrollment: 70
Fall 2020	CHEM5725 Advanced Analytical Chemistry I	Enrollment: 12

CURRICULUM DEVELOPMENT

Course Development and Curriculum Design. Designed and implemented multiple courses from scratch, including: CHEM 4720/5720: Modern Mass Spectrometry (fully developed original course materials including lecture slides, assignments, mid-term exams, and Canvas site, integrated GitHub-hosted student projects to facilitate modern collaborative learning) and CHEM 5725: Data Analysis for the Natural Sciences (created and continuously updated a digital textbook, Integrated Bioanalytics, including R-based analytical methods). See: https://thebustalab.github.io/integrated_bioanalytics/book/index.html

Integration of Real-World Applications and Community Engagement. Developed experiments connecting coursework to real-world applications, including: A new quantitative analysis laboratory experiment on “Determination of Lead in Drinking Water,” incorporating collaboration with the City of Duluth and funded by the Chancellor’s Small Grant; Guest lectures from industry professionals (Agilent Technologies, ToFWERK, local chemical analysis firms) in Instrumental Analysis and Modern Mass Spectrometry courses; Alumni-authored introductions to laboratory experiments, linking course content directly to professional practice in academia and industry.

Innovative Assessment and Grading Practices. Implemented evidence-based grading practices such as: Replacing high-stakes exams with frequent low-stakes quizzes to improve student learning outcomes and reduce assessment stress (CHEM 4242, 2222). Using iterative feedback and revision cycles inspired by “Ungrading” methods, allowing students to repeatedly revise assignments to achieve mastery (CHEM 5725). Piloted and fully implemented practical final exams in CHEM 2223 in collaboration with the Wainman Lab.

Active Learning and Student Engagement. Incorporated group-based active learning assignments across multiple courses (CHEM 2222, 4242, 5720). Introduced optional “challenge” problems to better engage high-achieving students during in-class activities (CHEM 2222). Transitioned final project presentations to in-class poster sessions to enhance student engagement and peer-to-peer interactions (CHEM 4242).

Incorporation of Advanced Analytical and Computational Techniques. Introduced units on advanced data analysis methods, including machine learning methods such as random forests for regression and classification, as well as artificial intelligence applications including embedding models and large language models for textual analysis and summarization (CHEM 5725/4725).

Recognition and Professional Development. Awarded the Swenson College of Science and Engineering Young Teacher Award for excellence in teaching. Received institutional support (Chancellor’s Small Grant, UMD Office of Community Engagement mini-grant) for innovative teaching-related projects. Participated in external training workshops, including the Mobile Institute on Scientific Teaching, UMN Center for Education Innovation workshops, and webinars hosted by institutions such as Harvard University on using artificial intelligence in teaching.

RESEARCH ADVISOR

2025-present [24] Skylar Vargas (Major: Biochemistry) Undergraduate Student
 2024-present [23] Brianne Beebe (Major: Biochemistry) Undergraduate Student
 2024-present [22] Samantha Saenger (Major: Biochemistry) Undergraduate Student
 2023-present [21] Jenna Fette (Major: Biochemistry) Undergraduate Student
 2023-present [20] Jenny Ruliffson (Major: Chemistry) Masters Student
 2023-present [19] Rory Westerman Masters Student
 2022-present [18] Madison Larson Masters Student
 2025-2025 [17] Allie Beyer (Major: Biochemistry) Undergraduate Student
 2024-2025 [16] Rachel Knapp (Major: Biochemistry) Undergraduate Student
 2023-2025 [15] Zachary Reuter (Major: Chemistry) Undergraduate Student
 2022-2025 [14] Braidon Johnson (Major: Chemical Engineering) Undergraduate Student
 2022-2025 [13] Kylie Mondloch (Major: Chemistry) Undergraduate Student
 2022-2024 [12] Emma Fitzgibbons Masters Student
 Subsequently: Forensic Chemistry PhD program (prestigious), Sam Houston State University, Texas.
 2022-2024 [11] Taylor Abrahamson Masters Student
 Subsequently: Forensic / Property Room Technician, Anoka County Sheriff’s Office, Minnesota.
 2021-2024 [10] Nicole Babineau (Major: Biochemical Engineering) Undergraduate Student
 2020-2024 [9] Nicole Groth (Major: Biology) Undergraduate Student
 2021-2023 [8] Maddie Baregi (Major: Biochemistry) Undergraduate Student
 2021-2023 [7] Samuel Scott Masters Student
 Subsequently: Regulatory Supervisor / Food Scientist at RFI Ingredients in Denver, Colorado.
 2021-2022 [6] Amber McRae (Major: Biochemistry) Undergraduate Student
 2021-2022 [5] Clint McCue (Major: Biochemistry) Undergraduate Student
 2021-2022 [4] Noah Gorman (Major: Chemistry) Undergraduate Student
 2020-2022 [3] Jacob Lastovich (Major: Biology) Undergraduate Student
 2020-2022 [2] Le Thanh Dien Nguyen Masters Student
 Subsequently: Pursuing PhD in Chemistry at the University of Alberta in Edmonton, Canada.
 2020-2020 [1] Alexis Salmon (Major: Biology) Undergraduate Student

THESIS COMMITTEE MEMBER

2025-present	[22]	Ian Halpaus	Master's Thesis/Research Committee
2025-2025	[21]	Madison Larson	Master's Thesis/Research Committee
2024-present	[20]	Rory Westerman	Master's Thesis/Research Committee
2024-present	[19]	Jenny Ruliffson	Master's Thesis/Research Committee
2024-2024	[18]	Soren Sjerven	Master's Thesis/Research Committee
2024-2024	[17]	Taylor Abrahamson	Master's Thesis/Research Committee
2024-2024	[16]	David Hainlen	Master's Thesis/Research Committee
2024-2024	[15]	Thomas Badzinski	Master's Thesis/Research Committee
2023-2023	[14]	Jonathan Tigner	Master's Thesis/Research Committee
2023-2024	[13]	Bryan Reutzel	Master's Thesis/Research Committee
2023-2024	[12]	Ross Brink	Master's Thesis/Research Committee
2023-2024	[11]	Caitlin Hughes-Parry	Master's Thesis/Research Committee
2023-2024	[10]	Emma Fitzgibbons	Master's Thesis/Research Committee
2023-2025	[9]	Joseph Marchand	Master's Thesis/Research Committee
2022-2022	[8]	Dien Nguyen	Master's Thesis/Research Committee
2022-2023	[7]	Rebecca Rooney	Master's Thesis/Research Committee
2022-2024	[6]	Benjamin Christopherson	Master's Thesis/Research Committee
2022-2025	[5]	Malachy Brink	Master's Thesis/Research Committee
2021-2023	[4]	Samuel Scott	Master's Thesis/Research Committee
2021-2023	[3]	Guenter Schwoerer	Master's Thesis/Research Committee
2020-2022	[2]	Bennett Hanson	Master's Thesis/Research Committee
2020-2022	[1]	Uttam Gomes	Master's Thesis/Research Committee

Service

AD HOC REVIEWER

2025-2025	Tree Physiology	Total number of articles: 1
2024-2024	Plant, Cell, and Environment	Total number of articles: 1
2024-2024	Trends in Biochemical Sciences	Total number of articles: 1
2023-2023	Industrial Crops and Products	Total number of articles: 1
2023-2023	Proceedings of the National Academy of Sciences	Total number of articles: 1
2022-2025	The Plant Journal	Total number of articles: 8
2022-2022	Phytochemistry Reviews	Total number of articles: 1
2021-2025	Nature Communications	Total number of articles: 3
2021-2023	New Phytologist	Total number of articles: 4
2021-2021	The Bryologist	Total number of articles: 1
2021-2021	The Plant Cell	Total number of articles: 1
2020-2025	Plant Direct	Total number of articles: 4
2020-2024	Planta	Total number of articles: 2
2020-2021	Frontiers in Plant Science	Total number of articles: 4
2020-2020	BMC Plant Biology	Total number of articles: 1
2020-2020	Metabolites	Total number of articles: 1
2019-2019	ACS Applied Materials and Interfaces	Total number of articles: 1
2019-2019	ACS Journal of Agricultural and Food Chemistry	Total number of articles: 1
2019-2019	Journal of Integrative Agriculture	Total number of articles: 1
2019-2019	Scientific Reports	Total number of articles: 1
2019-2019	The Plant Genome	Total number of articles: 1

2018-2025 Plant Physiology Total number of articles: 8
2018-2021 Horticulture Research Total number of articles: 2
2018-2019 Plant Physiology and Biochemistry Total number of articles: 2
2018-2018 Functional Plant Biology Total number of articles: 1
2018-2018 Lipids Total number of articles: 1
2017-2017 Plant Cell Reports Total number of articles: 1

GRANT REVIEWER

2022-2024 (ad-hoc) Deutsche Forschungsgemeinschaft Total number of proposals: 2
2021-2024 (ad-hoc) National Science Foundation Total number of proposals: 3
2021-2023 (panelist) National Science Foundation Total number of panels: 1
2021-2021 (ad-hoc) Binational Agricultural R&D Fund (BARD) Total number of proposals: 1

SCIENTIFIC COMMUNITY SERVICE

2022-present Awards Committee, Phytochemical Society of North America
2021-present Primary Organizer, #PhytochemTalks Virtual Seminar Series
2019-2022 American Chemical Society
2019-2022 Young Members Committee, Phytochemical Society of North America
2018-2021 American Society of Plant Biologists
2018-2020 Botanical Society of America
2013-present Phytochemical Society of North America

UNIVERSITY SERVICE

2024-present Member, SCSE Outreach Committee
2023-present Chair, Integrated Biosciences Admissions Committee
2022-2022 Member, Ad Hoc SCSE Awards Committee
2021-present Member, Departmental Outreach Committee
2021-2022 Member, Integrated Biosciences Admissions Committee
2021-present Advisor, Chemistry Club
2020-2021 Member, Graduate Studies Committee
2020-2021 Member, Physical Resources Committee
2018-2019 Secretary, University of Nebraska Lincoln Plant Science Student and Postdoc Society

INTERVIEWS AND SCIENCE COMMUNICATION

2022 Podcast "Meet Your Professor"
2022 Virtual Alumni Tour "The UMD Plant Chemistry Laboratory"
2020 Twitch Stream "Drink and Think"
2020 Podcast "Evolution Eats"
2019 News Website Chemical and Engineering News
2018 Podcast In Defense of Plants