

Daniel Northrup, Ph.D.
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Technology development leader in public and private sector with expertise in genetics, agriculture, and sustainability. Successful design, management, and execution of transformative research portfolios impacting food production, human and animal nutrition, renewable energy, and soil health. Experience at product life stages from inception to product launch. Strong interpersonal skills with a proven track record of creating strategic partnerships for coordinated public-private and NGO investment in successful new business ventures and research areas.

Experience/ Employment:

Galvanize Climate Solutions, Principal, Science and Technology

January 2022 – Present

Vision: Building a leading investment platform that combines technology, policy, and economics to develop and scale urgent climate solutions

- **Technical / Impact Diligence:** Lead domain specific due diligence efforts in life science and artificial for flagship Innovation and Expansion fund that is investing in venture and growth stage companies with significant climate potential in the next 5 years. Perform impact assessment of technology for GHG reductions of successful companies.
- **Thought leadership / Strategy:** use technical expertise to develop roadmaps for agriculture’s decarbonization effort that include near-term adjustments, mid-term scaling needs, and longer-term technology development with quantification that would establish a net negative sector.

Benson Hill, Director of Special Projects

June 2019 – January 2022

Vision: Optimize plant genetics to promote sustainability and improve human health through vertical integration and value chain innovation

Projects:

- **Aquaculture:** Designed and contracted fit-for-purpose testing using in vivo feeding trials for two fish species identified as top opportunities through market sizing and value. Produced marketing materials and approached customers to execute successful first premium product sale (>\$1M). Published a trade industry article in *Aquafeed Magazine*. Invited speaker at USDA, “Aquaculture is Agriculture” strategy meeting. Supported market analysis for international expansion.
- **Investor Relations / Business Case Development:** Performed supply chain analysis and projected demand for protein ingredients for the rapidly growing plant-based meat industry. Quantified a “protein gap” between projected demand and the existing supply chain and ingredient set that is addressed by Benson Hill’s novel ingredients. This case study on critical material limitations is prominently featured in investor relations presentations.
- **Sustainability:** Lead product life cycle analysis through third party studies that demonstrate a 50% reduction in GHG footprint and 70% reduction in water footprint for novel protein ingredients. Developed highly featured summaries for public sustainability strategy and product marketing material. Success of the program led the company to expand this analysis to include all mature products and product concepts. Led and published a peer-reviewed paper on novel technologies to decarbonize maize production.
- **Grant Writing:** Organized and wrote 5 successful grants in 2 years to the United Soybean Board for \$775k that expand R&D efforts in novel trait development and lab testing for soybean quality traits.

Booz Allen Hamilton, Associate

September 2014 – May 2019

Client: Advanced Research Projects for Energy (ARPA-E), Technical Advisor

Technical program manager for the ARPA-E Biological Sciences Team that designed and deployed an active \$90M crop improvement portfolio. This effort attracted over \$100M in combined public and private sector funding, launched 6 new startups, facilitated a multinational acquisition, and created the first U.S. open-source reference data network for scale neutral innovations in crop phenotyping (Phenotype = Genotype x Environment x Management).

Program TERRA: Transportation Energy Resources from Renewable Agriculture

2014

Vision: Double Agricultural Productivity for Food, Feed, Fiber, and Fuel

- Integrated advanced technology platforms in crop genetics, field robotics, remote sensing, computational analytics, and machine learning to create autonomous breakthrough decision support systems in agriculture. Secured program approval from U.S. Department of Energy Secretary Moniz.
- Developed and executed comprehensive 5-year project management work plans with quantitative milestones and budgets for a \$50M portfolio of multi-institute projects on digital plant phenotyping and analytics technologies.
- Established and nurtured strategic partnerships with crop commodity organizations (National Sorghum Producers, National Corn Growers Association, North America Wheat Growers Association), the Bill and Melinda Gates Foundation, The Nature Conservancy, and the DOE Joint Genome Institute that resulted in nearly \$10M funding to support expansion of the technologies to additional markets.
- Lead ARPAE collaboration with the DARPA program, Data Driven Discovery of Models, to create and apply automated machine learning tools that allow plant breeders and agronomists to use state of the art machine learning tools with minimal software expertise.

Program ROOTS: Rhizosphere Observations Optimizing Terrestrial Sequestration

2016

Vision: Restoring Soil Carbon for Crop Productivity, Climate Resilience, and Environmental Sustainability

- Championed cutting-edge technology transfer from medicine, military, aerospace, and energy into novel innovation platforms for deployment in agriculture, forestry, and land management.
- Conducted due diligence efforts to determine the state of the art for root phenotyping, crop mechanistic modeling, in-situ biogeochemical characterization and soil health planetary boundaries for program design.
- Developed pitch materials for ARPA-E leadership acceptance of the program, co-authored the request for proposals, coordinated external review, and led selection of the 10 project, \$40M ROOTS program.

Program SMARTFARM: Systems for Monitoring and Analytics for Renewable Transportation Fuel from Agricultural Resources and Management

2019

Vision: Leverage Market Forces to Create Novel Revenue Streams and Boost Farm Sustainability by reducing farm emissions by 70%

- Led stakeholder engagement with federal government agencies (USDA, DOE, EPA), state regulators (CARB), researchers, producers, commodity groups, farmers, and policy advocates to create novel technology options for field level greenhouse gas monitoring.
- Facilitated the launch of the \$10M in phase 1 ground truth system and a \$15M phase 2 novel technologies program to create regulatory grade data products targeted to add emissions mitigation to the agricultural economy by differentiation in sustainability and product quality.

National Institutes of Health, Postdoctoral Fellowship

February 2009 – September 2014

- Led collaborations with three labs to publish six papers in high-impact, peer reviewed journals focused on epigenetic mechanisms during development controlled by transcription factors and histone modifying enzymes.
- Developed protocols and used bioinformatics tools to investigate immune cell development pathways using next generation sequencing for functional genomics (ChIP-seq) and transcriptomics (RNA-seq).

Education:

- PhD, Immunology, University of Pennsylvania December 2008
- BSE, Biomedical Engineering, Duke University May 2003

Professional Activities / Affiliations:

- Iowa State University, Agronomy Department, Affiliate Assistant Professor
- United Soybean Board, Member, Sustainability Advisory Council
- Dryland Genetics, Non-executive, Independent Board Member
- Innerplant, Scientific Advisor
- Lum.ai, Scientific Advisor
- Invited Speaker and conference planner for, USDA-ARS strategic meeting, “Aquaculture is Agriculture”

- Awardee, Bill and Melinda Gates Foundation, Grand Challenges Exploration - 2020, “Generating Synthetic Agricultural Ground Reference Data from Satellite Observations”
- Expert and thought leader in plant phenotyping / digital agriculture: including an invited lecture on phenotyping to a 14 US national commodity boards, successful grant application and host of a two day NIFA sponsored conference “Data Driven Agriculture” on plant breeding, infield sensors, and satellite remote sensing capabilities.
- Technical editor, **The Plant Phenome Journal**, 2017-2022

Peer Reviewed Publications:

(*Shared first author)

- Li, Y, Xu, H, Northrup, D, Wang, M. *Effects of soybean varieties on life-cycle greenhouse gas emissions of biodiesel and renewable diesel. Biofuels, Bioproducts, & Biorefining.* January 2023. <https://doi.org/10.1002/bbb.2462>
- Northrup, D, Basso, B, Wang, M, Morgan, C, Benfey, P. *Novel technologies for emission reduction complement conservation agriculture to achieve negative emissions from row-crop production. Proceedings of the National Academy of Sciences.* July 2021 Vol. 118(28). <https://doi.org/10.1073/pnas.2022666118>
- Liu, X, Kwon, H, Northrup, D, Wang, M. *Shifting Agricultural Practices to produce sustainable, low carbon intensity feedstocks for biofuel production. Environmental Research Letters,* July 2020 Vol 15(8). DOI: 10.1088/1748-9326/ab794e
- Northrup, D, Yagi, R, Cui, K, Proctor, WR, Wang, C, Placek, K, Pohl, LR, Wang, R, Ge, K, Zhu, J, Zhao, K. *Histone demethylases UTX and JMJD3 are required for NKT cell development in mice. Cell and Bioscience,* 2017, May:1(7):25.
- Escobar, TM, Kanellopoulou, C, Kugler, DG, Kilaru, G, Nguyen, CK, Nagarajan, V, Bhairavabhotla, RK, Northrup, D, Zahr, R, Burr, P, Liu, X, Zhao, K, Sher, A, Jankovic, D, Zhu, J, Muljo, SA. *miR-155 activates cytokine gene expression in Th17 cells by regulating the DNA-binding protein Jarid2 to relieve polycomb-mediated repression. Immunity,* 2014 June:40(6):865-879.
- Yagi, R, *Zhong, C, *Northrup, D, Yu, F, Bouladoux, N, Spencer, S, Hu, G, Barron, L, Sharma, S, Nakayama, T, Belkaid, Y, Zhao, K, Zhu, J. *The Transcription Factor GATA3 Is Critical for the Development of All IL-7R α -Expressing Innate Lymphoid Cells. Immunity,* 2014 March:40(3)378-388.
- Banerjee, A, Northrup, D, Boukarabila, H, Jacobsen, SE, Allman D. *Transcriptional repression of Gata3 is essential for early B cell commitment. Immunity,* 2013 May:38(5):930-942.
- Hu, G, *Cui, K, *Northrup, D, Liu, C, Wang, C, Tang, Q, Ge, K, Levens, D, Crane-Robinson, C, Zhao, K. *H2A.Z Facilitates Access of Active and Repressive Complexes to Chromatin in Embryonic Stem Cell Self-renewal and Differentiation. Cell Stem Cell,* 2013 Feb 7;12(2):180-92.
- Hu G, Schones DE, Cui K, Ybarra R, Northrup D, Tang Q, Gattinoni L, Restifo NP, Huang S, Zhao K. *Regulation of nucleosome landscape and transcription factor targeting at tissue-specific enhancers by BRG1. Genome Research,* 2011 Oct;21(10):1650-8.
- Wei G, Abraham BJ, Yagi R, Jothi R, Cui K, Sharma S, Narlikar L, Northrup DL, Tang Q, Paul WE, Zhu J, Zhao K. *Genome-wide analyses of transcription factor GATA3-mediated gene regulation in distinct T cell types. Immunity,* 2011 Aug 26;35(2):299-311.
- Northrup, DL and Zhao, K. *Application of ChIP-Seq and related techniques to the study of immune function. Immunity,* 2011 Jun 24;34(6):830-42.
- Harman, B.C., Northrup, D.L., and Allman, D. *Resolution of unique Sca-1^{high} c-Kit lymphoid-biased progenitors in adult bone marrow. J. Immunol.* 2008 Dec 1; 181(11):7514-24.
- *Pongubala, JM, *Northrup, DL, Lancki, DW, Medina, KL, Treiber, T, Bertolino, E, Thomas, M, Grosschedl, R, Allman, D, and Singh, H. *Transcription factor EBF restricts alternative lineage options and promotes B cell fate independently of Pax5. Nature Immunology.* 2008 Jan; 9:203-215.
- Erickson, GR, Northrup, D, Guilak, F. *Hypo-osmotic stress induces calcium-dependent actin reorganization in articular chondrocytes. Osteoarthritis and Cartilage.* 2003 Mar;11(3):187-97.

Scientific / Trade Publications:

- Northrup, D, Lucas, H. Better from the beginning: Using plant genetics and value chain integration to provide functional and sustainable soy ingredients for aquaculture rations. *Aquafeed Magazine.* July Vol 13(3):21.
- Contributing Author: *The Power of Resiliency in Agriculture's Ecosystem Services*, special report for US Farmers and Ranchers Alliance: <https://usfarmersandranchers.org/wp-content/themes/usfra-microsite/assets/downloads/USFRA-2019-Report.pdf>