

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: Modeling Enzyme Regulation in Plants
- 2019 MS in Experimental Statistics, LSU
Thesis: Parameter Estimation and Optimization for Mathematical Models 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

Journal articles

IN PREPARATION

- 11 **Dale, R.**, Kato, N. (2018) Re-evaluating Michaelis-Menten assumptions for firefly luciferase - a universal minimal model.

SUBMITTED

- 10 **Dale, R.**, Kato, N., Wischusen, E. (2018) Four assessment methods to measure student
gains in a graduate course on mathematical modeling in cell biology. (*preprint*:
<https://submit.biorxiv.org/submission/pdf?msid=BIORXIV/2018/346890>)
- 9 **Dale, R.**, Chen, Y., He, H. (2018) Hierarchical modeling of the effect of pre-exposure pro-
phylaxis on HIV in the US.
(*preprint*: <https://www.biorxiv.org/content/early/2018/03/22/285940>)

PUBLISHED

- 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. <https://doi.org/10.1371/journal.pone.0200126>
- 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.
- 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 complemen-
tation 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 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 dis-
ruption of homomeric interactions. Plant Cell Environ 38(10): 2012-2022.

[‡] indicates experimental/wetlab contributions.

Honors & awards

- 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	<i>Plantae</i> Fellow
2017	International Conference on Health Policy and Statistics 2018 Travel Award
2017	Duke University <i>Geometry of Redistricting</i> Hackathon Travel Award
2017	International Society for Bayesian Analysis New Researcher Travel Award, O'Bayes
2017	Emory University <i>StatFest</i> Travel Award
2017	Women in Statistics and Data Science Travel Award
2017	SMB Subgroup on Immunology and Infection Travel Award
2017	NIMBioS <i>Pan-Microbial Trait Modeling</i> 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	<i>Video game for the promotion of plant biology and quantitative skill development in high school students</i>
2018	LSU Biograds	<i>Validation of a method to generate a system of differential equations from Boolean network models</i>
2018	LSU Libraries Open-Access Author Fund	<i>Estimating epidemiological parameters of a stochastic differential model of HIV dynamics in the United States using hierarchical Bayesian statistics</i>
2011	Sea Grant Undergraduate Research Grant	<i>Ideal CO₂ Concentration for Algal Growth</i>

Talks

INVITED TALKS

2018	Session Organizer, "Mathematical Biology Speed-Dating Collaboration", Association for Women in Math. April 2019.
2018	Session Chair, "Epidemiology Part B", Annual Meeting of the Society for Mathematical Biology, July 2018.

CONTRIBUTED TALKS

2018	European Student Council Symposium	<i>Generation of nonlinear-differential-equations system from a model of Boolean relationships in Arabidopsis salt stress network</i>
2018	Finding Your Inner Modeler Year II	<i>Modeling red-light photoreceptor photobody formation in plants</i>
2018	Annual Meeting of the Society for Mathematical Biology	<i>Studying the effect of pre-exposure prophylaxis on the dynamics of different populations susceptible to HIV</i>
2018	CIRTL Teaching-As-Research Network	<i>Student gains in a graduate course on mathematical modeling in cell biology</i>
2018	2018 Sigma Xi Student Research Showcase	<i>Improved Mathematical Model Enhances Understanding of Endoreplication in Arabidopsis Trichomes with 4D Visualization</i>
2018	International Conference on Health Policy and Statistics 2018	<i>Bayesian Estimate of the</i>

- 2017 *Parameters of a Stochastic Differential Model of HIV Incidence in the United States*
 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

Mentor with *PlantingScience*: mentor elementary and high school science teams

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.

Mentor with BIOS, the Biology Intensive Orientation for Students at LSU.

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 ex-](#)

[amples 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 lawyers 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 *Letters to a Future Scientist*

Volunteer with *Skype A Scientist*

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)

Scientific Outreach & Service to the Community

Community network leader of the Big Data and Cyberinfrastructure network on *Plantae*.

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 ([@bio_modeling](#)) (2017)

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); Virtual machines

OTHER SKILLS

Latex, vector graphics in Latex