Renee Dale, PhD

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Areas of specialization

Mathematical Biology • Computational Biology • Biostatistics • Bayesian Statistics • Mathematical Biology Education • Plant Biology • Parameter Estimation Techniques • Interdisciplinary Communication & Collaboration

Education

2020 MS in Experimental Statistics, LSU
Thesis: Parameter Estimation and Optimization for Mathematical Models using Bayesian Statistics

2019 PhD in Biological Sciences, LSU
Dissertation: Dynamical Modeling in Cell Biology with Ordinary Differential Equations

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

Postdoctoral Scholar, Baxter Lab & Topp Lab, Donald Danforth Plant Science Center
&& *MS Candidate*, Experimental Statistics, Louisiana State University

Teaching Experience

2017 Guest Instructor, LSU

2017 Research Assistant, Biological Sciences, LSU

2017 Research Assistant, Mathematics, LSU

2013-2019 Teaching Assistant, LSU

Journal articles

In preparation

14 **Dale, R.***, Craig, S., Abdelmassih, M. (2019) Mathematical modeling of catechol oxidase dynamics in an undergraduate biology laboratory.

13 **Dale, R.*** & Li, C. (2019) Collaborative workshop shows common language elements in

‡ indicates experimental/wetlab contributions. § indicates author ordering is alphabetical (common in math) * indicates corresponding author.

interdisciplinary relationships between experimental and computational biologists.

12 **Dale, R.***, Reeves, D.B. (2019) Quantifying distributions in time-series data for mechanistic mathematical modeling.

Accepted/In Press

11 **Dale, R.***, Kato, N., Wischusen, E. (2020) Modeling and analysis of the firefly luciferase reaction and a G-protein coupled receptor signaling pathway with ordinary differential equations increases self confidence in mathematical cell biology for novice graduate students. Letters in Biomathematics. Pre-print

10 **Dale, R.**, Chen, Y., He, H. (2020) Hierarchical modeling of the effect of pre-exposure prophylaxis on HIV in the US. *Book Chapter.* Biostatistics and Computational Biology. Springer Press. Pre-print

Published

9 **Dale, R.**, Ohmuro, Y., Ueda, H., Kato, N. (2019) Non-Steady State Analysis of Enzyme Kinetics in Real Time Elucidates Substrate Association and Dissociation Rates: Demonstration with Analysis of Firefly Luciferase Mutants. Biochemistry 2019 58 (23), 2695-2702. Text

8 **Dale, R.***, Guo, B. (2018) Estimating epidemiological parameters of a stochastic differential model of HIV dynamics in the United States using hierarchical Bayesian statistics. PLoS ONE 13(7): e0200126. Text

7 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. 2018, 177 (4) 1569-1579. Text

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. Text

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. Text

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

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. Text

2 Kusmar, 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. Text

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 & Environment 38(10): 2012-2022. Text

Honors & awards

2019 Midwest Dynamical Systems Travel Award, Early Career Conference
2019 Bath University Travel Award, 'Probability Meets Biology'
2019 Rice University Travel Award, AWM 2019
2018 European Student Council Symposium Travel Fellowship
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 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

Grants

2018 SMB Education and Outreach Grant *Video game for the promotion of plant biology and quantitative skill development in high school students*
2018 LSU Biograds *Validation of a method to generate a system of differential equations from Boolean network models*
2018 LSU Libraries Open-Access Author Fund *Estimating epidemiological parameters of a stochastic differential model of HIV dynamics in the United States using hierarchical Bayesian statistics*
2011 Sea Grant Undergraduate Research Grant *Ideal CO_2 Concentration for Algal Growth*

Software & Websites

2019- **Developing database** of scientists with Diversity Plant Biology.
https://blog.garnetcommunity.org.uk/diversify-plantsci/
2018- **Developing collaborative database** promoting interdisciplinary collaborations between mathematical biologists and experimental biologists.
https://rdale1.shinyapps.io/InitMathBio
2019 **Developed fellowship database** for Cientifico Latino, allowing users to search and match with the fellowship database.
https://www.cientificolatino.com/searchable-fellowships

2019 **Developed web application** for undergraduate introductory biology students to run Hardy-Weinberg simulations and extract statistical summaries to test biological hypothesis of the effect of various effects on genotypes and phenotypes. Current version.

2017 **Developed web application** for undergraduate introductory biology students to enhance their understanding of traditionally difficult concepts, such as membrane potential & enzyme kinetics. Current version.

Talks

Invited Talks

2019 Session Organizer, "Mathematical Plant Biology: A Collaborative Session", Plant Biology 2019

2019 Session Organizer, "Current Challenges in Mathematical Biology", Association for Women in Math Research Symposium 2019.

2018 Session Chair, "Epidemiology Part B", Annual Meeting of the Society for Mathematical Biology, July 2018.

Contributed Talks

2019 Donald Danforth Plant Science Center Symposium: Crop Improvement: Climate Resilience for Nutrition *Dynamical modeling in plant cell biology with ordinary differential equations*

2018 European Student Council Symposium *Generation of nonlinear-differential-equations system from a model of Boolean relationships in Arabidopsis salt stress network*

2018 Finding Your Inner Modeler Year II *Modeling red-light photoreceptor photobody formation in plants*

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

2019 Donald Danforth Plant Science Center Symposium: Crop Improvement: Climate Resilience for Nutrition *Dynamical modeling in plant cell biology with ordinary differential equations*

2019 Carnegie Postdoctoral Scholar Symposium *Generation of nonlinear-differential-equations system from a model of Boolean relationships in Arabidopsis salt stress network*

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*

Scientific Outreach & Service to the Community

Education

Curriculum Development: CURE lab for introductory biology involving modeling and programming techniques.

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)

Mentoring

2018- **Mentor** with Association for Women in Mathematics Mentorship program

2019- **Postdoctoral Consultant** with Ceintifico Latino's mentoring program.

2018- **Volunteer** with *Letters to a Future Scientist*
2018- **Volunteer** with *Skype A Scientist*
2014-2019 **Judge** for local and regional Louisiana Science and Engineering Fair (LSEF) for both Junior and Senior levels.
2018 **Mentor with BIOS**, the Biology Intensive Orientation for Students at LSU.
2018 **Judge** for American Statistical Association online poster competition for high school students.
2018 **Panelist**, *Coaching Your Daughter for STEM* at LSU Museum of Natural History.
2014, 2018 **Mentor** for local middle school students to assist with their science fair projects

Scientific Outreach

2020 **Volunteer** with 500 Women Scientists for 2 events in St Louis in January.
2017- **Community network leader** of the Big Data and Cyberinfrastructure network on Plantae.
2017-2018 ***Plantae* Fellow** with ASPB's community, with a focus on mathematical plant biology. My profile
2017- **Academic blogging** detailing computational procedures to help beginners in computational biology and the general computing public (2017)
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)

Service to the Community

2020 **Scholarship Reviewer**, Out to Innovate, NOGLSTP.
2019 **Journal Reviewer**, Genes.
2019 **Journal Reviewer**, International Journal of Molecular Sciences.
2018 **Journal Reviewer**, AIDS and Behavior.
2018 **Journal Reviewer**, Heliyon.
2018 **Guest editor**, What we're reading. Collection of recent research on mathematical modeling in plant biology.

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; Sensitivity analysis

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, some HTML); Virtual machines

Other skills

Latex, vector graphics in Latex

Affiliations

American Society for Plant Biology
Society for Mathematical Biology
Association for Women in Math
Graduate Women in Science
National Organization of Gay and Lesbian Scientists and Technical Professionals
American Statistical Association
National Postdoctoral Association
500 Women Scientists
Intercollegiate Biomathematics Alliance