Renee Dale, MS

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Areas of specialization

Mathematical Biology • Computational Biology • Biostatistics • Bayesian Statistics • Mathematical Biology Education • Plant Biology • Parameter Estimation Techniques

Education

2019 PhD in Biological Sciences, LSU
Dissertation: Mathematical Model Scaling in Cell Biology

2019 MS in Experimental Statistics, LSU
Thesis: Parameter Estimation and Optimization in Mathematical Modeling using Bayesian Statistics

2015 MS in Biological Sciences, LSU
Thesis: Mathematical Model of the Split Firefly Luciferase Assay

2013 BS in Biological Sciences, LSU

2013 BA in Philosophy, LSU
Thesis: Empathy, Altruism, and Prosocial Behavior in Humans and Primates

Current position

PhD Candidate, Biological Sciences, Louisiana State University
&& MS Candidate, Experimental Statistics, Louisiana State University

Teaching Experience

2013-2018 Teaching Assistant, LSU

2017 Guest Instructor, LSU

Honors & awards

2018 Finding Your Inner Modeler Year II Travel Award
2018 Parameter Estimation for Mechanistic Biological Models Workshop Travel award
2018 LSU McDaniel Scholarship
2018 SMB Landahl Travel Award
2018 Women in Math Networking Travel Award
2018 BAMM! Travel Award
2018 NextProf 2018 Workshop
2018 ASPB 2018 Travel Award
2017 CIRTL Associate
2017 *Plantae* Fellow
2017 International Conference on Health Policy and Statistics 2018 Travel Award
2017 Duke University *Geometry of Redistricting* Hackathon Travel Award
2017 International Society for Bayesian Analysis New Researcher Travel Award, *O'Bayes*
2017 Emory University *StatFest* Travel Award
2017 Women in Statistics and Data Science Travel Award
2017 SMB Subgroup on Immunology and Infection Travel Award
2017 NIMBioS *Pan-Microbial Trait Modeling* Travel Award
2017, 2018 LSU Graduate Student Travel Award
2017 Finding Your Inner Modeler Year I Travel Award
2017 Quantitative Cell Biology Network Workshop Travel Award
2013 Distinguished Communicator, Communication Across the Curriculum, LSU

Journal articles

In preparation

11 **Dale, R.**, Kato, N., Wischusen, E. (2018) Four assessment methods to measure student gains in a graduate course on mathematical modeling in cell biology. Letters in Biomathematics.
10 **Dale, R.**, Kato, N. (2018) Probabilistic differential equation modeling uncovers complexity of multi-step reaction enzyme characterization.

Submitted

9

Dale, R., Chen, Y., He, H. (2018) Hierarchical modeling of the effect of pre-exposure prophylaxis on HIV in the US. JIAS.
(*preprint*: https://www.biorxiv.org/content/early/2018/03/22/285940)

8 Kumar, N., **Dale, R.**‡, Kemboi, D., Zeringue, E. A., Kato, N., Larkin, J. C. (2018) Functional Analysis of Short Linear Motifs in the Plant Cyclin-Dependent Kinase Inhibitor SIAMESE. Plant Physiology.

7 **Dale, R.**, Guo, B. (2017) Estimating epidemiological parameters of a stochastic differential model of HIV dynamics in the United States using hierarchical Bayesian statistics. PLoS ONE. (*preprint*: https://doi.org/10.1101/219832)

Published

6 Chen, Y.C., **Dale, R.**, He, Hongyu, Le, Quoc-Anh T. (2017) Posterior Estimates of Dynamic Constants in HIV Transmission Modeling. Computational and Mathematical Methods in Medicine. https://doi.org/10.1155/2017/1093045

5 Brauer, E. K., Ahsan, N., **Dale, R.**‡, Kato, N., Coluccio, A. E., Piñeros, M. A., Kochian, L. V., Thelen, J. J., Popescu, S. C. (2016). The Raf-like kinase ILK1 and the high affinity K+ transporter HAK5 are required for Innate Immunity and Abiotic Stress Response. Plant Physiology. pp.00035.2016. http://dx.doi.org/10.1104/pp.16.00035

4 **Dale, R.**, Kato, N. (2016). Truly quantitative analysis of the firefly luciferase complementation assay. Current Plant Biology 5(2016): 57-64.

3 **Dale, R.**, Ohmuro-Matsuyama, Y., Ueda, H., Kato, N. (2016). Mathematical Model of the Firefly Luciferase Complementation Assay Reveals a Non-Linear Relationship between the Detected Luminescence and the Affinity of the Protein Pair Being Analyzed. PLoS ONE 11(2): e0148256. http://dx.doi.org/10.1371/journal.pone.0148256

2 Kumar, N., Harashima, H., Kalve, S., Bramsiepe, J., Wang, K., Sizani, B. L., Bertrand, L. L., Johnson, M. C., Faulk, C., **Dale, R.**‡, Simmons, L. A., Churchman, M. L., Sugimoto, K., Kato, N., Dasanayake, M., Beemster, G., Schnittger, A., Larkin, J. C. (2015). Functional Conservation in the SIAMESE-RELATED Family of Cyclin-Dependent Kinase Inhibitors in Land Plants. Plant Cell 27(11): 3065-3080

1 Fontenot, E. B., Ditusa, S. F., Kato, N., Olivier, D. M., **Dale, R.**‡, Lin, W. Y., Chiou, T. J., Macnaughtan, M. A., Smith, A. P. (2015). Increased phosphate transport of Arabidopsis thaliana Pht1;1 by site-directed mutagenesis of tyrosine 312 may be attributed to the disruption of homomeric interactions. Plant Cell Environ 38(10): 2012-2022.

‡ indicates experimental/wetlab contributions.

Talks

2018 Finding Your Inner Modeler Year II *Dynamical modeling of role of PCH1 in photobody formation*

2018 Annual Meeting of the Society for Mathematical Biology *Studying the effect of pre-exposure prophylaxis on the dynamics of different populations susceptible to HIV*

2018 CIRTL Teaching-As-Research Network *Student gains in a graduate course on mathematical modeling in cell biology*

2018 2018 Sigma Xi Student Research Showcase *Improved Mathematical Model Enhances Understanding of Endoreplication in Arabidopsis Trichomes with 4D Visualization*

2018 International Conference on Health Policy and Statistics 2018 *Bayesian Estimate of the Parameters of a Stochastic Differential Model of HIV Incidence in the United States*

2017 ULL Graduate Symposium *Is the HIV epidemic over? Bayesian methodology to estimate epidemiological parameters for a system of stochastic differential equations*

2017 SCALA 2017: Scientific Computing Around Louisiana *Posterior Estimates of Dynamic Constants in HIV Transmission Modeling*

Posters

2018 ASPB 2018 *Generation of nonlinear-differential-equations system from a model of Boolean relationships in Arabidopsis salt stress network*

2018 ASPB 2018 *Combating stereotypes of math and enhancing appreciation for plant biology in undergraduate students using video games*

2018 BAMM! *Generation of nonlinear-differential-equations system from a model of Boolean relationships in Arabidopsis salt stress network*

2018 Southern Section ASPB 2018 Regional Meeting *Improved Mathematical Model Enhances Understanding of Endoreplication in Arabidopsis Trichomes with 4D Visualization*

2018 Biograds Symposium *Bayesian Estimate of the Parameters of a Stochastic Differential Model of HIV Incidence in the United States*

2018 AAAS 2018 *Improved Mathematical Model Enhances Understanding of Endoreplication in Arabidopsis Trichomes with 4D Visualization*

2018 SCALA 2018 *Hierarchical modeling of HIV prevention*

2017 Objective Bayes Workshop *Bayesian Estimate of the Parameters of a Stochastic Differential Model of HIV Incidence in the United States*

2017 Emory University Stat Fest *Bayesian Estimate of the Parameters of a Stochastic Differential Model of HIV Incidence in the United States*

2017 Annual Meeting of the Society for Mathematical Biology *Bayesian Estimate*

of the Parameters of a Stochastic Differential Model of HIV Incidence in the United States

2017 LSU Boyd Adventures in Research: A Pathway to Biomedical Research *Posterior Estimates of Dynamic Constants in HIV Transmission Modeling*

Education & Mentoring Activities

Major Contributions

Developed web application for undergraduate introductory biology students to enhance their understanding of traditionally difficult concepts, such as membrane potential & enzyme kinetics. Current version (2017).
CIRTL Scholar: The LSU Center for the Integration of Research, Teaching, and Learning (CIRTL) provides this certificate to graduate students who study STEM education, design and carry out an experiment, and present or publish their findings. I took discipline-based education resource (DBER) courses, independently studied the literature, designed and carried out an experiment while guest instructor with BIOL 7800, and analyzed the data. I am currently writing up the results.
Curriculum Development: BIOL 7800 Mathematical Modeling in Cellular Biology with Dr. Kato at LSU (2017). I assisted in conceptual course material development (differential equations, cell biology) and was completely responsible for the technical, programming materials for the course. My lecture materials are available at my blog and my code examples here
Curriculum Development: Helped develop a new coursework for use at LSU course BIOL 1005 Laboratory for non-science majors (2016). To help the students come up with independent research topics, I suggested the inclusion of a proposal presentation prior to their writeup.
Developed web application on Ecological Inference to include RxC analysis for assisting laywers to determine possible cases of gerrymandering using district data (2017). Currently the code is private and still under development.
Volunteer statistical consultant with Statistics Without Borders (2018)

Minor Contributions

Volunteer with *Skype A Scientist*
Mentor: Association for Women in Math Mentor Network (2017)
Mentor: MentorNet (2017)
Judge: Volunteer judge for local and regional Louisiana Science and Engineering Fair (LSEF) for both Junior and Senior levels (2014 – present)
Judge: American Statistical Association online poster competition for high school students (2018)

Panelist, Coaching Your Daughter for STEM (2018)
Mentor: Assisted local middle school students with their science fair projects (2014 & 2018)
Volunteer tutor with STEMup (2018)

Scientific Outreach & Service to the Community

Animation Team Volunteer member with Graduate Women in Science.
Journal Reviewer, Heliyon (2018)
Guest editor, What we're reading. Collection of recent research on mathematical modeling in plant biology.(2018)
***Plantae* Fellow**: scientific outreach with a focus on mathematical plant biology. My profile (2017-2018)
Developed web application in concert with Finding Your Inner Modeler workshop series to promote collaboration between experimentalists and computationalists. Current version (2017).
Academic blogging detailing computational procedures to help beginners in computational biology and the general computing public (2017)
Academic Twitter devoted to scientific breakthroughs, opportunities for graduate students, computational methodologies, and mental health related information; #MathModelingMonday for brief, weekly descriptions of computational methods in biology (@b1o_model1ng) (2017)

Grants

2011 Sea Grant Undergraduate Research Grant *Ideal CO_2 Concentration for Algal Growth*

Computational Skills

Computing languages

Python, Matlab, Mathematica, R, Java, Comsol, C++, JMP, SAS, Spark

Mathematical techniques

Ordinary differential equations, stochastic differential equations, differential algebraic equations, mixed differential equations; Multivariate calculus, linear algebra

Computational techniques

Flux balance analysis, flux variability analysis; Global and local optimization; Parameter estimation, kinetic modeling, population modeling, protein-protein interaction modeling, gene expression and control modeling; Algorithm development and design;

Statistical techniques

Bayesian statistics, Data mining, linear and nonlinear regression, parameter selection, categorization, clustering

Big Data-related skills

Statistical techniques; Parallel computing (Matlab, R); GPU computing (CUDA in Matlab, R); Data sorting and large data set manipulation; Graphics (heat map, contour map, 3D graphics, 2D and 3D animation); Data mining; Matrix manipulation, High Performance Computing (Matlab); Database handling (Matlab, Python, Spark)

Engineering-related skills

Linux; Raspberry Pi setup and extension; RPi programming (including motors, automatic imaging); COMSOL microfluidic device design and fluids simulation

Application development

Graphical user interface design and implementation (Matlab, R), web application development (R Shiny); Virtual machines

Other skills

Latex, vector graphics in Latex

Professional Development

2018 Women in Math Networking Event at UTenn

2018 NextProf 2018 at University of Michigan; hosted by the Department of Mathematics

2017 AAAS Proposal Writing Program

2017 SMB Early Careers Workshop

2017 Power of Persuasion: A COACh Workshop for PhD Students

2017 Learning Theories that Drive Student Success

Affiliations

Graduate Women in Science Social Media Committee
NOGLSTP
WWCODE
American Society for Plant Biologists
Society for Mathematical Biology Subgroup: Immunology and Infection
American Statistical Association
Sigma Xi Full Member
Society for Industrial and Applied Mathematics
AAAS
Association for Women in Mathematics
LSU Women in Science Outreach & Social Media Committee; Twitter handler
Society for Mathematical Biology
Institute for Mathematical Statistics
Graduate Student Association
BioGrads