MEREDITH HANLON

Molly Hanlon

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Postdoctoral Scholar and Project Manager

Research interests and skills

I am an experienced root biologist with expertise in plant mineral nutrition, plant-soil relations, and plant growth under stress. I have worked and managed interdisciplinary teams of engineers, computational scientists, image analysts, and biologists to try to build tools to allow us to effectively phenotype roots and identify genes that underlie beneficial root traits. My skills include phenotyping, image analysis, field trial design and implementation, coding in R, and plant physiology.

Experience

Postdoctoral Scholar *University Park, PA, USA*

Department of Plant Science, Penn State University *2018 - present*

- Adviser: Dr. Jonathan P. Lynch
- Research: LEADER - Leaf Elemental Analysis for Deeper Roots - a non-invasive method for phenotyping root depth in the field
- Project: DEEPER - An integrated phenotyping platform for deeper roots. I handle agency (ARPA-E) reporting, as well as managing the project and progress of nine research groups at four different institutions in departments, including computation science, engineering, plant breeding, and plant science.

Education

Ph.D., Plant Biology *University Park, PA, USA*

Huck Institutue of Life Sciences, Penn State University *2017*

- Dissertation: New perspectives on conventional ideas about root system architecture and morphology
- Adviser: Dr. Kathleen M. Brown

B.S., Biochemistry *Meadville, PA, USA*

Allegheny College *2009*

- Thesis: Roles for auxin and peroxidases in the formation of the arbuscular mycorrhizal symbiosis between Glomus intraradices and tomato
- Adviser: Dr. Catharina Coenen

Awards

Penn State University 'Postdoc of the year'

Penn State Postdoc Society *2019*

Graduate Research Fellowship (GRFP)

National Science Foundation *2011-2014*

Graduate Opportunities Worldwide Fellowship

National Science Foundation and the Swedish Research Council *2014-2015*

Travelling Fellowship

Company of Biologists *2012*

University Graduate Fellowship

Penn State University *2011*

NASA Space Grant

PA Space Grant Consortium *2012-2014*

ARCS Scholarship
ARCS Foundation *2010-2013*

Harold M. State Research Fellowship
Allegheny College *2008*

Publications

Schneider, H. M., Klein, S. P., **Hanlon**, M. T., Kaeppler, S., Brown, K. M., & Lynch, J. P. (2020). Genetic control of root anatomical plasticity in maize. *The Plant Genome*, *13*(1). https://doi.org/10.1002/tpg2.20003

Schneider, H. M., Klein, S. P., **Hanlon**, M. T., Nord, E. A., Kaeppler, S., Brown, K. M., Warry, A., Bhosale, R., & Lynch, J. P. (2020). Genetic control of root architectural plasticity in maize. *Journal of Experimental Botany*, *71*(10), 3185–3197. https://doi.org/10.1093/jxb/eraa084

Bhosale, R., Giri, J., Pandey, B. K., Giehl, R. F. H., Hartmann, A., Traini, R., Truskina, J., Leftley, N., **Hanlon**, M., Swarup, K., Rashed, A., Voß, U., Alonso, J., Stepanova, A., Yun, J., Ljung, K., Brown, K. M., Lynch, J. P., Dolan, L., … Swarup, R. (2018). A mechanistic framework for auxin dependent arabidopsis root hair elongation to low external phosphate. *Nature Communications*, *9*(1). https://doi.org/10.1038/s41467-018-03851-3

Hanlon, M. T., Ray, S., Saengwilai, P., Luthe, D., Lynch, J. P., & Brown, K. M. (2018). Buffered delivery of phosphate to arabidopsis alters responses to low phosphate. *Journal of Experimental Botany*, *69*(5), 1207–1219. https://doi.org/10.1093/jxb/erx454

Burton, A. L., Johnson, J., Foerster, J., **Hanlon**, M. T., Kaeppler, S. M., Lynch, J. P., & Brown, K. M. (2014). QTL mapping and phenotypic variation of root anatomical traits in maize (Zea mays l.). *Theoretical and Applied Genetics*, *128*(1), 93–106. https://doi.org/10.1007/s00122-014-2414-8

Burton, A. L., Johnson, J. M., Foerster, J. M., Hirsch, C. N., Buell, C. R., **Hanlon**, M. T., Kaeppler, S. M., Brown, K. M., & Lynch, J. P. (2014). QTL mapping and phenotypic variation for root architectural traits in maize (Zea mays l.). *Theoretical and Applied Genetics*, *127*(11), 2293–2311. https://doi.org/10.1007/s00122-014-2353-4

Hanlon, M. T., & Coenen, C. (2010). Genetic evidence for auxin involvement in arbuscular mycorrhiza initiation. *New Phytologist*, *189*(3), 701–709. https://doi.org/10.1111/j.1469-8137.2010.03567.x

Shi, X., Choi, D., Heinemann, P. H., **Hanlon**, M., & Lynch, J. (2019). *RootRobot: A field-based platform for maize root system architecture phenotyping*. https://doi.org/10.13031/aim.201900806

Manuscripts Under Review

Liu, S., Barrow, C. S., **Hanlon**, M., Lynch, J. P., & Bucksch, A. (2020). *DIRT/3D: 3D phenotyping for maize (zea mays) root architecture in the field*. https://doi.org/10.1101/2020.06.30.180059

Schneider, H. M., Strock, C. F., **Hanlon**, M. T., Vanhees, D. J., Perkins, A. C., Ajmera, I. B., Mooney, S. J., Brown, K. M., & Lynch, J. P. (2020). *Small lignified cortical cells improve root penetration of hard soils*.

Manuscripts In Preparation

Hanlon, M. T., & Lynch, J. P. (2021). *LEADER: A new tool for estimating root depth in the field*.

Hanlon, M. T., Vejchasarn, P., McCouch, S. R., & Brown, K. M. (2020). *Genetic control of root hair growth in rice reveals grass-specific pathways*.

Reeger, J. E., Vejchasarn, P., **Hanlon**, M. T., Wheatley, M., Yang, Y., McCouch, S. R., & Brown, K. M. (2020). *Genomic regions and candidate genes affect root anatomical traits in diverse rice accessions,*

Oral Presentations

Predicting crop root depth for improved nutrient and water acquisition and carbon sequestration using handheld xrf. (2019, August). Denvery x-ray conference, Lombard, IL, USA.

Correlating root depth with leaf elemental accumulation to study improved soil structure and fertilizer use efficiency, water productivity and crop yield. (2018, November). CSSA tri-society meeting, Baltimore, MD, USA.

Using x-ray fluorescence technology to estimate root depth without coring or digging. (2018, February). Phenome, Tucson, AZ, USA.

Using a root phene-based approach to feed and fuel the world. (2016, November). Juniata college biology department seminar series, Huntingdon, PA, USA.

Do real plants do that? Creating a realistic system to study phosphorus deficiency in arabidopsis. (2016, April). **Marsho award for best oral presentation by a graduate student or post-doc**. Mid-atlantic meeting of the american society of plant biologists, Swarthmore, PA, USA.

Harnessing diversity to feed the world: Using genome wide association studies to improve the rice root system. (2015, September). Allegheny college biology department seminar series, Meadville, PA, USA.

Poster Presentations

Buffered delivery of phosphorus drastically affects arabidopsis growth responses to low phosphorus. (2016, July). **Outstanding poster award**. International workshop on plant membrane biology, Annapolis, MD, USA.

Buffered delivery of phosphorus drastically affects arabidopsis growth responses to low phosphorus. (2016, July). American society of plant biology meeting, Austin, TX, USA.

Genome wide association studies of rice root hairs. (2016, July). American society of plant biology meeting, Minneapolis, MN, USA.

Genome wide association studies of rice root hairs. (2016, May). Penn state plant biology symposium, University Park, PA, USA.

Buffered delivery of phosphorus drastically alters the phenotype and gene expression in arabidopsis roots. (2014, July). American society of plant biology meeting, Portland, OR, USA.

Elucidating control of lateral root plagiogravitropism in arabidopsis. (2013, July). American society of plant biology meeting, Providence, RI, USA.

Elucidating control of lateral root plagiogravitropism in arabidopsis. (2013, May). Interdisciplinary plant group symposium: Root biology, Columbia, MO, USA.

A role for auxin in the arbuscular mycorrhizal symbiosis. (2009, May). Penn state plant biology symposium, University Park, PA, USA.

A role for auxin in the arbuscular mycorrhizal symbiosis. (2009, April). Sigma xi conference for undergraduate research, Erie, PA, USA.

Teaching Experience

AgEco 134: Sustainable Agriculture, Science, and Policy
Teaching assistant *2015*

Horticulture 402W: Plant Nutrition
Teaching assistant and guest lecturer *2012-2014*

Plant Biology 514: Plant Ecophysiology
Teaching assistant *2012*

Biology 580: Plant Microbe Interactions
Teaching assistant (Allegheny College) *2007-2008*

Biology 360: Plant Physiology
Teaching assistant (Allegheny College) *2008*

Chemistry 110: Introduction to Chemistry
Teaching assistant (Allegheny College) *2006*

Other Preparation

Visiting Scholar

Umea Plant Science Centre *2014-2015*

- Project: The auxin metabolome of lateral roots
- Superviser: Prof. Karin Ljung
- Funding: NSF Grow Fellowship

Visiting Scholar

The Centre for Plant Integrative Biology, the University of Nottingham *2012*

- Project: Lateral root growth and the development of auxin gradients during growth
- Superviser: Prof. Malcolm Bennett
- Funding: Travelling Fellowship, the Company of Biologists

Research Technician

The Center for Lignocellulose Structure and Formation *2009-2010*

- Project: Binding partners of the cellulose-synthase complex of *Acetobacter xylinus*.
- Superviser: Dr. Tei-Hui Kao.

Service

- Center for Root and Rhizosphere Biology (CRRB) Journal Club coordinator: 2020 - present
- Steering Committee, Plantae - the online hub for plant science: 2016-2017
- Organizer of "Nonacademic careers in plant biology" workshop at the American Society of Plant Biology meeting: 2015
- Organizer of monthly State College Farmer's Market educational outreach program: 2016
- Student organizer, Penn State plant biology symposium: 2015
- Plant Biology Program Student Representative: 2012-2016
- Huck Institute Graduate Student Advisory Committee: 2015-2016
- Faculty search committees (geneticist and physiologist, Allegheny College): 2009
- Mentoring: multiple undergraduate students, both at Allegheny College and Penn State: NA
- Planting Science mentor and liason: 2012-2017
- ASPB Easter Egg roll outreach: 2015-2016
- Girl Scout workshops and Penn State Science Day events: 2010-2012
- "This is what a scientist looks like" presentation to middle and high school students: 2010-2017
- "The past, present, and future of genetic modifications" presentation to High School students: 2016
- ARCS Scholar Event, "What's up with roots?" Pittsburgh, PA, Community poster presentation: 2013
- Penn State Graduate School Donor outreach, "Roots, the hidden half," Pittsburgh, PA Community Poster presentation: 2012
- Council for Undergraduate Research Posters on the Hill event, "Mechanisms of Plant-Microbe Interactions." Washington, DC.: 2009

Reviewer

- Scientific Reports, Journal of Experimental Botany, Plant Physiology, Crop and Soil, Plant Methods, Plant and Soil, PLoS ONE, Plants

Professional Society Membership

- American Society of Plant Biologists
- Crop Science Society of America