

# TREVOR M. NOLAN

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## EDUCATION

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### 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

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### 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

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28. **Nolan, T.M.\***, N. Vukasinovic\*, C.W. Hsu\*, J. Zhang, I. Vanhoutte, R. Shahan, I. Taylor, L. Greenstreet, M. Heitz, P. Wang, P. Szekeley, A. Brosnan, Y. Yin, G. Schiebinger, U. Ohler, E. Russinova and P.N. Benfey. (2022). Brassinosteroid gene regulatory networks at cellular resolution. *bioRxiv*. <https://doi.org/10.1101/2022.09.16.508001>

- \* co-first authors

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://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/10.1007/978-1-4939-6813-8\\_7](https://doi.org/10.1007/978-1-4939-6813-8_7)
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>

## TALKS

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| 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

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| 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

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<b>Guest Lecturer</b>	Fall 2022
<i>Comparative Plant Transcriptomics</i>	<i>North Carolina State University</i>
<b>Teaching Assistant</b>	Spring 2018
<i>Genetics Laboratory (Genetics 313L)</i>	<i>Iowa State University</i>
<b>Guest Lecturer</b>	Fall 2016
<i>Molecular Genetics (Genetics 409)</i>	<i>Iowa State University</i>
<b>Guest Lecturer</b>	Spring 2016
<i>Transmission Genetics (Genetics 510)</i>	<i>Iowa State University</i>
<b>Tutor</b>	Fall 2012
<i>Principles of Genetics (Genetics 313)</i>	<i>Iowa State University</i>
<b>Undergraduate Teaching Assistant</b>	Fall 2011
<i>Principles of Genetics (Genetics 313 and 313L)</i>	<i>Iowa State University</i>

## MENTORING

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### Graduate Students

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

### Undergraduate Students

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 Research Experience for Teachers Program

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

## AWARDS AND FELLOWSHIPS

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<b>NSF National Plant Genome Initiative Postdoctoral Research Fellow</b> <i>Duke University</i>	2020-2023
<b>Plant Cell Atlas - Best Presentation</b> <i>First PCA Symposium</i>	2021
<b>Zaffarano Prize for Graduate Student Research</b> <i>Iowa State University</i>	2019
<b>Karas Award for an Outstanding Dissertation</b> <i>Iowa State University</i>	2019
<b>Genetics, Development and Cell Biology Award</b> <i>Iowa State University</i>	2019
<b>Genetics and Genomics Research Excellence Award</b> <i>Iowa State University</i>	2018
<b>Biochemical Journal Poster Award - 1st Place</b> <i>3rd International Conference on Brassinosteroid Research, San Diego, CA</i>	2018
<b>Best Poster Presentation by a Graduate Student</b> <i>Loomis and Crop Bioengineering Consortium Meeting, Ames, IA</i>	2018
<b>Brown Graduate Fellow</b> <i>Iowa State University</i>	2016-2017
<b>Plant Sciences Institute Fellow</b> <i>Iowa State University</i>	2013-2017
<b>Travel Awards</b>	
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 Workshop on Plant Development and Drought Resistance	2018
Iowa State University W.E. Loomis award for travel to Plant Biology Workshop on Plant Development and Drought Resistance	2017
Iowa State University W.E. Loomis award for travel to Plant Biology Workshop on Plant Development and Drought Resistance	2017
Iowa State University W.E. Loomis award for travel to Plant Biology Workshop on Plant Development and Drought Resistance	2016
Iowa State University GDCB travel award to the ICAR	2015
<b>Best Oral Presentation by a Graduate Student</b> <i>Post-transcriptional Gene Regulation in Plants Meeting, Austin, TX</i>	2016

<b>Best Poster Presentation by an Undergraduate Student</b> <i>ASPB Midwest Meeting, Chicago, IL</i>	2013
<b>Research in Genetics Summer Undergraduate Internship</b> <i>Sui Tong Chan Fung Fund for the Promotion of Study, Iowa State University</i>	2012

## GRANTS

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<b>Reconstructing spatial-temporal responses to drought in Arabidopsis and rice using time series single-cell transcriptomics</b> <i>PI: Trevor M. Nolan</i> NSF National Plant Genome Initiative Postdoctoral Research Fellowship in Biology	2020-2023
<b>Network-Based Discovery of Brassinosteroid Regulation of Plant Growth and Stress Responses in Arabidopsis</b> <i>PI: Yanhai Yin Co-PI: Justin Walley</i> Role: Led the development and writing of this funded proposal from the NSF Division of Molecular and Cellular Biosciences Cellular Dynamics and Function cluster.	2018-2021
<b>Crosstalk between Brassinosteroid and autophagy pathways in the regulation of plant growth and stress responses</b> <i>PI: Yanhai Yin Co-PIs: Diane Bassham and Justin Walley</i> Role: Generated preliminary data, participated in writing and designed experimental approach for this funded NIH R01 proposal.	2017-2020

## PROFESSIONAL ACTIVITIES

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<b>Conference Organizer</b> <i>Gordon Research Seminar - Plant Salt and Water Stress</i>	2024
<b>Session Chair</b> <i>Plant Molecular Biology Retreat</i>	2022
<b>Discussion Leader</b> <i>Molecular Mechanisms Underlying Stress Tolerance - GRS Salt and Water stress</i>	2022
<b>Discussion Leader</b> <i>Elucidating Abiotic Stress Survival Mechanisms - GRS Plant Molecular Biology</i>	2022
<b>Sigma Xi Scientific Research Society</b>	2019
<b>Graduate Student Representative</b> <i>Genetics, Development and Cell Biology Faculty Search Committee</i>	2017
<b>Iowa State University Crop Bioengineering Center Member</b>	2014-2019
<b>American Society of Plant Biologists Member</b>	2012-Present
<b>Grant Reviews</b>	
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*

2016-2022



## REFERENCES

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**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**

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**Dr. Justin Walley, Assistant Professor**

*Iowa State University*

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