Richard J. Barker, PhD

Senior Scientist · Plant Systems Biologist · NASA Plant AWG Chair

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SCHOLARLY & EXECUTIVE PROFILE

Plant systems biologist, biophysical instrumentation developer, and computational researcher specializing in photosynthetic boundary-layer transport, primary carbon allocation, organelle stress signaling, and biological digital twins. Over eleven years of research leadership in Botany and Genetics at the University of Wisconsin–Madison (2012–2023), followed by NASA GeneLab/OSDR bioinformatics leadership and current Senior Scientist appointment in Agricultural & Biological Engineering at Purdue University. Science Co-Lead for the NASA Lunar LEAF Science Definition Team; Chair of the NASA GeneLab Plant Analysis Working Group (100+ global scientists). Co-secured **~$2,000,000** in competitive research awards; recipient of the **2018 UW–Madison Undergraduate Mentoring Award**. Author of 34+ peer-reviewed works and creator of >150 open-source repositories and in-browser scientific tools.

PROFESSIONAL APPOINTMENTS

2024 – Pres.
Senior Scientist & Science Co-Lead (NASA Lunar LEAF)
Purdue University, Dept. of Agricultural & Biological Engineering
Lead research on biophysical fluid mechanics of plant/fungal growth interfaces, physics-informed neural network boundary layer modeling, and solid-state nutrient delivery systems (Mycoponics) with Prof. D. Marshall Porterfield.

2018 – Pres.
Chair, Plant Analysis Working Group (AWG)
NASA GeneLab / Open Science Data Repository (OSDR)
Direct an international consortium of 100+ plant and microbial scientists across academia and NASA centers; establish open-science data standards, consensus pipelines, and conference symposia.

2024 – Pres.
Chair, Education & Outreach Committee
American Society for Gravitational and Space Research (ASGSR)
Direct society-wide strategic communications, student programs, and national conference outreach initiatives.

2023 – 2024
Project Scientist
NASA GeneLab / OSDR · Blue Marble Space Institute of Science
Standardized cross-kingdom multi-omics data integration, reproducible pipeline automation, and metadata ontology harmonization under Branch Chief Dr. Sylvain Costes.

2017 – Pres.
Co-Founder & Director of Operations
Collaborative Science Environment (CoSE) Benefit Corp & AstroBotany.com
Engineered open-source phenotyping kits (ABCD card) and citizen science tools deployed across 3,000+ classrooms internationally in partnership with Fairchild Tropical Botanic Garden.

2022 – 2023
Chief Data Scientist
Yuri Gravity (Meckenbeuren, Germany)
Designed telemetry processing and computational hardware interfaces for automated microgravity flight bioreactors.

2014 – 2023 **Scientist (2015–2023) & Postdoctoral Associate (2014–2015)**
University of Wisconsin–Madison, Department of Botany (Birge Hall)
Conducted live biosensor imaging of ROS and calcium dynamics (Gilroy Lab); managed multi-unit lab operations, grant proposal compilation, web administration, and directly mentored 20+ undergraduate researchers (2018 Mentoring Award).

2012 – 2014 **Postdoctoral Research Associate**
University of Wisconsin–Madison, Department of Genetics
Engineered automated seed sowing manifolds, robotic kinematics, and computer vision phenotyping for root gravitropism studies (Masson Lab).

2002 – 2007 **Research Assistant**
John Innes Centre, Norwich, UK (Bevan Laboratory)
Arabidopsis functional genomics, mutant characterization, and greenhouse operations.

EDUCATION

2007 – 2011 **Ph.D. in Plant Science & Hormone Biochemistry**
University of Nottingham & Rothamsted Research, UK
Thesis: Molecular genetics and spatial regulation of gibberellin biosynthesis in the Arabidopsis root tip. Advisor: Prof. Peter Hedden. Awarded the Lawes Trust Agricultural Scholarship.

2003 – 2007 **B.Sc. (Hons) in Plant Science (First Class Honours)**
University of Nottingham, UK
First Class Honours with University Certificate of Merit; Kenneth Whymes Memorial Prize for Distinction in Plant Science (2006).

SPONSORED GRANTS CO-SECURED (TOTAL: ~$2,000,000)

Project Title	Agency / Program	Role	Period	Amount
NASA Lunar LEAF: Lunar Ecosystem & Feasibility	NASA BPS	Science Co-Lead	2024–27	$600,000
NASA TASTIE: Plant Spaceflight Stress Adaptation	NASA BPS	Co-Investigator	2021–24	$750,000
GeneLab Extending Data System Across Kingdoms	NASA Space Biology	Co-Investigator	2018–21	$300,000
TOAST Cross-Kingdom Discovery Portal	NASA Innovation Award	Co-Investigator	2016–19	$250,000
MANGO Multi-Attribute Omics Engine	NASA JPL / Biosci.	Co-Investigator	2018–21	$110,000
AstroBotany Educational Gaming & Phenotyping	WSGC	Principal Investigator	2018–19	$40,000

HONORS & AWARDS

- **Front Cover Article Feature**, *Biotechnology Journal* (Vol. 21, Issue 2, Feb 2026) for Mycoponics.
- **Thora Halstead Young Investigator Award**, American Society for Gravitational & Space Research (2019).
- **UW–Madison Undergraduate Mentoring Award**, College of Letters & Science (2018).
- **WARF / WID StartUp Weekend Winner**, Director of winning "FlashLapse" automated imaging team (2015).
- **BBSRC Biotechnology Business Competition National Finalist (2nd Place)**, Oxford, UK (2010).
- **Best Science Communication Student Award**, Rothamsted Research, UK (2008–2009).
- **Lawes Trust Agricultural Scholarship**, Rothamsted Research & Lawes Agricultural Trust (2007–2011).

SELECTED PEER-REVIEWED PUBLICATIONS

1. Porterfield, D.M., Moulton, S.X., Sanchez, A.K., Sorg, A., Koenig, T., Terrell, M.S., Zahner, S., Baena, A., Proctor, C. & **Barker, R.J.** (2026). Mycoponics: Controlled bioproduction utilizing biophysical, solid-state, liquid nutrient delivery. *Biotechnology Journal*, 21(2), e70184. **(Front Cover Feature)**.
2. Seo, D., Strickland, H.F., Zhou, M., **Barker, R.**, Ferl, R.J., Paul, A.-L. & Gilroy, S. (2025). GLARE: discovering hidden patterns in spaceflight transcriptome using representation learning. *npj Microgravity*, 11, 76.
3. Porterfield, D.M., Tulodziecki, D., Wheeler, R., **Barker, R.J.**, et al. (2025). Critical investments in bioregenerative life support systems for bioastronautics and sustainable lunar exploration. *npj Microgravity*, 11, 57.
4. **Barker, R.**, Kruse, C.P.S., Johnson, C., Reinsch, S.S., Wyatt, S. & Gilroy, S. (2023). Meta-analysis of the space flight and microgravity response of the Arabidopsis plant transcriptome. *npj Microgravity*, 9(1), 21.
5. Camera, A., … **Barker, R.**, et al. (2024). Aging and putative frailty biomarkers are altered by spaceflight. *Scientific Reports*, 14, 13098.
6. Overbey, E.G., Saravia-Butler, A.M., … **Barker, R.J.**, … & Galazka, J.M. (2021). NASA GeneLab RNA-seq consensus pipeline: standardized processing of short-read RNA-seq data. *iScience*, 24(4), 102361.
7. **Barker, R.**, Fernandez Garcia, M.N., Powers, S.J., Vaughan, S., Bennett, M.J., Phillips, A.L., Thomas, S.G. & Hedden, P. (2021). Mapping sites of gibberellin biosynthesis in the Arabidopsis root tip. *New Phytologist*, 229(3), 1521–1534.
8. Afshinnekoo, E., Scott, R.T., MacKay, M.J., … **Barker, R.**, … & Beheshti, A. (2020). Fundamental biological features of spaceflight: advancing the field to enable deep-space exploration. *Cell*, 183(5), 1162–1184.
9. Rutter, L., **Barker, R.**, Bezdan, D., et al. (2020). A new era for space life science: international standards for space omics processing. *Patterns*, 1(9), 100148.
10. **Barker, R.**, Lombardino, J., Rasmussen, K. & Gilroy, S. (2020). Test of Arabidopsis Space Transcriptome (TOAST): a discovery environment to explore multiple plant biology spaceflight experiments. *Frontiers in Plant Science*, 11, 147.
11. Choi, W.-G., **Barker, R.J.**, Kim, S.-H., Swanson, S.J. & Gilroy, S. (2019). Variation in the transcriptome of different ecotypes of Arabidopsis thaliana reveals signatures of oxidative stress in plant responses to spaceflight. *American Journal of Botany*, 106(1), 123–136.
12. Lien, M.R., **Barker, R.J.**, Ye, Z., Westphall, M.H., Gao, R., Singh, A., Gilroy, S. & Townsend, P.A. (2019). A low-cost and open-source platform for automated imaging. *Plant Methods*, 15, 6.
13. **Barker, R.**, Cox, B., Mackie, T.R. & Masson, P. (2013). Vacuum seed sowing manifold: a novel device for high-throughput sowing of Arabidopsis seeds. *Plant Methods*, 9(1), 41.

Full verified bibliography of 34+ peer-reviewed works: ORCID 0000-0001-5681-9857 · Interactive CV: dr-richard-barker.github.io/academic/