

John H. Lagergren

R&D Associate Staff Member - Biosciences, Plant Systems Biology Group, Oak Ridge National Laboratory

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Education

2016 - 2020	PhD, Applied Mathematics , North Carolina State University	GPA 4.0
2016 - 2018	MS, Applied Mathematics , North Carolina State University	GPA 4.0
2010 - 2015	BS, Applied Mathematics , East Tennessee State University	GPA 3.9

Experience

2023 - Present	R&D Associate Staff Member , Oak Ridge National Laboratory
2021 - 2023	Postdoctoral Research Associate , Oak Ridge National Laboratory
2021 - 2022	Lead Machine Learning Scientist , Off Camber Creative LLC
2016 - 2020	Graduate Research Assistant , North Carolina State University
2019 - 2020	ML/AI Technical Intern , Applied Research Associates
2018 - 2019	SAMSI Graduate Fellow , North Carolina State University
2015	REU Researcher , East Tennessee State University

Expertise

Methods	Deep learning: MLP, CNN, GNN, Transformer, PINN/BINN, RNN, VAE, GAN Machine learning: GBM, RF, iRF, SVM, kNN, MCL Math modeling: ODE, PDE, MCMC, SSR
Languages	Code: Python (PyTorch, Tensorflow, LightGBM, scikit-learn), R, MATLAB, Git Markup: \LaTeX , Microsoft Office, Google Suite, Adobe Suite Written: English, Finnish

Grants

2024	co-PI , Digital underground for the Advanced Plant Phenotyping Laboratory	\$715,000
2021 - 2024	Contrib. , Benefits and LUC effects of US energy crop carbon banking	\$1,398,000
2022 - 2023	PI , AI-enabled association of plant physiology and phenotypes	\$400,000

Awards

2023	ORPA Research Symposium, People's Choice Award , ORNL	
2020	Winton-Rose Award for Research Excellence , NCSU	\$1,000
2018 - 2019	SAMSI Graduate Fellowship , NCSU	\$25,000
2017	Graduate Student Research Symposium, Math Award , NCSU	
2016 - 2017	Graduate Fellowship , NCSU	\$4,000
2016	Outstanding Student Presenter Award , MAA	
2015	S-STEM Scholarship , ETSU	\$2,750
2014	Charles F. Wilkey Math Scholarship , ETSU	\$1,000

Publications

Journal articles (*equal contribution)

- 1 **J. Lagergren**, M. Pavicic, H. Chhetri, L. York, D. Hyatt, D. Kainer, E. Rutter, K. Flores, J. Bailey-Bale, M. Klein, G. Taylor, D. Jacobson, and J. Streich. *Few-shot learning enables population-scale analysis of leaf traits in *Populus trichocarpa**, Plant Phenomics, vol. 5, no. 72 (2023). <https://arxiv.org/abs/2301.10351>
- 2 M. Pavicic, A. Walker, K. Sullivan, **J. Lagergren**, A. Cliff, J. Romero, J. Streich, M. Garvin, MVP Suicide Exemplar Workgroup, Million Veteran Program, J. Pestian, B. McMahon, D. Oslin, J. Beckham, N. Kimbrel, D. Jacobson. *Using explainable-AI to find geospatial environmental and sociodemographic predictors of suicide attempts*, Accepted, Frontiers in Psychiatry (2023). <https://www.medrxiv.org/content/10.1101/2022.04.26.22274333v2.full>
- 3 **J. Lagergren**, M. Cashman, V.G.M. Vergara, P. Eller, J.G.F.M. Gazolla, H. Chhetri, J. Streich, S. Climer, P. Thornton, W. Joubert, D. Jacobson. *Climatic clustering and longitudinal analysis with impacts on food, bioenergy, and pandemics*. Phytobiomes Journal, vol. 7, no. 1 (2022). <https://doi.org/10.1094/PBIOMES-02-22-0007-R>
- 4 N. Kimbrel, A. Ashley-Koch, X. Qin, J. Lindquist, M. Garrett, M. Dennis, L. Hair, J. Huffman, D. Jacobson, R. Madduri, J. Trafton, H. Coon, A. Docherty, J. Kang, N. Mullins, D. Ruderfer, VA Million Veteran Program, **MVP Suicide Exemplar Workgroup**, International Suicide Genetics Consortium, P. Harvey, B. McMahon, D. Oslin, E. Hauser, M. Hauser, J. Beckham *A genome-wide association study of suicide attempts in the million veterans program identifies evidence of pan-ancestry and ancestry-specific risk loci*. Molecular Psychiatry, vol. 27, (2022). <https://doi.org/10.1038/s41380-022-01472-3>
- 5 **J. Lagergren**, J. Nardini, R. Baker, M.J. Simpson, K. Flores. *Biologically-informed neural networks guide mechanistic modeling from sparse experimental data*. PLOS Computational Biology, vol. 16, no. 12 (2020). <https://doi.org/10.1371/journal.pcbi.1008462>
- 6 **J. Lagergren**, K. Flores, M. Gilman, S. Tsynkov. *Deep learning approach to the detection of scattering delay in radar images*. Journal of Statistical Theory and Practice, vol. 15, no. 14 (2020). <https://doi.org/10.1007/s42519-020-00149-w>
- 7 J. Nardini, **J. Lagergren**, A. Hawkins-Daarud, L. Curtin, B. Morris, E. Rutter, K. Swanson, K. Flores. *Learning equations from biological data with limited time samples*. Bulletin of Mathematical Biology, vol. 82, no. 119 (2020). <https://doi.org/10.1007/s11538-020-00794-z>
- 8 **J. Lagergren***, J. Nardini*, G.M. Lavigne, E. Rutter, K. Flores. *Learning partial differential equations for biological transport models from noisy spatiotemporal data*. Proceedings of the Royal Society A, vol. 476, no. 2234 (2020). <https://doi.org/10.1098/rspa.2019.0800>
- 9 R. Everett, K. Flores, N. Henscheid, **J. Lagergren**, K. Larripa, D. Li, J. Nardini, P.T.T. Nguyen, E.B. Pitman, E. Rutter. *A tutorial review of mathematical techniques for quantifying tumor heterogeneity*. Mathematical Biosciences and Engineering, vol. 17, no. 4, pp 3660-3709 (2020). <http://dx.doi.org/10.3934/mbe.2020207>
- 10 **J. Lagergren***, A. Reeder*, F. Hamilton, R. Smith, K. Flores. *Forecasting and uncertainty quantification using a hybrid of mechanistic and non-mechanistic models for an age-structured population model*. Bulletin of Mathematical Biology, vol. 80, no. 6, pp 1578-1595 (2018). <https://doi.org/10.1007/s11538-018-0421-7>

Refereed proceedings (*equal contribution)

- 1 J. Merlet*, **J. Lagergren***, V.G.M. Vergara, M. Cashman, C. Bradburne, R. Plowright, E. Gurley, W. Joubert, D. Jacobson. *Data-Driven Whole-Genome Clustering to Detect Geospatial, Temporal, and Functional Trends in SARS-CoV-2 Evolution*. PASC '23: Proceedings of the Platform for Advanced Scientific Computing Conference, no. 26, pp 1–7 (2023). <https://doi.org/10.1145/3592979.3593425>
- 2 M. Cashman, V.G.M. Vergara, **J. Lagergren**, M. Lane, J. Merlet, M. Atkinson, J. Streich, C. Bradburne, R. Plowright, W. Joubert, D. Jacobson. *Longitudinal Effects on Plant Species Involved in Agriculture and Pandemic Emergence Undergoing Changes in Abiotic Stress*. PASC '23: Proceedings of the Platform for Advanced Scientific Computing Conference, no. 3, pp 1–10 (2023). <https://doi.org/10.1145/3592979.3593402>
- 3 T. Paniagua, **J. Lagergren**, G. Foderaro. *A simple deconvolutional mechanism for point clouds and sparse unordered data*. Proceedings of the AAAI Conference on Artificial Intelligence, vol. 34, no. 10 (2020). <https://doi.org/10.1609/aaai.v34i10.7217>
- 4 E. Rutter, **J. Lagergren**, K. Flores. *A convolutional neural network method for boundary optimization enables few-shot learning for biomedical image segmentation*. MICCAI 2019, Lecture Notes in Computer Science, vol. 11795, pp 190-198 (2019). https://doi.org/10.1007/978-3-030-33391-1_22
- 5 E. Rutter, **J. Lagergren**, K. Flores. *Automated object tracing for biomedical image segmentation using a deep convolutional neural network*. MICCAI 2018, Lecture Notes in Computer Science, vol. 11073, pp 686-694 (2018). https://doi.org/10.1007/978-3-030-00937-3_78

Pre-prints

- 1 **J. Lagergren***, M. Ruiz-Aravena*, D. Becker, W. Madden, L. Ruytenberg, A. Hoegh, B. Han, A. Peel, P. Eby, D. Jacobson, R. Plowright. *Environmental and ecological signals predict periods of nutritional stress for Eastern Australian flying fox populations*, 2024 - In review, Biology Letters.
- 2 M. Wright, M. Coombs, D. Macaya-Sanz, **J. Lagergren**, J. Romero, D. Jacobson, N.L. Engle, T.J. Tschaplinski, S.P. DiFazio, J. Cumming. *Variation in water limitation resistance in *Populus trichocarpa* is associated with a syndrome of physiological plasticity*, 2023 - In review, Tree Physiology.
- 3 **J. Lagergren**, E. Rutter, K. Flores. *Region growing with convolutional neural networks for biomedical image segmentation*, 2020. <https://arxiv.org/abs/2009.11717>
- 4 E. Rutter, **J. Lagergren**, G. Martin, E. Collins, H.T. Banks, G. LeBlanc, K. Flores. *LeDaphNet: an automated assessment of *Daphnia magna* populations using digital imaging and machine learning*, 2017. <http://www.lib.ncsu.edu/resolver/1840.20/35557>

Datasets and code

- 1 Data and code: **J. Lagergren**, M. Pavicic, H. Chhetri, L. York, D. Hyatt, D. Kainer, E. Rutter, K. Flores, J. Bailey-Bale, M. Klein, G. Taylor, D. Jacobson, and J. Streich. *Supporting information for few-shot learning enables population-scale analysis of leaf traits in *Populus trichocarpa**. Oak Ridge National Laboratory, Oak Ridge, TN USA (2023). <https://doi.org/10.11578/dc.20230321.1>
- 2 Data: **J. Lagergren**, M. Cashman, V.G.M. Vergara, P. Eller, J.G.F.M. Gazolla, H. Chhetri, J. Streich, S. Climer, P. Thornton, W. Joubert, D. Jacobson. *Supporting data for climatic clustering and longitudinal analysis with impacts on food, bioenergy, and pandemics*. Oak Ridge National Laboratory, Oak Ridge, TN USA (2022). <https://doi.org/10.13139/ORNLNCCS/1828678>
- 3 Data and code: **J. Lagergren**, J. Nardini, R. Baker, M. Simpson, K. Flores. *Biologically-informed neural networks guide mechanistic modeling from sparse experimental data*. North Carolina State University, Raleigh, NC USA (2020). <https://github.com/jlager/BINNs>

Presentations

Invited presentations

- *Artificial Intelligence for Image-Based Plant and Microbial Phenotyping*
Genomic Sciences Program Annual PI Meeting, Washington, DC, 2024
- *QTL Mapping of Swarming Motility and Germination Rate in a Bacillus subtilis Library*
Genomic Sciences Program Annual PI Meeting, Washington, DC, 2024
- *Mathematics and machine learning in computational biology*
NCSU Biomathematics Seminar, Raleigh, NC, 2023
- *AI-enabled association of plant physiology and phenotypes*
ORNL Laboratory Directed Research and Development, Oak Ridge, TN, 2023
- *Image segmentation for plant phenotyping with very few samples*
ORNL AI-Expo, Oak Ridge, TN, 2023
- *Few-shot learning for leaf and vein segmentation*
International Congress on Industrial and Applied Mathematics, Tokyo, Japan, 2023
- *QTL mapping of swarming motility and germination rate in Bacillus subtilis*
Center for Bioenergy Innovation Annual Science Meeting, Asheville, NC, 2023
- *Few-shot learning enables population-scale analysis of leaf traits in Populus trichocarpa*
Oak Ridge Postdoc Association (ORPA) Research Symposium, Oak Ridge, TN, 2023
- *Few-Shot Learning Enables Population-Scale Analysis of Leaf Traits in Populus trichocarpa*
Genomic Sciences Program Annual PI Meeting, Washington, DC, 2023
- *Explainable-AI predicts flying fox food shortages with applications to future pandemics*
SIAM Conference on Life Sciences, virtual, 2022
- *Few-shot learning enables fast and accurate image-based plant phenotyping*
Center for Bioenergy Innovation Annual Science Meeting, Asheville, NC, 2022
- *Employing rapid, accurate, high-precision phenotyping in poplar and switchgrass*
Genomic Sciences Program Annual PI Meeting, virtual, 2022
- *Data-driven network analysis detects environmental changes with impacts on food, energy, and pandemics*
SMB Annual Meeting, virtual, 2021
- *Equation learning for partial differential equation models of biological transport*
Joint Mathematics Meetings, virtual, 2021
- *Biologically-informed neural networks guide mechanistic modeling from sparse experimental data*
SMB Annual Meeting, virtual, 2020
- *Data denoising and partial derivative approximation with neural networks*
SIAM Conference on Mathematics of Data Science, virtual, 2020
- *Neural networks: what they are and how to train them*
Lanzas Lab, NCSU College of Veterinary Medicine, Raleigh, NC, 2019
- *Applications of machine learning to heterogeneous population data*
SAMSI Precision Medicine Transition Workshop, Raleigh, NC, 2019
- *Undergraduate Workshop: Career Opportunities Panel*
SAMSI program on methods for precision medicine (PMED), Raleigh, NC, 2018

- *Data-driven prediction and UQ of chaotic systems using a mechanistic and non-mechanistic hybrid model*
SIAM Southeastern Atlantic Sectional Conference, Chapel Hill, NC, 2018

Mini-symposia (*co-organized)

- J. Nardini*, **J. Lagergren***. *Leveraging machine learning for discovery of mathematical models in biology*, SIAM Conference on Mathematics of Data Science, June 2020.