

TREVOR M. NOLAN

Website: www.TrevorNolan.science

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

(515) 577-7320 ◇ trevor.nolan@duke.edu

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

Mechanisms of Chloroplast biogenesis in variegation mutants.

Undergraduate Research Assistant

2010

Meifen Wei, Iowa State University

Psychological research on cultural sensitivity in advisor-advise relationships.

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. (In press)*

- * 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. Szekeley, 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*. <https://doi.org/10.1038/s41589-023-01346-x>
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*, *SciencDaily* 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/>

4. Pogorelko, G., S. Kambakam, **T.M. Nolan**, A. Foudree, O. Zabolina 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/journal.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>

INVITED TALKS

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| 18. 4th International Conference on Brassinosteroid Research. Ghent, Belgium. | August 17th, 2023. |
| 17. Salk Institute. San Diego, CA. | August 10th, 2023. |
| 16. Plant Cell Atlas Single Cell Sequencing Techniques in Plant Biology. | April 14th, 2023. |
| 15. PAG30 - Root Genomics. San Diego, CA. | January 17th, 2023. |
| 14. PAG30 - Spatial transcriptomics. San Diego, CA. | January 16th, 2023. |
| 13. 10X Genomics Webinar on plant single-cell. | October 20th, 2022. |
| 12. NSF PGRP Awardee Meeting. Alexandria, VA. | September 7th, 2022. |
| 11. VIB-UGent Center for Plant Systems Biology. Ghent, Belgium. | June 2nd, 2022. |
| 10. Duke DCMB Seminar. | September 22nd, 2021. |
| 9. NSF PGRP Awardee Meeting. | September 10th, 2020. |
| 8. Bioinformatics and Computational Biology Symposium. Iowa State University. | May 1st, 2020. |
| 7. Centre for Research in Agricultural Genomics. Barcelona, Spain. | May 9th, 2019. |
| 6. Plant Sciences Institute Board Meeting. Ames, IA. | April 5, 2019. |
| 5. Salk Institute for Biological Studies. San Diego, CA. | July 31st, 2018. |
| 4. Duke University. Durham, NC. | July 26th, 2018. |
| 3. University of California San Diego. San Diego, CA. | March 13th, 2018. |
| 2. GDCB Brown Bag Seminar Series. Ames, IA. | November 11th, 2015. |
| 1. Crop Bioengineering Consortium Summer 2015 Meeting. Ames, IA. | June 17-18, 2015. |

CONTRIBUTED TALKS

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| 16. Plant Molecular Biology Retreat. Wrightsville, NC. | October 16th, 2022. |
| 15. Spatial and Temporal Dynamics in Plant Biology. Holderness, NH. | June 12 - 17, 2022. |

14. GRC: Mechanisms of Abiotic Stress Resilience and Applications for Agriculture. Les Diablerets, Switzerland. May 22 - 27, 2022.
13. Unraveling Plant Stress Responses Using Multidisciplinary Approaches. Les Diablerets, Switzerland. May 21-22, 2022.
12. CSHL Plant genomes, systems biology and engineering. December 1-4, 2021.
11. HHMI Cell and Developmental Biology meeting. September 29th, 2021.
10. Plant Genomes in a Changing Environment. Virtual Conference. October 12-14, 2020.
9. Plant Genomes in a Changing Environment. Virtual Conference. October 12-14, 2020.
8. Climate Change-Linked Stress Tolerance in Plants. Hannover, Germany. May 13-16, 2019.
7. 3rd International Conference on Brassinosteroid Research. San Diego, CA. August 1-4, 2018.
6. Plant Biology 2018. Montreal, Quebec, Canada. July 14-18, 2018.
5. Workshop on Plant Development and Drought Stress. Pacific Grove, CA. November 5-8, 2017.
4. International Conference on Arabidopsis Research. St. Louis, MO. June 19-23, 2017.
3. Post-transcriptional Gene Regulation in Plants Meeting. Austin, TX. July 14-15, 2016.
2. Plant Biology 2016. Austin, TX. July 9-13, 2016.
1. International Conference on Arabidopsis Research. Paris, France. July 5-9, 2015.

POSTER PRESENTATIONS

11. GRC Single-Cell Approaches in Plant Biology. Ventura, CA. July 30th, 2023.
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
<i>Comparative Plant Transcriptomics</i>	<i>North Carolina State University</i>
Teaching Assistant	Spring 2018
<i>Genetics Laboratory (Genetics 313L)</i>	<i>Iowa State University</i>
Guest Lecturer	Fall 2016
<i>Molecular Genetics (Genetics 409)</i>	<i>Iowa State University</i>

Guest Lecturer
Transmission Genetics (Genetics 510)

Spring 2016
Iowa State University

Tutor
Principles of Genetics (Genetics 313)

Fall 2012
Iowa State University

Undergraduate Teaching Assistant
Principles of Genetics (Genetics 313 and 313L)

Fall 2011
Iowa State University

MENTORING

Postdocs

Pablo Szekely 2021-Ongoing

Graduate Students

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

Undergraduate Students

Neyla Kirby 2023-Ongoing
Shanshan Gao 2023-Ongoing
Obale Obale 2023
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 <i>Duke University</i>	2020-2023
Plant Cell Atlas - Best Presentation <i>First PCA Symposium</i>	2021
Zaffarano Prize for Graduate Student Research <i>Iowa State University</i>	2019
Karas Award for an Outstanding Dissertation <i>Iowa State University</i>	2019
Genetics, Development and Cell Biology Award <i>Iowa State University</i>	2019
Genetics and Genomics Research Excellence Award <i>Iowa State University</i>	2018
Biochemical Journal Poster Award - 1st Place <i>3rd International Conference on Brassinosteroid Research, San Diego, CA</i>	2018
Best Poster Presentation by a Graduate Student <i>Loomis and Crop Bioengineering Consortium Meeting, Ames, IA</i>	2018
Brown Graduate Fellow <i>Iowa State University</i>	2016-2017
Plant Sciences Institute Fellow <i>Iowa State University</i>	2013-2017
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 <i>Post-transcriptional Gene Regulation in Plants Meeting, Austin, TX</i>	2016
Best Poster Presentation by an Undergraduate Student <i>ASPB Midwest Meeting, Chicago, IL</i>	2013
Research in Genetics Summer Undergraduate Internship <i>Sui Tong Chan Fung Fund for the Promotion of Study, Iowa State University</i>	2012

GRANTS

Reconstructing spatial-temporal responses to drought in Arabidopsis and rice using time series single-cell transcriptomics <i>PI: Trevor M. Nolan</i>	2020-2023
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
<i>Gordon Research Seminar - Plant Salt and Water Stress</i>	
Plant Cell Atlas Committee Member	2023
<i>Single-cell sequencing</i>	
<i>Spatial Omics</i>	
<i>Plant Cell types and States</i>	
Biodiversity Cell Atlas	2023
<i>Taxonomic focus working group</i>	
Session Chair	2022
<i>Plant Molecular Biology Retreat</i>	
Discussion Leader	2022
<i>Molecular Mechanisms Underlying Stress Tolerance - GRS Salt and Water stress</i>	
Discussion Leader	2022
<i>Elucidating Abiotic Stress Survival Mechanisms - GRS Plant Molecular Biology</i>	
Sigma Xi Scientific Research Society	2019
Graduate Student Representative	2017
<i>Genetics, Development and Cell Biology Faculty Search Committee</i>	
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

Eugenia.Russinova@psb.vib-ugent.be

Dr. Justin Walley, Assistant Professor

Iowa State University

jwalley@iastate.edu