KEVIN HUDNALL

PHD, BIOSYSTEMS ENGINEERING

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RESEARCH PROFILE

I am a theoretical biologist studying the biological foundations of measurement. My work uses dynamical systems theory and information theory to develop a mathematically precise and empirically grounded account of *the living tree of life*. Alongside this ongoing foundational program, my postdoctoral research uses population-genetic modeling and genomic analysis to investigate how evolutionary mechanisms shape genealogical and genomic structure.

EDUCATION

University of California, Davis
Ph.D. in Biosystems Engineering — June 2026
Advisor: Raissa D'Souza
Thesis: *The Living Tree of Life and Relative Motion: First Steps in Biokinematics*
Synopsis: Developed a biological theory predicting that relative motion induces structured gradients that differentially shape growth and collapse in living systems.

University of California, Davis
M.S. in Biological Systems Engineering — June 2019
Advisor: Tina Jeoh
Thesis: *Cross-linking of polymannuronate during spray-drying to form microcapsules*
Synopsis: Developed experimentally backed molecular dynamics simulations that informed how carbohydrates interact during microcapsule formation.

University of California, Davis
B.S. in Biological Systems Engineering with honors — June 2017
Minor in Mathematics

University of California, Berkeley
B.A. in Philosophy and Anthropology (double major) with distinction — May 2010

ACADEMIC APPOINTMENT

2026 – Present — **Planetary Health Postdoctoral Fellow**
Department of Biology – University of Vermont

Details: Developing mathematical and computational approaches in population genetics to investigate how evolutionary mechanisms shape genealogical and genomic structure, with applications to host–pathogen dynamics and planetary health.

PUBLICATIONS

Published

Hudnall, K. *Individuality and the Living Tree of Life: An Information-Geometric Theory of Biological Form.* Mathematical Biosciences, 402, 109820. https://doi.org/10.1016/j.mbs.2026.109820.

Hudnall, K. (2025) *Information and the living tree of life: A theory of measurement grounded in biology.* BioSystems, 258, 105610. https://doi.org/10.1016/j.biosystems.2025.105610

Hudnall, K. and D'Souza, R. M. (2025) *What does the tree of life look like as it grows? Evolution and the multifractality of time*. Journal of Theoretical Biology*, 582*, 112121. https://doi.org/10.1016/j.jtbi.2025.112121

Jeoh, T., Wong, D. E., Strobel, S. A., **Hudnall, K.**, Pereira, N. R., Williams, K. A., Arbaugh, B. M., Cunniffe, J. C., & Scher, H. B. (2021). *How alginate properties influence in situ internal gelation in crosslinked alginate microcapsules (CLAMs) formed by spray drying.* PLOS ONE, 16(2), e0247171.

Strobel, S. A., **Hudnall, K.**, Arbaugh, B., Cunniffe, J. C., Scher, H. B., & Jeoh, T. (2020). *Stability of Fish Oil in Calcium Alginate Microcapsules Cross-Linked by In Situ Internal Gelation During Spray Drying*. Food and Bioprocess Technology, 13(2), 275-287.

Under review/under consideration (submitted)

Hudnall, K. *Three Principles of Life*. Theory in Biosciences (Under review).

Hudnall, K. *From Distance to Nearness: Rethinking Geometry on the Tree of Life.* Journal of Mathematical Biology (Under consideration).

EARLIER RESEARCH EMPLOYMENT

2019 – 2020	**Graduate Student Researcher** Biological Systems Engineering – UC Davis Details: Mathematically/computationally modeled transport phenomena in leaf stomata.
Summer 2019	**Graduate Student Researcher** Horticulture Innovation Lab – UC Davis Details: Coordinated agricultural projects between UC Davis graduate students and African host countries.
2017 – 2018	**Graduate Student Researcher** Biological Systems Engineering – UC Davis Details: Examined physiochemical properties of microcapsules formed by alginate cross-linking.
2015 – 2017	**Undergraduate Research Assistant** Biological Systems Engineering – UC Davis Details: Studied bioconversion applications of agricultural waste products.
2015 – 2016	**Undergraduate Research Assistant** Plant Pathology – UC Davis (USDA) Details: Researched phytophthora as a pathogen to walnut and almond root stock.

2010 – 2011 **Undergraduate Research Assistant**
Environmental Science, Policy, and Management – UC Berkeley

Details: Researched the effect of synthetic pheromones as pest deterrent to navel orange worm.

TEACHING EMPLOYMENT

TA – ECS 253 Network Theory (Grad level)	Spring 25
TA - EBS 265 Design & Analysis of Engineering Experiments (Grad level)	Spring 23
TA - EBS 170A, B, C Senior Engineering Design (Senior level)	Fall, Winter, Spring 20 - 21
TA - EBS 127 Mass Transfer & Reaction Kinetics (Senior level)	Fall 18, 19, 21, 24
TA - EBS 125 Heat Transfer (Junior level)	Spring 19, 22, 23, 24, 25
Guest lecturer - ECS 132 Prob. & Stat. Modeling for Comp. Sci. (Junior level)	Spring 24
TA - EBS 75 Property of Materials in Biosystems (Sophomore level)	Winter 18, 19, 22, 23, 24
TA - ENG 3 Introduction to Engineering Design (Freshman level)	Winter 19, Spring 20
TA - EBS 1 Foundations of Biosystems Engineering (Freshman level)	Fall 22, 23
Reader - ABT 15 Applied Biosystems Technology (Sophomore level)	Winter 17

TALKS GIVEN

UC Davis Mathematics Department Probability Seminar — March 2026
Title: *Some mathematical riches from the living tree of life: multifractals, nearness spaces, and complex attractors*

Biological and Agricultural Engineering Seminar Series, UC Davis — October 16, 2024
Title: *The living tree of life and the physics of motion*

UC Davis Mathematics Department Student-Run Research Seminar — May 10, 2023
Title: *What does the tree of life look like as it grows?*

California Research Alliance by BASF — April 23, 2018
Title: Formation of Spray-Dried Cross-Linked Alginate Microcapsules (CLAMs)

HONORS AND AWARDS

Jastro-Shields Graduate Research Scholarship	2017, 2018, 2019, 2020, 2021
UC Davis College of Engineering Graduate Student Teaching Award	2022, 2023

PROJECTS

Representative computational and theoretical biology projects (multifractal tree models, lineage dynamics, information-theoretic analysis) are available at: https://github.com/KevinAndrewHudnall.