



Clay Swackhamer CV

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EDUCATION

University of California, Davis

Ph.D. 2022

Major: Biological Systems Engineering
Minor: Modeling and Control of Biological Systems
Specialization: Food Engineering
GPA: 3.94

Penn State University

B.S. 2015

Major: Biological Engineering
Minor: Spanish
Specialization: Food and Biological Process Engineering
Schreyer Honors College Scholar
GPA: 3.92

University of Alicante

Fall 2014

Semester abroad in Alicante, Spain
Completed 15 credits taught in Spanish, including a microbiology course with a laboratory
GPA: 4.00

PEER-REVIEWED PUBLICATIONS

1. **C. Swackhamer**, R. Doan*, G. Bornhorst, “Development and characterization of standardized model, solid foods with varying breakdown rates during gastric digestion.” 2022. Journal of Food Engineering. 316:110827. [10.1016/j.jfoodeng.2021.110827](https://doi.org/10.1016/j.jfoodeng.2021.110827).
2. Y. Mennah-Govela, **C. Swackhamer**, G. Bornhorst, “Gastric secretion rate and protein concentration impact intragastric pH and protein hydrolysis during dynamic in vitro gastric digestion.” 2020. Food Hydrocolloids for Health. [10.1016/j.fhfh.2021.100027](https://doi.org/10.1016/j.fhfh.2021.100027).
3. **C. Swackhamer**, J. Mullin, “Emergency Transition of Intro Communication and Design Course to Remote Teaching.” 2021. American Society of Engineering Education Conference. Available at: <https://peer.asee.org/emergency-transition-of-intro-communication-and-design-course-to-remote-teaching>. **Won best paper award in Design in Engineering Education Division: Award announcement.**
4. A. Hayes, F. Gozzi, A. Diatta, T. Gorissen, **C. Swackhamer**, S. Bellmann, B. Hamaker, “Some pearl millet-based foods promote satiety or reduce glycaemic response in a crossover trial.” 2020. British Journal of Nutrition. [10.1017/S0007114520005036](https://doi.org/10.1017/S0007114520005036).
5. N. Nativ-Zeltzer, R. Ueha, Y. Nachalon, B. Ma, G. Pastenkos, **C. Swackhamer**, G. Bornhorst, M. Lefton-Greif, J. Anderson, P. Belafsky. “Inflammatory Effects of Thickened Water on the Lungs in a Murine Model of Recurrent Aspiration.” 2020. The Laryngoscope. [10.1002/lary.28948](https://doi.org/10.1002/lary.28948).
6. A. Hayes, **C. Swackhamer**, Y. Mennah-Govela, M. Martínez, A. Diatta, G. Bornhorst. B. Hamaker. “Pearl millet (*Pennisetum glaucum*) couscous breaks down faster than wheat couscous in the Human Gastric Simulator, though has slower starch hydrolysis.” 2020. Food & Function. 11: 111-122. [10.1039/C9FO01461F](https://doi.org/10.1039/C9FO01461F). **Selected as cover article, created original art for journal cover using Adobe Illustrator:** <https://pubs.rsc.org/en/content/articlelanding/2020/fo/d0fo90003f>.

7. **C. Swackhamer**, Z. Zhang, A. Taha, G. Bornhorst. "Fatty acid bioaccessibility and structural breakdown from in vitro digestion of almond particles." 2019. Food & Function. 10: 5174-5187. [10.1039/C9FO00789J](https://doi.org/10.1039/C9FO00789J)
 8. **C. Swackhamer**, G. Bornhorst. "Fracture properties of foods: Experimental considerations and applications to mastication." 2019. Journal of Food Engineering. 263: 213-226. [10.1016/j.jfoodeng.2019.07.002](https://doi.org/10.1016/j.jfoodeng.2019.07.002)
 9. D. Ciolkosz, R. Hilton, **C. Swackhamer**, H. Yi, V. Puri, D. Swomley, G. Roth, "Farm-scale biomass pelletizer performance for switchgrass pellet production." 2015. Applied Engineering in Agriculture. 31(4): 559-567. [10.13031/aea.31.10803](https://doi.org/10.13031/aea.31.10803)
- * undergraduate student mentored

INDUSTRY EXPERIENCE

Engineering intern

Winter-Summer 2016

LignoLink, INC.
Innovation Park, PA

- Conducted aqueous ammonia pretreatment and enzymatic hydrolysis reactions on 98 biomass samples (corn stover)
- Designed, constructed, and validated High Performance Liquid Chromatography (HPLC) assay for 5 sugar monomers in hydrolyzed biomass samples
- HPLC development included equipment selection, purchase, installation, calibration, and development of semi-automated data analysis routine using MATLAB
- Created the first logo and website for a faculty-led startup company, funded by the National Science Foundation-Small Business Innovation Research (NSF-SBIR) program
- Information about the company: [NSF page](#), [News article](#)

Engineering intern

Summer 2015

McCormick & Company INC, Materials Process Engineering Group
Hunt Valley, MD

- Measured physical properties of dry seasoning mixes (gravy mixes, taco seasoning, steak seasonings) using 5 instruments in food powder technology platform
- Helped create plan to achieve \$160,000 annual cost savings by reducing overblending, which can affect product bulk density and lead to overfill losses
- Conducted over 300 experiments, mostly involving powder flowability and compaction properties; processed data using descriptive statistics and modeling
- Quantified link between blend time and product bulk density
- Collaborated with McCormick engineers in 3 countries

TEACHING EXPERIENCE

Teaching assistant *Spring 2019, Fall 2019, Winter 2020, Spring 2020, Fall 2020, Winter 2021, Spring 2021, Fall 2021, Winter 2022*

Course ENG 003: Intro to Engineering Design
UC Davis College of Engineering

- Responsible for two lab sections every academic quarter (ca. 22 students each)
- Served as a teaching assistant for 9 quarters, thus working with about 400 students in total
- Taught basics of circuit building using Arduino and Raspberry Pi

- Topics included circuit prototyping on breadboards, writing Arduino and python code, interfacing with analog devices, and troubleshooting circuits using a multimeter
- Built circuits to interface with sensors measuring temperature, weight, light, moisture, color, humidity, dust level, carbon dioxide concentration, pH, and water flow rate
- Built circuits to interface with devices such as servo motors, DC motors, solenoid valves, Raspberry Pi camera
- Taught engineering design topics including the iterative process of design, prototyping, decision matrices, and effective presentation techniques
- Directly advised ca. 90 student teams as they created original design projects
- Participated in the emergency transition of this highly in-person course to remote teaching in the spring of 2020 during the COVID-19 pandemic. Helped conduct research on student learning outcomes using a validated survey instrument. Published peer-reviewed paper on our findings at the American Society of Engineering Education conference and won the best paper award in the division. [Award announcement](#).

Teaching assistant

Fall 2018

Course EBS 001: Foundations of Biological Systems Engineering
UC Davis Department of Biological and Agricultural Engineering

- Provided written feedback for 49 students on homeworks and exams
- Held weekly office hours
- Supervised construction of seven algae photobioreactors and seven solar food dehydrators made by student teams for their final project

Teaching intern

Fall 2015

Course BE 301: Mathematical Modeling of Biological and Physical Systems
Penn State Department of Agricultural and Biological Engineering

- Teaching intern for course BE 301: Mathematical Modeling of Biological and Physical Systems (approximately 20 students)
- Held weekly office hours
- Ran review sessions and helped troubleshoot student MATLAB codes

PRESENTATIONS

1. **C. Swackhamer**, R. Doan*, G. Bornhorst. "Food physical properties influence mechanisms of particle breakdown of solid foods during in vitro gastric digestion in the Human Gastric Simulator." Poster presentation. Institute of Food Technologists Conference. *July 2022*.
2. **C. Swackhamer**, "Breakdown of solid foods during in vitro gastric digestion." PhD exit seminar in UC Davis Department of Biological and Agricultural Engineering. *January 2022*.
3. **C. Swackhamer**, J. Mullin "Emergency Transition of Intro Communication and Design Course to Remote Teaching." Remote/virtual oral presentation. American Society of Engineering Education Conference. **Won best paper award in the division.** [Award announcement](#). *July 2021*.
4. **C. Swackhamer**, R. Doan*, G. Bornhorst. "Fracture property analysis of standardized, model solid foods during in vitro gastric digestion." Remote/virtual poster presentation. Institute of Food Technologists Conference. *July 2021*.
5. R. Doan*, **C. Swackhamer**, G. Bornhorst. "Buffering capacity of standard model foods as related to simulated gastric digestion." Virtual Poster Presentation. UC Davis Undergraduate Research Conference. Davis, CA, *April 2021*.
6. **C. Swackhamer**, S. Keppler, A. Poltorak, T.F. Bedane, K. Cheung, N. Awais, F. Marra, G. Bornhorst. "Video analysis and computational fluid dynamic modeling of a novel multi-module peristaltic simulator"

for gastrointestinal research.” Remote/virtual poster presentation. Institute of Food Technologists Conference. **Won first place in Food Engineering Division graduate student research poster competition.** *July 2020.* [Award announcement.](#)

7. **C. Swackhamer**, R. Doan*, G. Bornhorst. “Development and characterization of standardized model, solid foods with varying breakdown rates during gastric digestion.” Remote/virtual poster presentation. Institute of Food Technologists Conference. *July 2020.*
8. Z. Fu*, **C. Swackhamer**, G. Bornhorst. “Effect of simulated gastric juice on texture change of almond particles during simulated gastric digestion.” Poster Presentation. UC Davis Undergraduate Research Conference. Davis, CA, *April 2019.*
9. **C. Swackhamer**, Z. Zhang, A. Taha, G. Bornhorst. “Fatty acid bioaccessibility, structural breakdown, and properties of digesta from in vitro digestion of almond particles.” Poster Presentation. Conference of Food Engineering. Minneapolis, MN, *September 2018.*
10. A. Hayes, **C. Swackhamer**, M. Martínez, Y. Mennah-Govela, G. Bornhorst, B. Hamaker. “Breakdown rate of couscous made from pearl millet versus wheat in a simulated gastric environment linked to gastric emptying.” Poster Presentation. Institute of Food Technologists Conference. Chicago, IL, *July 2018.*
11. X. Cao*, **C. Swackhamer**, G. Bornhorst. “Experimental investigation of the impact of processing variables on fracture properties of almonds.” Poster Presentation. UC Davis Undergraduate Research Conference. Davis, CA, *April 2018.*
12. A. Hayes, **C. Swackhamer**, M. Martínez, Y. Mennah-Govela, G. Bornhorst, B. Hamaker. “Insights to the delayed gastric emptying rate and slow digestibility of pearl millet couscous.” Poster Presentation. Sorghum in the 21st Century. Cape Town, South Africa, *April 2018.*
13. A. Olenskyj, Y. Mennah-Govela, **C. Swackhamer**, K. Rios-Villa, G. Bornhorst. “Softening half-time and final normalized hardness as indicators of food structural breakdown during in vitro digestion.” Poster Presentation. Institute of Food Technologists Conference. Las Vegas, NV, *June 2017.*
14. **C. Swackhamer**, Y. Mennah-Govela, G. Bornhorst. “Physical property changes in soaked and activated almonds.” Poster Presentation. Almond Board of California Conference. Sacramento, CA, *December 2016.*
15. **C. Swackhamer**. “Effect of codon optimization on bacterial translation elongation rates.” Presentation. Penn State Department of Agricultural and Biological Engineering Department seminar: Exit seminar for undergraduate honors thesis presentation. University Park, PA, *December 2015.*
16. **C. Swackhamer**, “Industrial batch fermentation of L-Lysine using *Corynebacterium glutamicum*.” Presentation. Northeast Agricultural and Biological Engineering Conference (ASABE regional conference), Newark, DE, *July 2015.*
17. **C. Swackhamer**, A. Smith, E. Sileo, S. Krug, “Next-generation approaches to overcome the challenges of metabolic pathway engineering.” Presentation. iGEM Giant Jamboree, Boston, MA, *October 2014.*
18. **C. Swackhamer**, B. Wright, “Small scale densification of *Panicum virgatum* through pelletization.” Poster Presentation. Northeast Agricultural and Biological Engineering Conference (NABEC), Altoona, PA, *July 2013.*
19. **C. Swackhamer**, B. Wright, “Small scale densification of *Panicum virgatum* through pelletization.” Poster Presentation. Penn State Undergraduate Research Exposition, University Park, PA, *April 2013.*
20. **C. Swackhamer**, V. Vadyak, N. Vitacco. A. Alsuwaidi, “Portable recharging system for personal electronic devices.” Poster Presentation. Penn State Engineering Design Showcase, University Park, PA, *December 2012.*

* indicates undergraduate researcher mentored

AWARDS

1. **Best paper award** in Design in Engineering Education Division at American Society of Engineering Education Conference. *July 2021*. [Award announcement](#).
2. **UC Davis Jastro-Shields Fellowship** for graduate students in agricultural or environmental sciences based on competitive application for original research. Proposal title: “Influence of mechanical properties on the particle breakdown dynamics of standard, model solid foods during in vitro gastric digestion using a peristaltic simulator.” \$1,000. *July 2021*.
3. **UC Davis Jastro-Shields Fellowship** for graduate students in agricultural or environmental sciences based on competitive application for original research. Proposal title: “Breakdown of model solid foods based on the Standard American Diet using shear and fracture testing diet to quantify mechanical breakdown during in vitro gastric digestion.” \$3,000. *September 2020*.
4. **Best teaching assistant award 2020**. Department of Biological and Agricultural Engineering, UC Davis College of Engineering. *August 2020*. [Award announcement](#).
5. **First place in graduate student research poster competition**. Food Engineering Division. Institute of Food Technologists Conference. *July 2020*. [Award announcement](#).
6. **UC Davis Graduate Student Travel Award** \$500. *May 2020*.
7. **Biological Systems Engineering Graduate Program Fellowship Award** \$2,000. *May 2020*.
8. **Walter Rosenburg Research Fund** to support the research of PhD candidates in Biological and Agricultural engineering, based on faculty nomination \$2,000. *May 2020*.
9. **John C. Harper Memorial Fellowship** for graduate students in Biological Systems Engineering specializing in Food Engineering, based on faculty nomination \$3,500. *November 2019*.
10. **UC Davis Jastro-Shields Fellowship** for graduate students in agricultural or environmental sciences based on competitive application for original research. Proposal title: “Development and mechanical property testing of a novel system of test foods for studying food breakdown during in vitro gastric digestion.” \$2,500. *July 2019*.
11. **UC Davis Jastro-Shields Fellowship** for graduate students in agricultural or environmental sciences based on competitive application for original research. Proposal title: “Development and validation of a low-cost, single camera calibrated computer vision system for particle size analysis of foods subjected to in vitro digestion.” \$2,000. *October 2018*.
12. **UC Davis Jastro-Shields Fellowship** for graduate students in agricultural or environmental sciences based on competitive application for original research. Proposal title: “Characterizing the influence of physical properties on lipid release from fractured almonds using simulated gastric digestion.” \$1,700. *October 2017*.
13. **UC Davis Mentoring at Critical Transitions Award** for graduate students based on competitive application and potential to transition to future role as mentor, \$3,000. *September 2017*.
14. **UC Davis Scholars Award** first year fellowship for outstanding graduate students at UC Davis, \$58,000. *September 2016*.
15. **Outstanding Senior Award** in Penn State Department of Biological and Agricultural Engineering. *May 2016*.
16. **First place** in undergraduate paper competition for presentation of “Industrial Batch Fermentation of L-Lysine using *Corynebacterium glutamicum*.” Northeast Agricultural and Biological Engineering Conference (NABEC). *July 2015*.

17. **Gold medal** for team presentation of “Next-Generation Approaches to Overcome the Challenges of Metabolic Pathway Engineering.” iGEM Giant Jamboree. *October 2014.*
18. **Myriant Corporation Scholarship** for Excellence in Bioenergy. *October 2013.*
19. **Third place award** in engineering division for poster presentation of “Small Scale Densification of *Panicum virgatum* through Pelletization.” Penn State Undergraduate Research Exposition. *April 2013.*
20. **“Best in class” award** for poster presentation of “Portable Recharging System for Personal Electronic Devices.” Penn State Engineering Design Showcase. *December 2012.*

CERTIFICATIONS

1. **Professional Engineer (PE).** Agricultural engineer registered with California Board for Professional Engineers, Land Surveyors, and Geologists. License number 589. *2022.*
2. **Social and Behavioral Research Best Practices for Clinical Research.** Three hour course with quiz and certificate, developed by the Collaborative Institutional Training Initiative (CITI). *2020.*
3. **Social and Behavioral Science Responsible Conduct of Research.** Three hour course with quiz and certificate, developed by the Collaborative Institutional Training Initiative (CITI). *2020.*
4. **Proposal Writing Program: Writing Successful Grant Proposals.** Five hour professional development program with quiz and certificate, developed by the American Association for the Advancement of Science (AAAS). *2017.*
5. **Synthetic biology certificate for undergraduates,** Synthetic Biology Engineering Research Center (SYNBERC). *2015.*
6. **Laboratory safety fundamentals** certificate, UC Davis Safety Services. *2016-present.*
7. **Passed Fundamentals of Engineering Exam (FE-general disciplines).** Certified engineer in Training (EIT), license number ET021732. *2015-present.*

PROFESSIONAL AFFILIATIONS AND LEADERSHIP

1. **Member,** Sigma Xi, The Scientific Research Honor Society (*2020-present*)
2. **Representative for UC Davis General Graduate Student Association,** Biological Engineering Graduate Student Association, UC Davis (*2019-2020*)
3. **Secretary,** Biological Engineering Graduate Student Association, UC Davis (*2018*)
4. **Member,** Society of Food Engineering (SoFE) (*2018-present*)
5. **Alumni Relations Co-Chair,** Biological Engineering Graduate Student Association, UC Davis (*2017*)
6. **Laboratory Safety Officer,** Food Engineering Laboratory, UC Davis (*Spring 2017, Spring 2019*)
7. **Member,** Institute of Food Technologists (IFT) (*2016-present*)
8. **Treasurer,** Alpha Epsilon, Honors Society of Biological Engineering, Penn State chapter (*2015*)
9. **Alumni Relations Chair,** Alpha Gamma Rho National Agricultural Sciences Fraternity (*2013-2014*)
10. **Financial Chair,** Penn State Agricultural Sciences Student Council (*2013-2014*)
11. **Member,** American Society of Agricultural and Biological Engineers (*2013-present*)
12. **Member,** Gamma Sigma Delta, National Honors Society in Agriculture (*2013-present*)