Renee Dale, PhD

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[SEMANTICSCHOLAR]

AREAS OF SPECIALIZATION

Mathematical Biology • Computational Biology • Enzyme Kinetics • Signaling • Bayesian Statistics • Mathematical Biology Education • Plant Biology • Parameter Estimation Techniques • Interdisciplinary Collaboration

Education

2021	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

Teaching Experience

2017	Guest Instructor, LSU
2017	Research Assistant, Biological Sciences, LSU
2017	Research Assistant, Mathematics, LSU
2013-2019	Teaching Assistant, LSU

Journal articles

SUBMISSION PLANNED IN NEXT 3 MONTHS

16	Challenges and opportunities to build quantitative self-confidence for biologists.
15	**Dale, R.**, He, H. Absorbing Markov Chain and PrEP drug adherence.
14	**Dale, R.**, Craig, S. Mathematical modeling of catechol oxidase dynamics in an undergraduate biology laboratory.

SUBMITTED

13	

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

Burnett, J.L.*, **Dale, R.***, Hou, C.Y., Aulenbach, S., Bristol, S.R., Palomo-Munoz, G., Stack-Whitney, K., Wellman, T., Valle, D. (2021) Ten Simple Rules for Creating a Scientific Web Application.

12 **Dale, R.**, Oswald, S., Jalihal, A., LaPorte, M.F., Fletcher, D.M., Hubbard, A., Shiu, S., Bucksch, A., Nelson, A.D.L. (2021) Overcoming the challenges to enhancing experimental plant biology with computational modeling. Frontiers in Plant Science. *Preprint:*https://osf.io/jfdb9/

PUBLISHED

11 **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.

10 **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.

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.

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.

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.

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.

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.

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.

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.

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.

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

Grants

2021 NSF Postdoctoral Fellowship: *Establishing parametric variability as a driver of plasticity across genotypes with diverse life histories.* (2021 - 2024)
https://nsf.gov/awardsearch/showAward?AWD_ID=2109790

2020 SMB Education and Outreach Grant *Video game for the promotion of plant biology and quantitative skill development in high school students*

2020 ASPB Plant BLOOME. PI: Callis-Duehl, K. Co-PI: **Dale, R.** *Educational Video Game Integrates Concepts in Plant and Mathematical Biology for 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*

Honors & awards

2021 International Conference on Arabidopsis Research Travel Award

2020 QCB *Cell Modeling Hackathon* Award

2020 Plant Biology 2020 Travel Award

2020 NIMBioS *Quantitative Graduate Education in the Life Sciences* Invitation

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

Community Initiatives

2020- **Modeling and Beyond**: developing online community and forum of early career modelers: https://amoghpj.github.io/modeling-and-beyond/

2018- **InitMathBio:** Developed collaborative database and community forum promoting interdisciplinary collaborations between mathematical biologists and experimental biologists. https://initmathbio.com

Software & Websites

2020- **Diversify Plant Science** developing webtool database of scientists for Diversify Plant Science. https://blog.garnetcommunity.org.uk/diversify-plantsci/

2019 **Cientifico Latino** Developed searchable fellowship and REU database tools for Cientifico Latino, allowing users to search and match with the fellowship database.

2019 **Hardy Weinberg Simulator** 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. https://rdale1.shinyapps.io/popgensim/.

2017 **Developed web application** for undergraduate introductory biology students to enhance their understanding of traditionally difficult concepts, such as membrane potential & enzyme kinetics. https://rdale1.shinyapps.io/wischu_biol2018/.

Talks

Invited Talks

2020 Session Organizer, "Discovering the rules of life through computational plant biology", Plant Biology 2020

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

2020 PlantBiology2020 *Using a Trait-based Dynamic Mathematical Framework to Investigate the Relationship Between Phenotypic Dynamical Parameters and the Genome in Setaria*

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. (2019)
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.

MENTEES

2020- **Dr. Yena Kim**. Mathematical Biologist. Instructor at University of Hawaii Pacific. *via AWM mentoring network*

2019- **Stewart Craig**. Undergraduate at Louisiana State University and former student, estimated graduation 2021.

COMMUNITY MENTORING

2018- **Society for Math Biology** mentor during eSMB2020.
2018- **Association for Women in Mathematics** mentor.
2019- **Postdoctoral Consultant** with Ceintifico Latino's mentoring program.
2018- *Letters to a Future Scientist* volunteer.
2018- *Skype A Scientist* volunteer.
2018 **Mentor with BIOS**, the Biology Intensive Orientation for Students at LSU.
2014, **Mentor** for local middle school students to assist with their science fair projects
2018

SCIENTIFIC OUTREACH

2017- **Community network leader** of the Big Data and Cyberinfrastructure network on Plantae.
2017- *Plantae* **Fellow** with ASPB's community, with a focus on mathematical plant biology.
2018 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 (@b10_model1ng)

SERVICE TO THE COMMUNITY

2021 *Letters in Biomathematics* reviewer
2021 **GWIS** reviewer, National Fellowship Program
2019- **NOGLSTP** reviewer, Out to Innovate scholarship and award applications, STEM division.
2019 *Genes* reviewer
2019 *International Journal of Molecular Sciences* reviewer
2018 *AIDS and Behavior* reviewer

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.
2018	*Heliyon* reviewer
2018	**Guest editor**, What we're reading. Collection of recent research on mathematical modeling in plant biology.
2014-2019	**Judge** for local and regional Louisiana Science and Engineering Fair (LSEF) for both Junior and Senior levels.

Affiliations

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

Computational Skills

COMPUTING LANGUAGES

Python, Matlab, Mathematica, R, Java, JMP, SAS

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; Approximate Bayesian Computation

STATISTICAL TECHNIQUES

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

Big Data-related skills

Statistical techniques; High Performance Computing utilization; 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)

Application development

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

Other skills

Latex, vector graphics in Latex