

## Mingyuan ZHU, Ph.D.

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## Education

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### Ph.D. Plant Biology

May 2020  
Cornell University  
Dissertation: Timing is crucial for plant organ morphogenesis

### B.S. Life Sciences

May 2013  
Tsinghua University

## Research experience

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### Postdoc associate

March 2023 - present

Dr. Philip BENFEY's laboratory, Duke University, Durham, NC, USA

Supported by HHMI. Characterizing biomechanical and molecular mechanisms controlling rice root tip helical movement. Comparing the single-cell transcriptomes of gel-grown and soil-grown rice seedlings in different natural cultivars. Generating transgenic rice resources.

Featured techniques: Single-cell RNA sequencing, Spatial transcriptomics, CRISPR-based gene editing on crops, Optimized crop transformation.

### Postdoc associate

August 2020 – March 2023

Dr. Philip BENFEY's laboratory, Duke University, Durham, NC, USA

Supported by NSF and Duke University. Identified the markers of various rice root cell types and regulators of rice root cells differentiation. Compared the single-cell transcriptomes of gel-grown and soil-grown rice seedling in one rice upland cultivar, Kitaake.

Featured techniques: Single-cell RNA sequencing, Spatial transcriptomics

### Research Assistant (PhD Candidate)

April 2014 – May 2020

Dr. Adrienne ROEDER's laboratory, Cornell University, Ithaca, NY, USA

Studied mechanisms controlling organ size robustness with *Arabidopsis* sepals as the model system. Investigated the function of a little-studied *Arabidopsis* gene *DRMY1* in regulating sepal initiation pattern and protein metabolism.

Established the live imaging protocol for *Arabidopsis* fruit development and analyzed the post-fertilization fruit growth pattern.

Featured techniques: Time-lapse confocal imaging, Morpho-dynamic analysis of plant cellular growth, Molecular genetics, RNA-seq, ChIP-seq, Western blotting.

**Research Assistant (Short-term visiting collaborator)** February 2018 - April 2018  
Dr. Arezki BOUDAUD's laboratory, ENS de Lyon, Lyon, Auvergne-Rhône-Alpes, France

Quantified the cell wall stiffness of *Arabidopsis* sepals with Atomic Force Microscopy. Used Immunofluorescence to track auxin transporter protein distribution.

*Featured techniques:* Protein immunolocalization and Atomic force microscopy.

**Research Assistant (Undergraduate)** November 2009 - May 2013  
Dr. Dong LIU's Laboratory, Tsinghua University, Beijing, China

Identified mutated genes within *Arabidopsis* mutants hypersensitive to phosphate starvation. Studied how PP2C proteins regulate low phosphate responses.

*Featured techniques:* Prokaryotic expression and purification of protein, Enzyme activity assay.

**Research Assistant (Summer Intern)** June 2012 - August 2012  
Dr. Laura OLSEN's Laboratory, The University of Michigan, Ann Arbor, MI, USA

Confirmed that citrate synthases can be imported into peroxisomes of pumpkins with Western blotting. Verified the effect of certain amino acids in the protein importing process by guided mutagenesis

*Featured techniques:* In vitro transcription, In vitro translation, Genetic engineering.

## Publications

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**Zhu, M.\***, Hsu, C-W.\*, Lucas, O. P., Taylor, I. W., Mijar, M., Nolan, T. M., Sadanandom, A., Bennett, M. J., Benfey, P. N., Pandey, B. K. (2024). Single-cell transcriptomics reveal how root tissues adapt to soil stress. *Under revision after review for Nature*.

Kong, S. \*, **Zhu, M.\***, Scarpin, M.R., Pan, D., Jia, L., Martinez, R.E., Alamos, S., Vadde, B.V., Garcia, H.G., Qian, SB., Brunkard, J.O. Roeder, A. H. (2024). DRMY1 promotes robust morphogenesis by sustaining translation of a hormone signaling protein. *Developmental Cell*, In press.

Kong, S., **Zhu, M.**, Pan, D., Lane, B., Smith, R. S., & Roeder, A. H. (2024). Tradeoff Between Speed and Robustness in Primordium Initiation Mediated by Auxin-CUC1 Interaction. *Nature communication*, 15(1), 5911.

Kong, S., **Zhu, M.**, and Roeder, A. H. (2024). Self-organization underlies developmental robustness in plants. *Cells & Development* 203936. *Invited review*

**Zhu, M.**, & Benfey, P. N. (2023). Plant physiology: The to-and-fro of hormone signals to respond to drought. *Current Biology*, 33(3), R114-R117.

**Zhu, M.\***, Taylor, I. W.\*, & Benfey, P. N (2022). Single-cell genomics revolutionizes plant development studies across scales. *Development*, 149(6), dev200179. *Invited review*

Rajanala, A., **Zhu, M.**, Taylor, I.W., Pierce, C. J., Hales, M., Benfey, P.N., & Goldman, D.I. (2022). Modeling plant root circumnutation using cellular simulation. *Bulletin of the*

*American Physical Society*. (2024), Y03. 013

Shao, Y., Lehner, K. R., Zhou, H., Taylor, I., **Zhu, M.**, Mao, C. ^, & Benfey, P. N. (2021). VAP-RELATED SUPPRESSORS OF TOO MANY MOUTHS (VST) family proteins are regulators of root system architecture. *Plant Physiology*, 185(2), 457-468.

**Zhu, M.**, Chen, W., Mirabet, V., Hong, L., Bovio, S., Strauss, S., Schwarz, E., Tsugawa, S., Wang, Z., Smith, R.S., Li, C.-L., Hamant, O., Boudaoud, A.^, and Roeder, A.H.K. (2020) Robust organ size requires robust timing of initiation orchestrated by focused auxin and cytokinin signaling. *Nature Plants*, 6(6), 686-698.

Ripoll, J. J\*., **Zhu, M\***., Brocke, S., Hon, C. T., Yanofsky, M. F., Boudaoud, A., & Roeder, A. H. (2019). Growth dynamics of the Arabidopsis fruit is mediated by cell expansion. *Proceedings of the National Academy of Sciences*, 116(50), 25333-25342.

**Zhu, M.**, & Roeder, A. H. (2020). Plants are better engineers: the complexity of plant organ morphogenesis. *Current Opinion in Genetics & Development*, 63, 16-23. *Invited review*

Hong, L., Dumond, M., **Zhu, M.**, Tsugawa, S., Li, C.B., Boudaoud, A., Hamant, O. and Roeder, A.H., (2018). Heterogeneity and robustness in plant morphogenesis: from cells to organs. *Annual Review of Plant Biology*, 69, pp.469-495. *Invited review*

Hong, L.\*., Dumond, M.\*., Tsugawa, S.\*., Sapala, A, Routier-Kierzkowska, A.-L., Zhou, Y., Chen C., Kiss, A., **Zhu, M.**, Hamant, O., Smith, R.S., Komatsuzaki, T., Li, C.-L., Boudaoud, A, and Roeder, A.H.K. (2016) Variable cell growth yields reproducible organ development through spatiotemporal averaging. *Developmental Cell*, 38(1), 15-32.

(\*: co-first authors)

## Presentations

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### *Oral Presentations*

9<sup>th</sup> International Plant Biomechanics Conference

Quebec, Canada, August 2018

“A MYB domain protein controls organ size uniformity through affecting cell wall stiffness in *Arabidopsis*”

Mechanisms of Plant Development, FASEB

New York, USA, August 2019

“Timing of organ initiation by hormone signaling is critical for robust organ size”

Mechanisms of Plant Development, FASEB

Vermont USA, July 2022

“Integrating single-cell and spatial transcriptomics to understand rice root development”

Cold Spring Harbor Laboratory Meeting - Plant Genomes, Systems Biology & Engineering

New York USA, November 2023

“Integrating single-cell and spatial transcriptomics to study rice root responses to soil compaction”

Plant & Animal Genome Conference 2024 (Invited speaker)  
California USA, January 2024  
“Exploring genetic adaptation and single-cell-level responses to soil compaction in wheat and rice”

The 34th International Conference on Arabidopsis Research (ICAR 2024)  
California USA, July 2024  
“Single cell and spatial transcriptomics reveal how rice root tissues adapt to soil stress”

3rd Plant Cell Atlas (PCA) Symposium (Invited speaker)  
Michigan USA, August 2024  
“Single cell and spatial transcriptomics reveal how rice root tissues adapt to soil compaction”

2024 Weill Institute Summer Retreat (Invited speaker)  
New York USA, August 2024  
“Single cell and spatial transcriptomics reveal how rice root tissues adapt to soil compaction”

### ***Poster Presentations***

Mechanisms of Plant Development, FASEB  
Vermont USA, August 2015  
“A SANT domain protein controls organ size uniformity in Arabidopsis”

The 27th International Conference on Arabidopsis Research (ICAR 2016)  
Gyeongju South Korea, July 2016  
“A MYB domain protein controls organ size uniformity in Arabidopsis”

Mechanisms of Plant Development FASEB  
Vermont USA, August 2017  
“A MYB domain protein controls organ size uniformity in Arabidopsis”

Polyploidy in Organ Development, Repair, and Disease  
Maine USA, October 2018  
“Seed derived signals regulate Arabidopsis valve development through affecting ploidy level”

Mechanisms of Plant Development, FASEB  
New York USA, August 2019  
“Transcriptomics analysis toward identification of the mechanism through which VOS2 promotes robust sepal size in Arabidopsis”

Advances in Genome Biology and Technology (AGBT) Agricultural  
California USA, April 2022  
“Integrating single-cell and spatial transcriptomics to understand rice root development”

Gordon Research Conferences-Single-Cell Approaches in Plant Biology  
California USA, August 2023  
“Integrating single-cell and spatial transcriptomics to understand rice root responses to soil compaction”

American Society of Plant Biologists, Plant Biology 2024  
Hawaii USA, June 2024  
“Single-cell transcriptomics reveal how root tissues adapt to soil stress”

## Teaching Experience

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### *Teaching Assistantship*

30450203 Biochemistry  
Spring 2013 Tsinghua University

BIOPL 3431 Laboratory in Molecular Biology and Genetic Engineering of Plants  
Spring 2015 Cornell University

### *Mentorship*

Zhou WANG, NSF REU Summer Intern	2015
Stephanie BROCKE, NSF REU Summer Intern	2017
Haarika SRINATH, Cornell Undergraduate	2016 - 2018
Weiwei CHEN, Exchange graduate student on fellowship	2018 - 2019
Medhavinee MIJAR, Duke research associate	2022 - present
Runlong DONG, Duke graduate student	2023
Mao KOBAYASHI, Duke undergraduate	2023 - present

## Honors and Awards

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<b>Member of Tsinghua Xuetao Life Science Program (Part of National Talent Training program for Basic Science)</b> Selected and awarded by Tsinghua University	2011 – 2013
<b>The National Scholarship for Comprehensive Performance</b> Awarded by School of Life Sciences, Tsinghua University, Tsinghua University	2011
<b>The National Scholarship for Comprehensive Performance</b> Awarded by School of Life Sciences, Tsinghua University, Tsinghua University	2012
<b>Graduated with Honor</b> Awarded by Tsinghua University	2013

**Research Travel Grant**

Awarded by Graduate School, Cornell University 2018

**Schmittau-Novak Small Grant**

Awarded by School of Integrative Plant Science, Cornell University 2018

**Honorable Mention for Best Student Oral Presentation at Plant Biomechanics 2018**

Awarded by PBM2018 organizing committee 2018

**Barbara McClintock Award**

Awarded by School of Integrative Plant Science, Cornell University 2019

**AFM Travel Grant for the Plant Biology Faculty for 2019**

Awarded by F1000 publisher 2019

**ASPB Travel Grant**

Awarded by ASPB Equity, Diversity and Inclusion Committee 2024

## Services

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- Primary reviewer: Nature Plants, Plant Cell, Plant Physiology, Plant Journal, Cell Reports, Development, Horticulture, BMC Biology, STAR Protocols, Plants People Planet, Plos Computational Biology, iScience, Frontiers in Plant Science, Physiologia Plantarum, Journal of Experimental Botany, Planta, Frontiers in Plant Physiology  
(Independent review times in total: 27)
- Elected North American Early Career Scholar - North American Arabidopsis Steering Committee  
November 2023 - Present  
Major Duties:  
Serve as a member of the Diversity, Equity, Inclusion, and Belonging Award committee.  
Organize the “Exploring Career Opportunities in Academia & Industry Panel” workshop at ICAR 2024.  
Co-chair the “Sustainable Crops/Food/Bioproducts, Improving Photosynthesis” plenary session at ICAR 2024.
- Member, Plant Cell Rubrics Committee - Plant Cell Atlas (PCA)  
August 2023 - Present  
Major Duties:  
Participate in network meetings and regular discussions.  
Organize and nominate speakers for an online webinar series “What are plant cell states?”.

- Leading Founder - Plant Method Exchange Platform (PMEX)  
Supported by NAASC and Officially launched: July 2024 at ICAR 2024  
Major Duties:  
Recruit founding members.  
Write protocol templates.  
Advertise and promote the platform.  
Official website: <https://plant-methods.owlstown.net/>
- Member, Local Organizing Committee - New Phytologist, Next Generation Scientists Conference  
August 2023 - June 2024  
Major Duties:  
Review and select conference speakers.  
Organize two breakout sessions: “Career transitions for PhD/Postdoc: Environment, PhysDev, and Biotech”.  
Co-Chair the plenary session: “Session 6”.
- Member, Editorial Board - Plant Morphogenesis and Evolution Section, Frontiers in Plant Physiology  
June 2023 - Present  
Major Duties:  
Topic Editor for the special issue: “Advances in Computational Biology: Bridging Omics Studies and Development in Plants.”  
Reviewer for paper submissions.
- Member, F1000Prime (now H1Connect Faculty Opinions)  
June 2018 – December 2020  
Major Duties:  
Write more than 15 recommendations for published manuscripts.

## Public Outreach

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### FEMMES<sup>+</sup> Capstone activity leader

April 2024

Designed and led a one-day outreach program introducing students from Durham (4<sup>th</sup> through 6<sup>th</sup> grade) to plant biology concepts and techniques.

Collaborated with Duke staff members and Duke undergraduates to engage 19 local elementary school students (18 of whom were female) in the learning experience, giving them hands-on experience with dissecting microscopes and confocal microscopes.