TREVOR M. NOLAN

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Duke University ◇ FFSC Rm 4128 ◇ 124 Science Drive ◇ Durham, NC 27708
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EDUCATION

Iowa State University *2013 - 2018*
Ph.D. in Genetics and Genomics
Plant Sciences Institute and Brown Graduate Fellow

Iowa State University *2009 - 2013*
B.S. in Genetics
summa cum laude and Honors Program

RESEARCH EXPERIENCE

Postdoctoral Researcher July 2019-Ongoing
Laboratory of Philip Benfey, Duke University

Postdoctoral Researcher December 2018 - July 2019
Laboratory of Yanhai Yin, Iowa State University

Network Based Discovery of Brassinosteroid Regulation of Plant Growth and Stress Responses in Arabidopsis.

Graduate Research Assistant 2014 - 2018
Laboratory of Yanhai Yin, Iowa State University

To Grow or Survive: Plants Modulate Brassinosteroid-Regulated Transcription Factor BES1 During Drought to Mediate Growth-Stress Tradeoffs.

Undergraduate Research Assistant 2011-2013
Laboratory of Steven Rodermel, Iowa State University

PUBLICATIONS

30. **Nolan, T.M.***, and R. Shahan*. (2023). Resolving plant development in space and time with single-cell genomics. *Invited review, Current Opinion in Plant Biology.*
    - * co-first authors
29. **Nolan, T.M.***, N. Vukasinovic*, C.W. Hsu*, J. Zhang, I. Vanhoutte, R. Shahan, I. Taylor, L. Greenstreet, M. Heitz, A. Afanassiev, P. Wang, P. Szekely, A.Brosnan, Y. Yin, G. Schiebinger, U. Ohler, E. Russinova and P.N. Benfey. (2023). Brassinosteroid gene regulatory networks at cellular resolution in the Arabidopsis root. *Science.* https://doi.org/10.1126/science.adf4721
    - * co-first authors
28. Wang., Y, J. Perez-Sancho, M. Platre, B.Callebaut, M. Smokvarska, K.Ferrer, Y.Luo, T. Sato, **T. Nolan**, P.Benfey, W. Busch, M. Kvasnica, J. Winne, E. Bayer, N. Vukainovi and E. Russinova. Plasmodesmata mediate cell-to-cell transport of brassinosteroid hormones. *Nature Chemical Biology (In press)*
27. Hsu, C.-W., R. Shahan, **T.M. Nolan**, P.N. Benfey, and U. Ohler. (2022). Protocol for fast scRNA-seq raw data processing using scKB and non-arbitrary quality control with COPILOT. *STAR Protocols* 3, 101729. https://doi.org/10.1016/j.xpro.2022.101729.

26. Liao, C.-Y.*, Y. Pu*, **T.M. Nolan***, C. Montes, H. Guo, J. Walley, Y. Yin, and D.C. Bassham. (2022). Brassinosteroids modulate autophagy through phosphorylation of RAPTOR1B by the GSK3-like kinase BIN2 in Arabidopsis. *Autophagy* 118. https://doi.org/10.1080/15548627.2022.2124501

    - * co-first authors

25. Montes, C., P. Wang, C. Liao, **T.M. Nolan**, G. Song, N. Clark, J. Elmore, H. Guo, D. Bassham, Y. Yin, and J. Walley. (2022). Integration of multi-omics data reveals interplay between brassinosteroid and TORC signaling in Arabidopsis. *New Phytologist*. https://doi.org/10.1111/nph.18404

24. Wang, P., N. Clark, **T.M. Nolan**, G. Song, P. Bartz, C. Liao, C. Montes-Serey, E. Katz, J. Polko, J. Kieber, D. Kliebenstein, D. Bassham, J. Walley, Y. Yin, and H. Guo. (2022). Integrated omics reveal novel functions and underlying mechanisms of the receptor kinase FERONIA in Arabidopsis thaliana. *The Plant Cell*. https://doi.org/10.1093/plcell/koac111

23. Wang, P., N. Clark, **T.M. Nolan**, G. Song, O. Whitham, C-Y. Liao, C. Montes-Serey, D.C. Bassham, J. Walley, Y. Yin, Y and H. Guo (2022). FERONIA functions through Target of Rapamycin (TOR) to negatively regulate autophagy. *Front. Plant Sci.* 13, 961096. https://doi.org/10.3389/fpls.2022.961096.

22. Shahan,R., C. Hsu, **T.M. Nolan**, B. Cole, I. Taylor, L. Greenstreet, S. Zhang, A. Afanassiev, A. Hendrika C. Vlot, G. Schiebinger, P.N. Benfey, and U. Ohler. (2022). A single-cell Arabidopsis root atlas reveals developmental trajectories in wild-type and cell identity mutants. *Developmental Cell*. 57 (4), 543-560. e9 https://doi.org/10.1016/j.devcel.2022.01.008

    - On the cover of *Developmental Cell*.

21. Wang, P., **T.M. Nolan**, N. Clark, H. Jiang, C. Montes-Serey, H. Guo, D. Bassham, J. Walley, and Y. Yin. (2021). The F-box E3 ubiquitin ligase BAF1 mediates the degradation of the brassinosteroid-activated transcription factor BES1 through selective autophagy in Arabidopsis. *The Plant Cell*. 33 (11), 3532-3554 https://doi.org/10.1093/plcell/koab210

20. Shahan, R., **T.M. Nolan** and P.N. Benfey. (2021). Single-cell analysis of cell identity in the Arabidopsis root apical meristem: insights and opportunities. *Journal of experimental botany*. 72 (19), 6679-6686 https://doi.org/10.1093/jxb/erab228

19. Clark N., **T.M. Nolan**, P. Wang, G. Song, C. Montes, C. Valentine, H. Guo, R. Sozzani, Y.Yin, and J. Walley. (2021). Integrated omics networks reveal the temporal signaling events of brassinosteroid response in Arabidopsis. *Nature communications*. 12 (1), 1-13 https://doi.org/10.1038/s41467-021-26165-3

18. Xiang, L.*, **T.M. Nolan***, Y. Bao, M. Elmore, T. Tuel, J. Gai, D. Shah, P. Wang, N. Huser, A.Hurd, S.McLaughlin, S.Howell, J.Walley, Y. Yin, and L. Tang. (2021). Robotic Assay for Drought (RoAD): an automated phenotyping system for brassinosteroid and drought responses. *The Plant Journal*. 107 (6), 1837-1853. https://https://doi.org/10.1111/tpj.15401

    - * co-first authors

17. **Nolan, T.M.**, N. Vukasinovic, D. Liu, J. Russinova and Y. Yin. (2020). Brassinosteroids: Multidimensional Regulators of Plant Growth, Development and Stress Responses. *Plant Cell*. 32 (2), 295-318. https://doi.org/10.1105/tpc.19.00335

16. Jiang, H., B. Tang, Z. Xie, **T.M. Nolan**, H. Ye, G. Song, J. Walley and Y. Yin. (2019). GSK3-Like Kinase BIN2 Phosphorylates RD26 to Potentiate Drought Signaling in Arabidopsis. *The Plant Journal*. https://doi.org/10.1111/tpj.14484

15. Xie, Z., **T.M. Nolan**, H. Jiang, B. Tang, M, Zhang, Z. Li and Y. Yin. (2019). The AP2/ERF Transcription Factor TINY Modulates Brassinosteroid-Regulated Plant Growth and Drought Response in Arabidopsis. *Plant Cell.* 31 (8), 1788-1806. https://doi.org/10.1105/tpc.18.00918

14. Wang, P., **T.M. Nolan**, Y. Yin and D. Bassham. (2019). Identification of a transcription factor-centered regulatory network of autophagy genes in Arabidopsis. *Autophagy.* 1-17. https://doi.org/10.1080/15548627.2019.1598753

13. Xie, Z., **T.M. Nolan**, H. Jiang and Y. Yin. (2019). AP2/ERF Transcription Factor Regulatory Networks in Hormone and Abiotic Stress Responses in Arabidopsis. *Frontiers in Plant Science.* 10, 228. https://doi.org/10.3389/fpls.2019.00228

12. Guo, H., **T.M. Nolan**, Z. Xie, G. Song, J. Walley and Y. Yin. (2018). FERONIA Receptor Kinase Contributes to Plant Immunity by Suppressing Jasmonic Acid Signaling in Arabidopsis thaliana. *Current Biology.* 28 (20), 3316-3324. https://doi.org/10.1016/j.cub.2018.07.078

11. **Nolan, T.M.**, J. Chen, and Y. Yin. (2017). Cross-talk of Brassinosteroid signaling in controlling growth and stress responses. *Biochemical Journal.* 474 (16), 2641-2661. https://doi.org/10.1042/BCJ20160633

10. Chen, J., **T.M. Nolan**, H. Ye, M. Zhang, H. Tong, P. Xin, J. Chu, C. Chu, Z. Li, and Y. Yin. (2017). Arabidopsis WRKY46, WRKY54 and WRKY70 Transcription Factors Are Involved in Brassinosteroid-Regulated Plant Growth and Drought Response. *Plant Cell.* 29 (6), 1425- 1439. https://doi.org/10.1105/tpc.17.00364

9. **Nolan, T.M.**, B. Brennan, M. Zhang, M. Yang, J. Chen, M. Zhang, Z. Li, X. Wang, D. Bassham, J. Walley, and Yin, Y. (2017). Selective Autophagy of BES1 Mediated by DSK2 Balances Plant Growth and Survival. *Developmental Cell.* 41 (1), 33-46. https://doi.org/10.1016/j.devcel.2017.03.013

    - Featured in *Science Signaling, BioTechniques, ScieneDaily* and *Iowa Farmer Today.*

8. Yang, M., C. Li, Z. Cia, Y. Hu, **T.M. Nolan**, F. Yu, Y. Yin, Q. Xie, G. Tang and X. Wang. (2017). SINAT E3 ligases control the light-mediated stability of the brassinosteroid-activated transcription factor BES1 in Arabidopsis. *Developmental Cell.* 41 (1), 47-58. https://doi.org/10.1016/j.devcel.2017.03.014

7. Ye, H., S. Liu, B. Tang, J. Chen, Z. Xie, **T.M. Nolan**, H. Jiang, H. Guo, H. Lin, L. Li, Y. Wang, H. Tong, M. Zhang, C. Chu, Z. Li, M. Aluru, S. Aluru, P. Schnable and Y. Yin. (2017). RD26 mediates crosstalk between drought and Brassinosteroid signaling pathways. *Nature Communications.* 8, 14573. https://doi.org/10.1038/ncomms14573

6. Jiang, H., X. Want, **T.M. Nolan**, Y. Yin, M. Aluru and L. Dong. (2017). Automated microfluidic plant chips-based plant phenotyping system. *IEEE 12th International Conference on Nano/Micro Engineered and Molecular Systems (NEMS).* 756-760. https://doi.org/10.1109/NEMS.2017.8017129

5. **Nolan, T.M.**, H. Guo, S. Liu, L. Li, P. Schnable, and Y. Yin. (2016). Identification of Brassinosteroid Target Genes by Chromatin Immunoprecipitation Followed by High-throughput Sequencing (ChIP-seq) and RNA-seq. *Brassinosteroid Analysis Book.* https://doi.org/10.1007/978-1-4939-6813-8_7

4. Pogorelko, G., S. Kambakam, **T.M. Nolan**, A. Foudree, O. Zabotina and S. Rodermel. (2016). Impaired Chloroplast Biogenesis in Immutans, an Arabidopsis Variegation Mutant, Modifies Developmental Programming, Cell Wall Composition and Resistance to Pseudomonas syringae. *Plos one.* 11, 4. https://dx.doi.org/10.1371%2Fjournal.pone.0150983

3. Wang, X., J. Chen, Z Xie, S Liu, **T.M. Nolan**, H. Ye, M. Zhang, H. Guo, P. Schnable, Z.

Li, and Y. Yin. (2014). Histone Lysine Methyltransferase SDG8 Is Involved in Brassinosteroid-Regulated Gene Expression in Arabidopsis thaliana. *Molecular Plant* 7, 1303- 1315. https://doi.org/10.1093/mp/ssu056

2. Putarjunan, A., X. Liu , **T.M. Nolan**, F. Yu , and S. Rodermel. (2013). Understanding chloroplast biogenesis using second-site suppressors of *immutans* and *var2*. *Photosynthesis Research* 116, 437-453. https://doi.org/10.1007/s11120-013-9855-9

1. Foudree, A., A. Putarjunan, S. Kambakam, **T.M. Nolan**, J. Fussell, G. Pogorelko, and S. Rodermel. (2012). The Mechanism of Variegation in *immutans* Provides Insight into Chloroplast Biogenesis. *Frontiers in Plant Science* 3, 260. https://doi.org/10.3389/fpls.2012.00260

TALKS

32. Plant Cell Atlas Single Cell Sequencing Techniques in Plant Biology. Virtual. April 14th, 2023.
31. PAG30 - Root Genomics. San Diego, CA. January 17th, 2023.
30. PAG30 - Spatial transcriptomics. San Diego, CA. January 16th, 2023.
29. 10X Genomics Webinar on plant single-cell. Virtual. October 20th, 2022.
28. Plant Molecular Biology Retreat. Wrightsville, NC. October 16th, 2022.
27. NSF PGRP Awardee Meeting. Alexandria, VA. September 7th, 2022.
26. Spatial and Temporal Dynamics in Plant Biology. Holderness, NH. June 12 - 17, 2022.
25. VIB-UGent Center for Plant Systems Biology. Ghent, Belgium. June 2nd, 2022.
24. GRC: Mechanisms of Abiotic Stress Resilience and Applications for Agriculture. Les Diablerets, Switzerland. May 22 - 27, 2022.
23. Unraveling Plant Stress Responses Using Multidisciplinary Approaches. Les Diablerets, Switzerland. May 21-22, 2022.
22. CSHL Plant genomes, systems biology and engineering. December 1-4, 2021.
21. HHMI Cell and Developmental Biology meeting. September 29th, 2021.
20. Duke DCMB Seminar. September 22nd, 2021.
19. NSF PGRP Awardee Meeting. September 10th, 2020.
18. Plant Genomes in a Changing Environment. Virtual Conference. October 12-14, 2020.
17. Bioinformatics and Computational Biology Symposium. Iowa State University. May 1st, 2020.
16. Plant Genomes in a Changing Environment. Virtual Conference. October 12-14, 2020.
15. Climate Change-Linked Stress Tolerance in Plants. Hannover, Germany. May 13-16, 2019.
14. Centre for Research in Agricultural Genomics. Barcelona, Spain. May 9th, 2019.
13. Plant Sciences Institute Board Meeting. Ames, IA. April 5, 2019.
12. 3rd International Conference on Brassinosteroid Research. San Diego, CA. August 1-4, 2018.
11. Salk Institute for Biological Studies. San Diego, CA. July 31st, 2018.
10. Duke University. Durham, NC. July 26th, 2018.
9. Plant Biology 2018. Montreal, Quebec, Canada. July 14-18, 2018.
8. University of California San Diego. San Diego, CA. March 13th, 2018.

7. Workshop on Plant Development and Drought Stress. Pacific Grove, CA. November 5-8, 2017.
6. International Conference on Arabidopsis Research. St. Louis, MO. June 19-23, 2017.
5. Post-transcriptional Gene Regulation in Plants Meeting. Austin, TX. July 14-15, 2016.
4. Plant Biology 2016. Austin, TX. July 9-13, 2016.
3. GDCB Brown Bag Seminar Series. Ames, IA. November 11th, 2015.
2. International Conference on Arabidopsis Research. Paris, France. July 5-9, 2015.
1. Crop Bioengineering Consortium Summer 2015 Meeting. Ames, IA. June 17-18, 2015.

POSTER PRESENTATIONS

10. Plant Cell Atlas First PCA Symposium. December 8th, 2021.
9. Climate Change-Linked Stress Tolerance in Plants. Hannover, Germany. May 13-16, 2019.
8. Walter E and Helen Parke Loomis Lecture and Mini-Symposium. Ames, IA. May 6th, 2019.
7. Novel candidate gene discovery by computing on phenotypes. Ames, IA. April 3rd, 2019.
6. 1st International Plant Systems Biology Meeting. Roscoff, France. September 10-14, 2018.
5. Loomis and Crop Bioengineering Consortium 2018 Meeting. Ames, IA. May 8-10, 2018.
4. Predictive Crop Design: Genome-to-phenome. Lincoln, NE. April 6-7, 2017.
3. ASPB Midwest Section Meeting. Chicago State University, Chicago, IL. March 23-24th, 2013.
2. Plant Biology 2012. Austin, TX. July 20-24, 2012.
1. ASPB Midwest Section Meeting. University of Nebraska, Lincoln, NE March 24-25, 2012.

TEACHING

Guest Lecturer Fall 2022
Comparative Plant Transcriptomics *North Carolina State University*

Teaching Assistant Spring 2018
Genetics Laboratory (Genetics 313L) *Iowa State University*

Guest Lecturer Fall 2016
Molecular Genetics (Genetics 409) *Iowa State University*

Guest Lecturer Spring 2016
Transmission Genetics (Genetics 510) *Iowa State University*

Tutor Fall 2012
Principles of Genetics (Genetics 313) *Iowa State University*

Undergraduate Teaching Assistant Fall 2011
Principles of Genetics (Genetics 313 and 313L) *Iowa State University*

MENTORING

Graduate Students

Teun Bruins	2023
Tanner Cook	2018
Ashley Paulsen	2017
Basanta Bista	2017
Max McReynolds	2016
Jie Tang	2016

Undergraduate Students

Shanshan Gao	2023-Ongoing
Obale Obale	2023-Ongoing
Eric Xie	2022-Ongoing
Ashley Hurd	2018-2019
Nicole Huser	2016-2019
Sean McLaughlin	2016-2019
Jessica Parrott	2016
Paige Rassel	2016
Kyle Small	2016
Ben Brennan	2014-2015

Technical Support Staff

Aiden Brosnan	2021-Ongoing
Jingyuan Zhang	2020-Ongoing
Megan Perkins-Jacobs	2019-2021

Mentor in Cell Biology Academy (CeBA)
for high school students from underrepresented backgrounds

Alejandra Diaz	2023

Mentor in Research Experience for Teachers Program

Nick Smith, Eagle Grove High School	2017-2018
Brent Chambers, Bellevue High School	2014

AWARDS AND FELLOWSHIPS

NSF National Plant Genome Initiative Postdoctoral Research Fellow 2020-2023
Duke University

Plant Cell Atlas - Best Presentation 2021
First PCA Symposium

Zaffarano Prize for Graduate Student Research 2019
Iowa State University

Karas Award for an Outstanding Dissertation 2019
Iowa State University

Genetics, Development and Cell Biology Award 2019
Iowa State University

Genetics and Genomics Research Excellence Award 2018
Iowa State University

Biochemical Journal Poster Award - 1st Place 2018
3rd International Conference on Brassinosteroid Research, San Diego, CA

Best Poster Presentation by a Graduate Student 2018
Loomis and Crop Bioengineering Consortium Meeting, Ames, IA

Brown Graduate Fellow 2016-2017
Iowa State University

Plant Sciences Institute Fellow 2013-2017
Iowa State University

Travel Awards

GRC Salt and Water Stress in Plants Travel Grant 2022
Crop Bioengineering Center Travel Grant 2019
Iowa State University W.E. Loomis award for travel to Plant Biology 2018
Workshop on Plant Development and Drought Resistance 2017
Iowa State University W.E. Loomis award for travel to Plant Biology 2017
Iowa State University W.E. Loomis award for travel to Plant Biology 2016
Iowa State University GDCB travel award to the ICAR 2015

Best Oral Presentation by a Graduate Student 2016
Post-transcriptional Gene Regulation in Plants Meeting, Austin, TX

Best Poster Presentation by an Undergraduate Student 2013
ASPB Midwest Meeting, Chicago, IL

Research in Genetics Summer Undergraduate Internship 2012
Sui Tong Chan Fung Fund for the Promotion of Study, Iowa State University

GRANTS

Reconstructing spatial-temporal responses to drought in Arabidopsis and rice using time series single-cell transcriptomics 2020-2023
PI: Trevor M. Nolan

NSF National Plant Genome Initiative Postdoctoral Research Fellowship in Biology

Network-Based Discovery of Brassinosteroid Regulation of Plant Growth and Stress Responses in Arabidopsis 2018-2021
PI: Yanhai Yin Co-PI: Justin Walley

Role: Led the development and writing of this funded proposal from the NSF Division of Molecular and Cellular Biosciences Cellular Dynamics and Function cluster.

Crosstalk between Brassinosteroid and autophagy pathways in the regulation of plant growth and stress responses 2017-2020
PI: Yanhai Yin Co-PIs: Diane Bassham and Justin Walley

Role: Generated preliminary data, participated in writing and designed experimental approach for this funded NIH R01 proposal.

PROFESSIONAL ACTIVITIES

Conference Organizer 2024
Gordon Research Seminar - Plant Salt and Water Stress

Session Chair 2022
Plant Molecular Biology Retreat

Discussion Leader 2022
Molecular Mechanisms Underlying Stress Tolerance - GRS Salt and Water stress

Discussion Leader 2022
Elucidating Abiotic Stress Survival Mechanisms - GRS Plant Molecular Biology

Sigma Xi Scientific Research Society 2019

Graduate Student Representative 2017
Genetics, Development and Cell Biology Faculty Search Committee

Iowa State University Crop Bioengineering Center Member 2014-2019

American Society of Plant Biologists Member 2012-Present

Grant Reviews

European Research Council 2022
National Science Foundation Plant Genome Research Program 2021

Manuscript Reviews

Reviewed over 30 manuscripts in journals including
Plant Cell, *Developmental Cell*, *Nature Plants*, *Current Biology* and *Plant Physiology* 2016-Present

REFERENCES

Dr. Philip Benfey, Professor
Duke University

philip.benfey@duke.edu

Dr. Yanhai Yin, Professor
Iowa State University

yin@iastate.edu

Dr. Eugenia (Jenny) Russinova, Group Leader
VIB UGent Center for Plant Systems Biology

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Dr. Justin Walley, Assistant Professor
Iowa State University

jwalley@iastate.edu