Harmonie Marie Bettenhausen, Ph.D.

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**Professional Preparation/Education**

* Colorado State University Animal/Equine Sciences B.S. 1997-2000
* Colorado State University Food Science/Food Safety M.S. 2013-2017
* Colorado State University Horticulture/Metabolomics Ph.D. 2018-2021

**Research and Professional Experience**

* 2024-present Lecturer, James B. Beam Institute for Kentucky Spirits, University of KY
* 2021-present Facilitator, Craft Brewing Certificate Program, Cornell University Faculty
* 2021-present Courtesy Faculty, Dept. of Crop and Soil Science, Oregon State University
* 2021-2025 Director, Hartwick College Center for Craft Food and Beverage
* 2014-2017 Graduate Teaching Assistant/Brewing Lab Mgr., Dept. of Food Sc., CSU
* 2015-2017 Graduate Research Assistant, Dept. of Food Sc., CSU
* 2015-2021 Graduate Research Assistant, Dept. of Agriculture, CSU

**Selected Industry Experience**

* Brewer, Equinox Brewing Co., Fort Collins, CO (2013–2014)
* Cheesemaker/Microbiologist, MouCo Cheese Co., Fort Collins, CO (2011–2013)
* Youth & Organizational Development, Peace Corps, Bulgaria (2004–2007)
* Cellar Operations, Odell Brewing Co., Fort Collins, CO (2000–2004)
* Additional roles in environmental services and nonprofit administration (2002–2011)

**Area of Specialization**

Focus on flavor chemistry, cereal and sensory science, and agricultural biochemistry. Systems of study include barley, beer, wheat, hops, and cacao, with expertise in metabolomics and mass spectrometry.

**Teaching Responsibilities – current**

* AFE 300-009 (3 cr. Fall) – Sensory Science of Fermented Beverages
* HRT 335 (3 cr. Fall, summer, spring) – Distilling, Wine, and Brewing Sciences
* PLS 389 (3 cr. Spring– Wine Appreciation
* eCornell Facilitation - Malt Evaluation, Hops Flavor Chemistry, Yeast and Fermentation, Water Profiles, Beer Production and Refinement, Wine, Mechanical Food Processing, Wine Ingredients, Developing a Wine Production Plan, Evaluating Wines, Wine Essentials, Wines of the World

**Professional Societies and Activities**

* 2023-present *Editorial Board*, Journal of the American Society of Brewing Chemists
* 2020-present *Member,* Brewers Association
* 2020-present *Education and Technical Committee,* Craft Maltsters Guild
* 2019-present *Member,* Crop Science Society of America
* 2018-present *Member,* American Society for Mass Spectrometry
* 2017-present *Member,* Society of Sensory Professionals
* 2014-present   *Technical Committee/Member,* American Society of Brewing Chemists
* 2014-present  *Member,* International Food Technologists
* 2015-present    *Member,* Colorado Biological Mass Spectrometry Society
* 2013-present     *Member,* Master Brewers Association of America

**Honors and Awards**

2020 - Eric Kneen Memorial Award for outstanding paper of the year in Journal of American Society of Brewing Chemists

2019 – Colorado Food Summit Scholarship

2019 – Agricultural Graduate Student Scholarship

2019 – American Society for Mass Spectrometry Travel Grant Award winner for Annual National Meeting, Atlanta, GA

2018 – American Society for Mass Spectrometry Travel Grant Award winner for Fall Workshop on Metabolomics Informatics, San Francisco, CA

2018 – Wayne and Gladys Johnson Agricultural Graduate Scholarship

2016 – Chamberlain Family Graduate Scholarship

2016 – Pearle E. Betts Graduate Scholarship

2016 – American Society of Brewing Chemists Graduate Scholarship

**Grants Received**

* 2025 – Estate Whiskey Alliance ($10,000), Whiskey Terroir in Kentucky
* 2025 – Suntory Global/Jim Beam ($25,000), Ethyl Carbamate Mitigation
* 2025 – American Malting Barley Association, “Establishing a Path to Locally Sourced GN0 Barley for Kentucky Distillers and Educational Engagement.” ($13,750)
* 2024 - Educators Sharing Pedagogical Research and Effective Strategies for Student Outcomes (ESPRESSO) focusing on pedagogy.
* 2023 - Virginia Distillers Board, “Developing low-GN and GN-zero malt barley varieties for the Eastern United States” (with Virginia Tech University).
* 2023 - Michigan Craft Beverage Council, “Developing Quality Analysis Protocols for Non-Barley Grains Used in Craft Beverages” (with Michigan State University).
* 2020 - American Society of Brewing Chemists, “Comparison of Chemistry and Sensory of Aged v. Fresh Malts.” (with Colorado Malting Company and Admiral Malting, also supported by AMBA).
* 2020 - Brewers Association, “Understanding Effects of Environment on The Flavor Chemistry of Hops and Hopped Beer.”
* 2020 - Hop Research Council, “Understanding Relationships Between Environment and Hop Volatile Chemistry.”
* 2019 - Hop Research Council, “Application of metabolomics to discover influence of genetic and environmental factors affecting expression in newly released hop cultivars.”
* 2018 - American Malting Barley Association (AMBA), “REIMS as a rapid detection tool for malt quality analysis.”

**Synergistic Activities**

* **Development of ASBC Distilling Sub-committee** to engage industry partners. This brings together researchers, distillers, maltsters, and analytical experts to identify high-priority gaps and coordinate collaborative method development. Our short-term focus includes compiling existing approaches, evaluating reproducibility across labs, and beginning the groundwork for future interlaboratory validations.
* Engagement with industry partners, including breweries, distilleries, and agricultural institutions, to apply chemical analytics and quality metrics in brewing and distilling, enhancing industry standards and fostering knowledge exchange.
* Actively involved in mentoring undergraduate students, guiding them through research projects related to brewing, distilling, and food science.
  + Katie Christiensen – microbiome of barley/malt
  + Brandon Carter Akers – Ethyl Carbamate production
* Facilitated collaboration between academic research and practical industry applications, leveraging metabolomics and mass spectrometry to bridge the gap between plant science and food production.
* Provided expertise in reviewing manuscripts and grants for leading scientific journals and organizations, contributing to the advancement of research in brewing, food chemistry, and plant metabolomics.

**Book Chapters**

**Bettenhausen, H.M.**, Niroula, D., and Joshi, J. 2025. Applied Metabolomics for Studying Plant-Specialized Metabolites in Plant Health, Human Health, and Food Quality. In: Chen, J.-T. (Ed.), *High Throughput Plant Metabolomics*, CABI. pp. 1–16. <https://doi.org/10.1079/9781800626911.0001>

**Refereed publications**

1. Harmonie M. Bettenhausen, Corey Broeckling, Glen P. Fox (2025). From Grist to Gist - What Chemistry Reveals About Your Malt, Master Brewers Association of the Americas Technical Quarterly, *in review*.
2. Amelia Loeb, Alexis Perry, **Harmonie Bettenhausen**, Gina Brown-Guedira, Kimberly Howell, Jared Smith, Jason Walling, Hannah Uhlmann, Wynse Brooks, Nicholas Santantonio (2025). Temporal genetic relationships between growth, development and malting quality in winter barley (Hordeum vulgare) using aerial imagery. The Plant Phenome Journal, *in review.*
3. Brad J. Berron, Jon Brown, Jason Gambrell, Travis Cantrell, Meghan McIntosh, Sarah A. Wilson, Jarrad Gollihue, **Harmonie M. Bettenhausen** (2025). Impact of Bourbon Continuous Column Operations on Ethyl Carbamate Levels. Journal of the American Society of Brewing Chemists, DOI:10.1080/03610470.2025.2475277
4. Yin Li, Harmonie Bettenhausen (2025). Tailoring Malt for Brewing and Distilling: Characteristics and Uses of Brewer's Malt, High-Diastatic Power Distiller's Malt, and Pot Still Malt. Master Brewers Association of the Americas Technical Quarterly, DOI:10.1094/TQ-62-0102-01.
5. Maany Ramanan, **Harmonie M. Bettenhausen**, Gabriela Grigorean, Christine Dipenbrock, Glen Patrick Fox (2024). Barley grain proteome assessment using multi-environment trial data and machine learning. Journal of Agricultural and Food Chemistry, DOI: 10.1021/acs.jafc.4c07017
6. Wynse Brooks, Carl Griffey, Felipe Sabadin, Mark Vaughn, Limei Liu, John Seago, Wade Thomason, Jon Light, Elizabeth Rucker, Phillip Browning, Niki McMaster, David Schmale III, Brooks Saville, Thomas Hardiman, J. Tommy Custis, Karl Jones, Ned Jones Jr., Gregory Lillard, David Marshall, Myron Fountain, Tan Tuong, Michelle Lee, Joseph Oakes, Joshua Mott, Christopher Martens, **Harmonie Bettenhausen**, Aaron Macleod and Nicholas Santantonio (2024). Registration of ‘Avalon’ Winter Malt Barley. Journal of Plant Registrations. DOI:10.1002/plr2.20408
7. Campbell P. Morrissy, Curtis Davenport, Scott P. Fisk, Vern Johnson, Darrin Culp, Hayley Sutton, **Harmonie M. Bettenhausen**, Ron Silberstein, and Patrick M. Hayes (2023). Barley variety can interact positively with floor malting to produce unique malts and beers. Journal of the Institute of Brewing. DOI: 10.58430/jib.v130i1.43
8. Campbell P. Morrissy, Scott P. Fisk, Jarrad W. Gollihue, Hayley Sutton, **Harmonie M. Bettenhausen**, Bradley Berron, and Patrick M. Hayes (2023). Malting barley for North American distillers: Novel GN0 winter barley varieties meet and exceed contemporary expectations. Journal of Distilling. DOI: 10.61855/JDS0301.02
9. Katie J Nasiatka, **Harmonie M Bettenhausen**, Jacqueline M Chaparro, Adam L Heuberger, Jessica E Prenni (2023). Rapid characterization of hops (*Humulus lupulus*) using DART-MS and chemometrics, ACS Food Science and Technology. DOI: 10.1080/03610470.2023.2213238.
10. Glen Fox, **Harmonie M. Bettenhausen** (2023). Variation in quality of grains used in malting and brewing, Frontiers in Plant Science, Sec. Crop and Product Physiology, volume 14. DOI: 10.3389/fpls.2023.1172028
11. Chris Massman, Mariona Martínez-Subirà, **Harmonie Bettenhausen**, Tanya Filichkin, Scott Fisk, Laura Helgerson, Patrick M. Hayes (2023). The Malting Barley Blues, Journal of the American Society of Brewing Chemists, DOI:/10.1080/03610470.2023.2170615
12. Campbell P. Morrissy, Michael Féchir, **Harmonie M. Bettenhausen**, Karli R. Van Simaeys, Scott Fisk, Javier Hernandez, Kyle Mathias, Amanda Benson, Thomas H. Shellhammer & Patrick M. Hayes (2022): Continued Exploration of Barley Genotype Contribution to Base Malt and Beer Flavor Through the Evaluation of Lines Sharing Maris Otter® Parentage, Journal of the American Society of Brewing Chemists, DOI: 10.1080/03610470.2021.1952509
13. Campbell P. Morrissy, Curtis Davenport, Andy Hooper, Scott P. Fisk, **Harmonie M. Bettenhausen**, Patrick M. Hayes (2022). The effect of floor-malting on novel barley germplasm derived from a cross with Maris Otter®. Master Brewers Association Technical Quarterly.
14. **Bettenhausen HM**, Heuberger AL (2022). Malt Metabolomics and Considerations for Use in Quality Analysis, Master Brewers Association Technical Quarterly. https://doi.org/10.1094/TQ-59-2-0521-01​
15. Brooke Sayre-Chavez, **Harmonie M. Bettenhausen**, Adam L. Heuberger, Patrick M. Hayes, Maria Munoz-Amatriain (2022). Understanding the Genetic Basis of Barley Contributions to Beer Flavor. Journal of Cereal Science, Volume 104, https://doi.org/10.1016/j.jcs.2022.103430
16. Campbell P. Morrissy, Michael Féchir, **Harmonie M. Bettenhausen**, Karli R. Van Simaeys, Scott Fisk, Kyle Mathias, Amanda Benson, Thomas H. Shellhammer, and Patrick M. Hayes (2021). Continued exploration of barley genotype contribution to base malt and beer flavor through the evaluation of lines sharing Maris Otter parentage. Journal of the American Society of Brewing Chemists, https://doi.org/10.1080/03610470.2021.1952509
17. Prenni JE, Mason TJ, **Bettenhausen HM**, Chaparro, J, Uchanski ME (2021). Evaluation of ambient mass spectrometry tools for assessing inherent postharvest pepper quality. Journal of Horticulture Research, doi:10.1038/s41438-021-00596-x
18. **Bettenhausen, HM,** Barr, L, Yao, L, Heuberger AL (2021). Mass Spectrometry Metabolomics of Hot Steep Malt Extracts and Association to Sensory Traits, Journal of the American Society of Brewing Chemists, doi:10.1080/03610470.2020.1869499
19. Sarah M. Windes, **Harmonie M. Bettenhausen,** Karli R. VanSimaeys**,** Jeff Clawson, Scott Fisk, Juyun Lim, Sue H. Queisser, Thomas H. Shellhammer, Veronica Vega, Linxing Yao, Adam L. Heuberger & Patrick M. Hayes (2020). Comprehensive analysis of different contemporary barley genotypes enhances and expands the scope of barley contributions to beer flavor, Journal of the American Society of Brewing Chemists, doi:10.1080/03610470.2020.1843964
20. Clark C, **Bettenhausen HM**., Yao L, Heuberger AL, Stone M, (2020). Effects of Time and Temperature During Melanging on the Volatile Profile of Dark Chocolate. Scientific Reports, doi:10.1038/s41598-020-71822-01c17c71c-b130-4697-b089-f82b3f511476
21. **Harmonie M. Bettenhausen,** Amanda Benson, Scott Fisk, Dustin Herb, Javier Hernandez, Juyun Lim, Sue H. Queisser, Thomas H. Shellhammer, Veronica Vega, Linxing Yao, Adam L. Heuberger & Patrick M. Hayes (2020). Variation in Sensory Attributes and Volatile Compounds in Beers Brewed from Genetically Distinct Malts: An Integrated Sensory and Non-Targeted Metabolomics Approach, Journal of the American Society of Brewing Chemists, doi: 10.1080/03610470.2019.1706037
22. **Bettenhausen, H. M**., Barr, L., Broeckling, C. D., Chaparro, J. M., Holbrook, C., Sedin, D., & Heuberger, A. L. (2018). Influence of malt source on beer chemistry, flavor, and flavor stability. Food Research International, 113, 487-504. DOI: 10.1016/j.foodres.2018.07.024

**Non-peer-reviewed Publications**

1. Brad Berron, Jon Brown, Jason Gambrell, Travis Cantrell, Meghan Mattingly, Sarah Wilson, Jarrad, Gollihue, **Harmonie Bettenhausen** (2023)**,** Eliminating Suspected Carcinogens Using Distillation Operations, Artisan Spirit Magazine, Summer Issue #43.
2. Campbell Morrissy and **Harmonie Bettenhausen** (2023). Glycosidic nitrile and ethyl carbamate in malting barley, Artisan Spirit Magazine, Winter Issue #41.
3. **Harmonie Bettenhausen** (2022). The Future to Come for Barley Harvests, Artisan Spirit Magazine, Summer Issue #39.

**Invited Talks**

* Master Brewers Association of the Americas Fall Meeting, Cincinnati, OH, “JBBI Research,” October 2025.
* International Association of Millers, Annual Meeting, Indianapolis, IN, “Distilling and Milling,” September 2025
* Friends of the Boone County Arboretum, Bourbon and Blooms, “Roots of Flavor – How Grains Shape Bourbon,” July 2025
* Craft Maltsters Guild, “Chemical Variation Attributed to Storage and Shelf-life Stability of Malt,” April 2025
* Craft Brewers Conference, “Distilling 101,” April 2025
* World Brewing Congress, “American Single-malt Whiskey, an Emerging Category with Overlap and Implications to the Brewing Industry” and “Research in the Brewery,” August 2024
* James B. Beam Institute Industry Conference, “Barley and Bourbon – Workshop,” March 2024
* Craft Maltsters Conference, “Glycosidic Nitrile and the Role of Grains,” January 2024
* Society of Spirit Symposium, “The Future of Malt,” January 2024
* MBAA podcast, “*Episode 313| Omics*,” July 2023
* Empire State Barley and Malt Summit, Hyde Park, NY, “*Resiliency and Advocacy in the NE*,” December 2023
* BruLab podcast, “*Episode 124 | Understanding A Malt Certificate of Analysis*,” October 2023
* MBAA Annual Conference, Seattle, WA, “*Navigating Crop Variability in the N.E.* and *Quality Metrics in Craft Malt Production: Insights from Real-world Malthouse Adjustments.”* October 2023
* World Distilled Spirits Convention, Edinburgh, Scotland*, “GN”* May 2023
* James B. Beam Institute Industry Conference, Lexington, KY, “*Glycosidic Nitrile and Ethyl Carbamate,*” and “*Barley - the little crop that could*,” March 2023
* American Craft Distilling Convention, Portland, OR, “*Glycosidic Nitrile – You should care now,*” February 2023
* 9th Annual Hudson Valley Value-Added Grain School, Brewster, NY, “*The malting process,*” February 2023
* University of Arkansas – LaFontaine Course (virtual talk), “*The malting process,*” January 2023
* Michigan Great Beer State Conference & Trade Show, Traverse City, MI, “*Grain & Malting Quality – 2022- What the Chit?*” January 2022
* National Fusarium Head Blight Forum, Tampa, FL, “*Using Peracetic Acid to Mitigate FHB and DON in Malting Barley*,” December 2022
* Empire State Barley and Malt Summit, Poughkeepsie, NY, “*Looking Forward/Glycosidic Nitrile-Ethyl Carbamate in Malt*,” December 2022
* BruLab podcast, “*Episode 083 | Brewing with Rye*,” October 2023
* 23rd North American Barley Researchers Workshop/43rd Barley Improvement Conference, UC Davis, CA, “*Blue Aleurone and Malting Quality,*” September 2022
* ASBC Brewing Summit, Providence, RI, “*Understanding the Genetic Basis of Barley Contributions to Beer Flavor,*” August 2022
* American Craft Distilling Convention, New Orleans, LA, “*Responding to the Poor 2021 Malting Barley Harvest: Typing Analytical Observations to Impacts in the Distillery,*” July 2022
* James B. Beam Institute Industry Conference, Lexington, KY, “*Genotype and Environmental Effects on Functional and Flavor Attributes of Rye Grain for Distilling*,” March 2022
* Virtual Craft Malt Guild Conference & Expo, “*The Year the Rain Never Stopped - Barley Trends-Tales from the Trenches*,” February 2022
* Michigan Great Beer State Conference & Trade Show, Traverse City, MI, “*Grain & Malting Quality – 2021 Crop and Malting Quality Updates*,” January 2022
* Virtual Empire State Barley and Malt Summit, “*Managing malt quality in a difficult year*,” December 2021
* BruLab podcast, “*Showcasing New Technologies in Brewing Research: Omics*!,” February 2021
* CBMSS, virtual meeting, “*Extracting the Facts of the Hot Steep – an MS approach,”* November 2020
* Brewers Association (BA) Collab Hour Webinar, “*Extracting the Facts of the Hot Steep,”* October 2020
* Hop Research Council (HRC) Annual Meeting, Portland, OR, “*Hop Metabolomics to Enable Rapid and Accurate Profiling of Quality*,” January 2020
* Oregon State University Crop Science Seminar, Corvallis, OR, “*The contributions of barley variety to beer flavor: an integrated approach from grain to glass, and from DNA to metabolite*,” January 2020
* American Society of Brewing Chemists (ASBC) Brewing Summit, New Orleans, LA, “*Deep Dive into ASBC Methods*,” June 2019
* American Society of Mass Spectrometry (ASMS), Atlanta, GA, “*Metabolomics of Beer: Understanding the influence of barley genetics on beer flavor,”* June 2019
* Colorado Biological Mass Spectrometry Society (CBMSS), Fort Collins, CO, “*Food Omics,*” March 26, 2019
* ASBC Brewing Summit, San Diego, CA, “*Malt Flavor and Sensory Analysis: Back to Basics and Into the Future,”* August 2018
* CBMSS, Denver, CO, “*An Omics Approach to Characterize the Barley Metabolome and Proteome*,” – July 2018
* San Luis Valley Research Center-Miller Coors / CSU Barley Workshop, “*The Future of Barley is in the Pint,”* July 2017
* Master Brewers Association of the Americas (MBAA) Technical Summit, Fort Collins, CO, “*Metabolomics: an approach to determine barley’s contribution to beer flavor and flavor stability,”* May 2016
* CSU Ventures Innovations Finalist, Fort Collins, CO, “*Application of metabolomics to understand the contribution of barley to beer flavor and flavor stability*,” April 2016
* CSU Office of Vice President for Research Three Minute Thesis Presentation Fellowship Finalist, Fort Collins, CO, Presenter - February 2016

**Posters**

* World Brewing Congress, virtual, “*Omics Analysis of Malt from Heirloom Barley: The Potential for New Traits and Flavors from an Old World*.” September 2020.
* ASBC Brewing Summit, San Diego, CA New Orleans, LA, “*Application of metabolomics to discover influence of genetic and environmental factors affecting hop expression*,” June 2019
* American Society of Mass Spectrometry (ASMS), Atlanta, GA, “*Application of metabolomics to discover influence of genetic and environmental factors affecting hop expression*,” June 2019
* Colorado State University (CSU) Graduate School Showcase, Fort Collins, CO, “*Omics Analysis of Malt from Heirloom Barley: The Potential for New Traits and Flavors from an Old World*.” November 2018
* ASBC Brewing Summit, San Diego, CA, “*Omics Analysis of Malt from Heirloom Barley: The Potential for New Traits and Flavors from an Old World*.” August 2018
* Colorado Biological Mass Spectrometry Society (CBMSS), Denver, CO, “*Omics Analysis of Malt from Heirloom Barley: The Potential for New Traits and Flavors from an Old World*.” July 2018
* ASBC Malt Flavor and Aroma in Beer Symposium, Roseville, MN, “*An Omics Approach to Characterize the Barley Metabolome and Proteome*.” June 10-13, 2018
* ASBC Malt Flavor and Aroma in Beer Symposium, Roseville, MN, “*Omics Analysis of Malt from Heirloom Barley: The Potential for New Traits and Flavors from an Old World*.” June 10- 13, 2018
* CSU Graduate School Showcase, Fort Collins, CO, “*Influence of barley genetics on beer chemistry, flavor and flavor stability*.” November 2017
* ASBC World Brewing Congress, Denver, CO, “*Metabolomics: an approach to determine barley’s contribution to beer flavor and flavor stability.”* August 2016
* Young Scientists Symposium, Chico, CA, “*Application of metabolomics to understand barley variety and its contribution to beer flavor.”* April 2016
* CSU Graduate School Showcase, Fort Collins, CO, “*Improving beer flavor with barley breeding: a metabolomics approach*.” November 2015
* CBMSS, Denver, CO, “*Improving beer flavor with barley breeding: a metabolomics approach*.” October 2015