GAURAV MOGHE

Associate Professor, Plant Biology Section, Cornell University
Biochemical Genomics and Computational Biology Lab
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APPOINTMENTS

Associate Professor (2025-current), Assistant Professor (2017-2025)
  Plant Biology Section, School of Integrative Plant Sciences, Cornell University
  Field Member, Plant Breeding and Genetics Section & Computational Biology Field, Cornell U.
  Member, Chemistry-Biology Interface Training Program
  Faculty Fellow, Cornell Atkinson Center for Sustainability
Postdoctoral Research Associate (2013-2017)
  Dept. of Biochemistry and Molecular Biology, Michigan State University, USA
Lecturer, Masters in Bioanalytical Sciences (2006-2007)
  Dept. of Bioanalytical Sciences, Ramnarain Ruia College, University of Mumbai, India

EDUCATIONAL BACKGROUND

Doctor of Philosophy, Genetics and Quantitative Biology (2007-2013)
  Dept. of Plant Biology, Michigan State University, USA
Master of Science, Biochemistry (2004-2006)
  Dept. of Biochemistry, The Maharaja Sayajirao University of Baroda, India
Bachelor of Science, Microbiology and Biotechnology (2001-2004)
  Dept. of Microbiology, Ramnarain Ruia College, University of Mumbai, India

AWARDS AND HONORS

- 2023   Arthur J. Neish Young Investigator Award, Phytochemical Society of North America
- 2018   Early Career Award, The American Society of Plant Biologists
- 2017   BMB Postdoctoral Independent Career Potential Award, MSU
- 2016   13th Annual Solanaceae Meeting Travel Award (Speaker)
- 2016   Gordon Research Seminar on Plant Molecular Biology Speaker Travel Award
- 2013   Outstanding Genetics Graduate Student Award, MSU
- 2013   Dissertation Completion and Continuation Fellowships, MSU
- 2009   Research Fellowship, Quantitative Biology Program, MSU
- 2008   Research Fellowship, Gene Expression in Development and Disease, MSU

Awards and Honors for trainees

- 2023   Lars Kruse (postdoc), Phytochemical Society of North America Early Career Award
- 2023   Mac Flanagan (undergraduate student), ASPB SURF fellowship for summer research
- 2022   Elizabeth Mahood (graduate student), American Society of Plant Biologists Travel Award
- 2021   Se Jin Park (undergraduate student), Finalist, Undergraduate Research – Plant Sciences

- 2021 Elizabeth Mahood (graduate student), Best Oral Talk, Botany: Phytochemistry Section
- 2021 Elizabeth Mahood (graduate student), USDA-NIFA Predoctoral Fellowship
- 2019 Elizabeth Mahood (graduate student), NSF GRFP Honorable Mention
- 2018 Lars Kruse (postdoc), German Research Foundation (DFG) Postdoctoral Fellowship

JUMP TO SECTIONS

GRANT SUPPORT

GRANTS RECEIVED

Major awards (reverse chronological)

1. Global Centers: International Research Center for Enhancing Plant Resilience (Co-PI)
Funding source: National Science Foundation Global Centers Program
Co-PIs: Sue Rhee (MSU, Lead PI), Karilyn Sant (MSU), Molly Sears (MSU), Mazhar Sher (SDSU)
Duration: 01/01/2025 – 12/31/2029
Total support received: $5M total, subaward to Cornell $360K

2. AI and Evolution-guided genomic models for improving stress resilience in crops (PI)
Funding source: School of Integrative Plant Science Grand Challenge Graduate Fellowship
Co-PIs: Michael Gore, Edward Buckler
Duration: Summer 2024 – Summer 2026
Total support received: 1 graduate student x 2 years (~$96,000)

3. Collaborative Research: TRTech-PGR: PlantSynBio: FuncZyme: Building a pipeline for rapid prediction and functional validation of plant enzyme activities (PI)
Funding source: NSF-Plant Genome Research Program
Co-PIs: Jocelyn Rose (Cornell), Arjun Khakhar (Colorado State University)
Duration: 06/01/2023 – 05/31/2026
Total support received: ~1.8 M (~$1.2M to Cornell, ~620K to CSU)

4. Investigating the biosynthesis of resin glycosides in sweet potato using natural variation (PI)
Funding source: USDA-NIFA Foundational
Duration: 06/01/2023 – 05/31/2026
Total support received: $647,000

5. Improving feasibility of sweet potato farming in NYS using arbuscular mycorrhizal fungi (PI)
Funding source: USDA Hatch
Duration: 10/01/2022 – 09/20/2025
Total support received: $90,000

6. Evaluation of high-value phytochemical yields from NY grown sweet potatoes and their economic potential (PI)
Funding source: USDA Hatch
Duration: 10/01/2019 – 09/30/2022 (no cost extension till 09/30/2023)
Total support received: $104,299

7. High-throughput annotation of metabolic enzymes in *Brachypodium distachyon* using correlated transcriptomics and metabolomics (PI)
Funding source: Joint Genome Institute Community Science Program
Duration: 12/31/2018 – 12/31/2021
Total support received: Use of JGI metabolomics and transcriptomics facilities for experiments. At Cornell rates, this support is **equivalent to ~$28,000**

Other awards (reverse chronological)

1. Computational plant biology course at Cornell University (PI)
Funding source: NSF-funded The Extreme Science and Engineering Discovery Environment (XSEDE) education grant (now ACCESS)
Duration: Springs of 2019-2024 (annual renewals and supplements)
Total support received: Use of HPC infrastructure, **equivalent to ~$2500.** Cornell equivalent is not available but may range into tens of thousands of dollars for comparable access.

2. Engineering tomato as a biofactory for production of high value terpenoids (PI)
Funding source: Cornell CALS
Co-PI: Jim Giovannoni (BTI)
Duration: 12/01/2023 – 12/01/2024
Total support received: $15,000

3. Cornell – Weill Cornell Intercampus Symposium on "Drug Discovery from Nature's Metabolites" (PI)
Funding source: Cornell Office of Academic Integration
Co-PI: Giulia Friso (Plant Biology), Frank Schroeder (Chemistry), Sijin Li (Chem. Engg), Michelle Loy (Weill Medical), Monica Guzman (Weill Medical), Derek Tan (MSKCC)
Duration: 01/01/2023 – 12/31/2023
Total support received: $35,000

4. The evaluation of form and function: A study of laticifer and latex evolution in the Euphorbiaceae family (PI)
Funding source: Institute of Biotechnology, Cornell University, seed grant
Co-PI: Margaret Frank
Duration: 08/01/2019 - 12/31/2020
Total support received: $7948

Grants secured by trainees

- 2025 Bhaswati Sarmah (grad student), SIPS Schmittau-Novak Small Grant ($10,000)
- 2024 Bhaswati Sarmah (grad student), Cornell Graduate School Research Travel Grant ($1500)
- 2022 Mac Flanagan (undergrad), CALS Undergraduate Research Grant ($1000)
- 2022 Elizabeth Mahood (grad student), ASPB Travel Award
- 2021 Mohammad Irfan (postdoc), Cornell Atkinson Center Postdoctoral Small Grant ($8700)
- 2021 Jiho Lee (undergrad), CALS Undergraduate Research Grant ($1700)
- 2021 Elizabeth Mahood (grad student), USDA Predoctoral Fellowship (~$160,000)
- 2018 Lars Kruse (postdoc), German DFG Postdoctoral Fellowship (~$140,000)

RESEARCH ACCOMPLISHMENTS

PEER-REVIEWED PUBLICATIONS

*Squiggly underlines indicate Moghe Lab members. * Corresponding author*

1. Xinyu Yuan, Nathaniel Smith, **Gaurav Moghe** (2025) Analysis of plant metabolomics data using identification-free approaches. Applications in Plant Sciences. doi: 10.1002/aps3.70001

2. Nathaniel Smith, Xinyu Yuan, Chesney Melissinos, **Gaurav Moghe** (2025) FuncFetch: an LLM-assisted workflow enables mining thousands of enzyme–substrate interactions from published manuscripts. *Bioinformatics* doi: 10.1093/bioinformatics/btae756
   o Web resource: **FuncZymeDB**

3. Lars H. Kruse*, Alexandra Bennett, Vishwajyoti Baruah, Mohammad Irfan, **Gaurav Moghe** (2025) Extraction, annotation, and purification of resin glycosides from the morning glory (Convolvulaceae) family. *Methods in Molecular Biology*
   o **Webtool: RGscout**

4. Hongrui Wang, **Gaurav Moghe**, [13 authors], Jason Londo (2024) NYUS.2: an Automated Machine Learning Prediction Model for the Large-scale Real-time Simulation of Grapevine Freezing Tolerance in North America *Horticulture Research* doi: 10.1093/hr/uhad286
   o **Computer model helps grape growers adapt to shorter winters**

5. Elizabeth Mahood, Alexandra Bennett, Karyn Komatsu, Lars Kruse, Vincent Lau, Maryam Rahmati Ishka, Yulin Jiang, Armando Bravo, Katherine Louie, Benjamin Bowen, Katherine Louie, Maria Harrison, Nicholas Provart, Olena Vatamaniuk, **Gaurav Moghe*** (2023) Information theory and machine learning illuminate large-scale metabolomic responses of *Brachypodium distachyon* to environmental change. *The Plant Journal* doi: 10.1111/tpj.16160
   o **Cover article**
   o **Research highlight: Welcome to the machine: how machine learning identified metabolomic changes in Brachypodium distachyon under stress**

6. **Gaurav Moghe***, Mohammad Irfan, Bhaswati Sarmah (2023) Dangerous sugars: structural diversity and functional significance of acylsugar-like defense compounds in flowering plants. *Current Opinion in Plant Biology* doi: 10.1016/j.pbi.2023.102348

7. Arielle Johnson, Yuanzheng Yue, Sarah Carey, Se Jin Park, Lars Kruse, Ashley Bao, Asher Pasha, Alex Harkess, Nicholas Provart, **Gaurav Moghe***, Margaret Frank* (2023) Chromosome-level genome assembly of *Euphorbia peplus*, a model system for plant latex, reveals that relative lack of Ty3 transposons contributed to its small genome size. *Genome Biology and Evolution* doi: 10.1093/gbe/evad018
   o * Co-corresponding authors

8. Lars Kruse, Jason Chobirko, Ben Fehr, **Gaurav Moghe*** (2023) Phylogenomic analyses across land plants reveals motifs and co-expression patterns useful for functional prediction in the plant BAHD acyltransferase family. *Frontiers in Plant Science* doi: 10.3389/fpls.2023.1067613

9. **Gaurav Moghe**, <u>Lars Kruse</u>, Maike Peterson, Federico Scossa, Alisdair Fernie, Emmanuel Gacquerel, John C. D'Auria* (2023 issue) BAHD Company – the ever-expanding roles of the BAHD acyltransferase gene family in plants. ***Annual Reviews in Plant Biology*** doi: 10.1146/annurev-arplant-062922-050122

10. **Gaurav Moghe**, Susan Strickler. metaPathwayMap: A tool to predict metabolic pathway neighborhoods from structural classes of untargeted metabolomics peaks. ***bioRxiv*** (pre-print only), doi: 10.1101/2022.03.15.484337

11. V. de Crecy-Lagard et al (55 authors) (2022) A roadmap for the functional annotation of protein families: a community perspective ***Database*** doi: 10.1093/database/baac062
    - **Among the Top 10 Most Cited papers in the journal**

12. <u>Lars Kruse</u>, Austin Weigle, Mohammad Irfan, Jesus Martinez-Gomez, <u>Jason Chobirko</u>, Jason Schaffer, <u>Alexandra Bennettt</u>, Joe Jez, Chelsea Specht, Diwakar Shukla, **Gaurav Moghe*** (2022) Orthology-based analysis helps map evolutionary diversification and predict substrate class use of BAHD acyltransferases ***The Plant Journal*** doi: 10.1111/tpj.15902

13. <u>Lars Kruse, Alexandra Bennett, Elizabeth Mahood, Elena Lazarus, Se Jin Park</u>, Frank Schroeder, **Gaurav Moghe*** (2021) Illuminating the lineage-specific diversification of resin glycoside acylsugars in the morning glory (Convolvulaceae) family using computational metabolomics ***Horticulture Research*** doi: 10.1093/hr/uhab079

14. Honglin Feng, Lucia Acosta-Gamboa, <u>Lars Kruse</u>, Alba Ruth Nava Fereira, Sara Shakir, Hongxing Xu, Garry Sunter, Michael Gore, **Gaurav Moghe**, Georg Jander (2021) Acylsugars protect *Nicotiana benthamiana* against insect herbivory and dessication. ***Plant Molecular Biology*** doi: 10.1007/s11103-021-01191-3

15. <u>Alexandra Bennett, Elizabeth Mahood, Kai Fan</u>, **Gaurav Moghe*** (2021) Untargeted metabolomics of purple and orange-fleshed sweet potatoes reveals a large structural diversity of anthocyanins and flavonoids ***Scientific Reports*** 11:16408 doi: 10.1038/s41598-021-95901-y
    - **SIPS faculty team up for sweet potato improvement**

16. <u>Arielle</u> Johnson, **Gaurav Moghe**, Margaret Frank (2021) Growing a glue factory: Open questions in laticifer cell biology. ***Current Opinion in Plant Biology*** 64:102096. doi: 10.1016/j.pbi.2021.102096

17. <u>Mohammad Irfan</u>, Benjamin Chavez, Paride Rizzo, John D'Auria, **Gaurav Moghe*** (2021) Evolution-aided engineering of plant specialized metabolism ***aBiotech*** doi: 10.1007/s42994-021-00052-3

18. <u>Jacob Landis</u>, Christopher Miller, Amanda Broz, <u>Alexandra Bennett</u>, Robert Last, Patricia Bedinger, **Gaurav Moghe*** (2021) Migration through a major Andean ecogeographic disruption as a driver of genetic and phenotypic diversity in a wild tomato species ***Molecular Biology and Evolution*** 38(8): 3202-3219 doi: 10.1093/molbev/msab092

19. <u>Elizabeth Mahood</u>, <u>Lars Kruse</u>, **Gaurav Moghe*** (2020) Machine learning: A powerful tool for gene function prediction in plants ***Applications in Plant Sciences*** e11376 doi: 10.1002/aps3.11376
    - **Listed as one of the Most Influential papers in the 10 years of the journal**

20. Shayne Wierbowski, Tommy Vo, Pascal Falter-Braun, Timothy Jobe, Lars Kruse, Xiaomu Wei, Jin Liang, Michael Meyer, Nurten Akturk, Christen Rivera-Erick, Nicolas Cordero, Mauricio Paramo, Elnur Shayhidin, Marta Bertolotti, Nathaniel Tippens, Kazi Akther, Rita Sharma, Yuichi Katayose, Kourosh Salehi-Ashtiani, Pamela Ronald, Joseph Ecker, Peter Schweitzer, Shoshi Kikuchi, Hiroshi Mizuno, David Hill, Marc Vidal, **Gaurav Moghe**, Susan McCouch, Haiyuan Yu (2020) *Proceedings of the National Academy of Sciences* A massively parallel barcoded sequencing pipeline to generate the first single colony ORFeome and high-quality protein-protein interaction interactome for rice. doi: 10.1073/pnas.1918068117

21. Stacey Smith, Ruthie Angelovici, Karolina Heyduk, Hiroshi Maeda, **Gaurav Moghe**, Chris Pires, Joshua Widhalm, Jennifer Wisecaver (2019) The renaissance of comparative biochemistry. *American Journal of Botany*, 106(1): 3-13 doi: 10.1002/ajb2.1216

22. **Gaurav Moghe*** and Lars Kruse (2018) The study of plant specialized metabolism: Challenges and prospects in the genomics era *American Journal of Botany,* 105(6): 1-4 doi:10.1002/ajb2.1101

23. **Gaurav Moghe** and Stacey Smith (2018) The push and pull of plant specialized metabolism underlies a long-standing, colorful mystery. *New Phytologist,* 217(2) doi: 10.1111/nph.14914

PUBLICATIONS RESULTING FROM PRE-FACULTY RESEARCH

1. Bryan Leong, Steven Hurney, Paul Fiesel, TM Anthony, **Gaurav Moghe**, A Daniel Jones, Robert Last (2022) Identification of BAHD acyltransferases associated with acylinositol biosynthesis in *Solanum quitoense* (naranjilla) *Plant Direct* doi: 10.1002/pld3.415

2. Bryan Leong, Steven Hurney, Paul Fiesel, **Gaurav Moghe**, A. Daniel Jones, Robert Last (2020) Specialized metabolism in a nonmodel nightshade: Trichome acylinositol biosynthesis *Plant Physiology*, 183(3): 915-924 doi: 10.1104/pp.20.00276

3. John Lloyd, Megan Bowman, Christina Azodi, **Gaurav Moghe**, Kevin Childs, Shin-Han Shiu (2019) Evolutionary characteristics of intergenic transcribed regions indicate widespread noisy transcription in the Poaceae. *Scientific Reports*, 9, 12122 doi: 10.1038/s41598-019-47797-y

4. Haiyang Xu, **Gaurav Moghe**, Krystle Wiegert-Rininger, Anthony Schilmiller, Cornelius Barry, Robert Last, Eran Pichersky (2018) Identification of dehydrogenases involved in the biosynthesis of the monoterpene moiety of pyrethrin *Plant Physiology* doi: 10.1104/pp.17.01330

5. **Gaurav Moghe**, Bryan Leong, Steven Hurney, A. Daniel Jones, Robert Last (2017) Evolutionary routes to biochemical innovation revealed by integrative analysis of a plant-defense related specialized metabolic pathway. *eLife,* 6:e28468
    o [New study sheds light on mysterious plant compounds.](#) *Cornell Chronicle*
    o [Tomatoes' crystal ball reveals evolutionary secrets.](#) *MSU Today*
    o [Tomato hair holds clues to evolution.](#) *Futurity*

6. Pengxiang Fan, **Gaurav Moghe**, Robert Last (2016) Comparative biochemistry and *In Vitro* pathway reconstruction as powerful partners in studies of metabolic diversity. *Methods in Enzymology*, Synthetic Biology and Metabolic Engineering in Plants and Microbes Part A. vol. 575. (Book chapter)

7. **Gaurav Moghe**, Robert Last (2015) Something old, something new: Conserved enzymes and the evolution of novelty in plant specialized metabolism. ***Plant Physiology***, 169 (3):1512-1523
    o [**The genesis of plant languages: How plants evolve new metabolic pathways from existing ones.**](#) *Invited article, Atlas of Science*

8. Melissa Lehti-Shiu, Sahra Uygun, **Gaurav Moghe**, David Hufnagel, Hannah Jasicki, Vivian Fang et al. (2015) Molecular evidence for functional divergence and decay of a transcription factor derived from whole genome duplication in *Arabidopsis thaliana*. ***Plant Physiology***, 168(4):1712-1734

9. Jing Ning, **Gaurav Moghe**, Bryan Leong, Jeongwoon Kim, Itai Ofner et al. (2015) A feedback insensitive isopropylmalate synthase affects acylsugar composition in cultivated and wild tomato. ***Plant Physiology,*** 169)3:1821-1835

10. John Lloyd, Alexander Seddon, **Gaurav Moghe**, Matthew Simenc, Shin-Han Shiu (2015) Characteristics of plant essential genes allow for within-and between-species prediction of lethal mutant phenotypes. ***The Plant Cell***, 27(8):2133-2147

11. Anthony Schilmiller, **Gaurav Moghe**, Pengxiang Fan, Banibrata Ghosh, Jing Ning, A. Daniel Jones, Robert Last (2015) Functionally divergent alleles and duplicated loci encoding an acyltransferase contribute to acylsugar metabolite diversity in *Solanum* trichomes. ***The Plant Cell***, 27(4):1002-1017

12. **Gaurav Moghe**, David Hufnagel, Haibao Tang, Yongli Xiao, Christopher Town, Ian Dworkin et al. (2014) Consequences of whole genome triplication as revealed by comparative genomic analyses of the wild radish *Raphanus raphanistrum* and three other Brassicaceae species, ***The Plant Cell***, 26(5):1925-1937.
    o **Featured as a [Research Highlight](#) in Nature Reviews Genetics (July 2014), doi:10.1038/nrg3774**

13. **Gaurav Moghe**, Shin-Han Shiu (2014) The causes and molecular consequences of polyploidy in flowering plants. ***Annals of the New York Academy of Sciences,*** 1320: 16-34

14. Michael Campbell, MeiYee Law, Carson Holt, Joshua Stein, **Gaurav Moghe**, David Hufnagel, et al. (2014) MAKER-P: a tool-kit for the rapid creation, management, and quality control of plant genome annotations. ***Plant Physiology***, 164 (2): 513-524

15. **Gaurav Moghe**, Melissa Lehti-Shiu, Alexander Seddon, Shan Yin, Yani Chen, Piyada Juntawong, et al. (2013) Characteristics and significance of intergenic polyA transcription in *Arabidopsis thaliana*. ***Plant Physiology***, 161(1):210-224

16. Rebecca Davidson*, Malali Gowda*, **Gaurav Moghe**, Haining Lin, Brieanne Vaillancourt, Shin-Han Shiu et al. (2012) Comparative transcriptomics of three Poaceae species reveals patterns of gene expression evolution. ***The Plant Journal,*** 71(3):492-502.

17. Haining Lin, **Gaurav Moghe**, Shu Ouyang, Shin-Han Shiu, Xun Gu, C. Robin Buell (2010) Comparative analyses reveal distinct sets of lineage-specific genes within *Arabidopsis thaliana*. ***BMC Evolutionary Biology***, 10:41.

RESEARCH SEMINARS PRESENTED

1. Upcoming: Towards predicting the functions of all enzyme families. ***Penn State University symposium (June 2025)***.

2. Characterizing the diversity and biosynthesis of resin glycosides in the Convolvulaceae family. ***PAG Medicinal Biochemistry workshop (Jan 2025)***
3. Prediction of enzyme activities using large language models. ***PAG Ontologies Workshop (Jan 2025)***
4. Charting the evolution and predictability of functions in plant enzyme families. ***Indian Institute of Technology – Bombay (August 2024)***
5. Charting the evolution and predictability of functions in plant enzyme families. ***Michigan State University graduate student organized symposium (May 2024)***
6. Donald Danforth Center, Missouri ***(April 2024)***
7. Ongoing research in the Moghe Lab. ***Cornell Plant Breeding Section (February 2024)***
8. How do plants make so many compounds: A case study using acylsugars of the Solanaceae family May Berenbaum Co-evolution Symposium, Department of Ecology and Evolution, ***Cornell University (October 2023)***
9. ***Conferences 2023 – invited/contributed talks:*** *Gordon Research Conference, Barcelona (June),*
10. ***Conferences 2023 – invited/contributed talks:*** *Botany (July)*
11. ***Conferences 2023 – invited/contributed talks:*** *Phytochemistry (July)*
12. ***Conferences 2023 – invited/contributed talks:*** *ASPB (August)*
13. Computational approaches for parsing metabolic diversity from complex natural extracts. ***Cornell University Intercampus Drug Discovery Symposium (May 2023)***
14. Emergence of novelty in acylsugar biosynthesis in plants (graduate student invitation) ***University of Missouri – Columbia, Corteva Agroscience Symposium (March 2023)***
15. Emergence of novelty in acylsugar biosynthesis in plants ***University of Toronto – Scarborough (Nov 2022)***
16. Predictive analysis of plant metabolomes and metabolic enzymes (***Zhejiang U., China, Nov 2022***)
17. Predictive analysis of plant metabolomes and metabolic enzymes ***Purdue University (Sep 2022)***
18. ***Phytochemical Society of North America (July 2022)***
19. Uncovering the phytochemical diversity in the Convolvulaceae family using computational metabolomics. ***Convolvulaceae Seminar Series (June 2022)***
20. Challenges of functional propagation in plant enzyme families. ***NSF-sponsored workshop on protein function annotation, Orlando (Feb 2022)***.
21. Using Information theory and machine learning to analyze plant metabolomes ***Plant and Animal Genome Conference XXIX (Jan 2022, conference cancelled due to Covid)***
22. Enzyme families and the evolution of plant metabolic diversity ***Iowa State University (Sep 2021)***
23. Evolution of the diversity of defensive sugar metabolites in the morning glory (Convolvulaceae) family ***Botany 2021, colloquium on Phytochemistry***
24. Evolution of the diversity of defensive sugar metabolites in Solanaceae and Convolvulaceae ***Solanaceae Seminar Series*** (virtual seminar; January 2021)
25. Classification of lipids and other compounds into structural categories using supervised machine learning. ***American Society of Plant Biologists annual meeting*** (2020)
26. Emergence of innovation in plant metabolism ***University of California – San Diego*** (virtual seminar; May 2020)
27. Dissecting the structure and evolution of plant metabolic networks using a multi-disciplinary toolbox ***Rutgers University, New Brunswick*** (Jan 2020)
28. High-value metabolites in sweet potato ***Empire State Producers Expo***, Syracuse, NY (Jan 2020)
29. Chipping away at plant metabolic complexity using a multi-disciplinary toolbox ***University of Nebraska - Lincoln Plant Sciences annual symposium*** (Oct 2019)
30. The emergence of novelty in plant specialized metabolism. ***American Society of Plant Biologists Annual Meeting (Presidential Session)*** (July 2019)

31. Plant metabolic diversity: Evolution and Applications. **Plant Breeding and Genetics Section, Cornell University** (Feb 2019)
32. The evolution of novelty in plant metabolism. **Plant Biology Department, University of Massachusetts – Amherst** (Oct 2018)
33. Teasing apart the complexity of plant metabolic networks using integrative approaches. **Computational Biology field, Cornell University** (2018)
34. All in the family: The emergence of biochemical novelty in plant specialized metabolism. **Boyce Thompson Institute annual symposium** (2017)
35. Acylsugar biosynthesis and the evolutionary dynamics of specialized metabolic pathways. **Cold Spring Harbor Plant Biotechnology symposium** (2017)

TALKS (PRE-FACULTY)

1. Phylogenetics meets biochemistry: Unraveling plant specialized metabolism using multi-omic strategies. **Cornell University** (2017)
2. Comparative biochemical genomics of Solanaceae acylsugars illustrates the mechanisms of evolutionary diversification in plant specialized metabolism. **13th Annual Solanaceae Conference, UC-Davis** (2016)
3. The emergence of biological complexity: An investigation of acylsugar biosynthesis using comparative biochemical genomics**. Gordon Research Seminar on Plant Molecular Biology**, **Holderness School** (2016)
4. All in the family: The origins and evolution of acylsugar biosynthesis in Solanaceae. **PRL Tuesday noon seminar, MSU BEACON seminar** (2016)
5. High-throughput approaches and the study of natural metabolic variation in plants. **iCER NextGen talks, MSU** (2015)
6. Plant molecular evolution in the genomics era: How omic strategies can inform evolutionary studies of biological phenomena. **Indian Institute of Science, Education & Research (IISER), Pune, India** (2015)
7. An early look at the genome of wild radish *Raphanus raphanistrum* genome. **iCER NextGen talks, MSU** (2012)
8. Insights into genome evolution post-polyploidization in Brassicaceae using the newly sequenced genome of Wild Radish *(Raphanus raphanistrum)*. **American Society of Plant Biology Conference, Austin, TX** (2012), **MSU-BEACON Centre** (2013)
9. Characteristics and significance of intergenic polyA transcripts in *Arabidopsis thaliana*. **Great Lakes Bioinformatics Conference, Ann Arbor, MI** (2012)
10. Intergenic Dark Matter transcripts: Insights from the analyses of the *Arabidopsis thaliana* transcriptome. **Genetics Retreat*, MSU** (2011)
11. Discovery and analyses of novel RNA genes in *Arabidopsis thaliana*. **Genetics Forum, MSU** (2010), **Society for Molecular Biology and Evolution Conference, Iowa City** (2009)

CONTRIBUTIONS TO TEACHING AND MENTORING

COURSES TAUGHT

- **PLBIO 4000/6000: Concepts and techniques in computational biology (Spring 2019-); 4 credits**
    - Contains the following course content comprising theory lectures and hands-on exercises:
    - Module 1: Unix, HPC, Python, Introduction to Docker/GitHub/MySQL
    - Module 2: Local/global alignment, BLAST, phylogenetic reconstruction, orthology analysis
    - Module 3: Genome assembly using Illumina, PacBio, HiC, RNA-seq reference based (HISAT2) and denovo (Trinity) assembly, differential expression analysis using edgeR
    - Module 4: Hidden Markov Models, motif analysis, network reconstruction concepts, Gene Ontology analysis, protein structure prediction and docking
    - Module 5: Machine learning, supervised/unsupervised methods, Scikit-learn, PyCaret, WEKA, deep learning concepts
    - Module 6: Student projects
- **PLSCI 7202: Applications of machine learning to plant sciences (Fall 2020-2022); 8 lectures/year**
    - https://github.com/moghelab/ml-teaching-plsci7202
    - Contains concept lectures and hands-on exercises conducted in Jupyter Notebook using above Python libraries
    - Examples include predicting appropriate crop plantings using soil nutrition and weather features, whether mushrooms are edible/poisonous based on their morphological features, whether gene mutation is lethal/not lethal based on its sequence, expression and network features
- PLSCI 7450: Current Papers in Plant Biology (Spring 2025) Topic: Plant Metabolic Engineering
- PLBIO 6410: Introduction to LC-MS: Data acquisition and analysis (Fall 2018-); 2 lectures/year
- PLBIO 7410: Introduction to research literature in plant biology (Spring 2018-); 1 lecture/year
- Guest lecture: BTRY 4950: Gene Expression Clustering: Methodological considerations (2019)

Pre-faculty:
- TA, Theories and Practices in Bioinformatics (Dept. of Plant Biology, MSU, 2011, 2013)
- Guest lecture: Differential expression analysis using edgeR (Cold Spring Harbor Laboratories, 2013)
- TA, Frontiers in Plant Sciences (Cold Spring Harbor Laboratories, 2010, 2013)
- Guest lecture: Introduction to Python Programming (Theories and Practices in Bioinformatics, 2011)
- TA, Fundamental Genetics (Dept. of Zoology, MSU, 2009)
- Instructor, Masters in Bioanalytical Sciences (Ramnarain Ruia College, Mumbai, 2006)

MENTORING

As faculty:
- Mentored postdoctoral researchers (4), graduate students (3.5), rotating graduate students (8), lab technicians (2), undergraduate students (15), visitors (6) on various research projects. Some of these students successfully applied and received Cornell and federal grants. **At least three of these students were first-generation students taking their early steps into the scientific world.**
    - **Postdoctoral researchers:** Lars Kruse, Kai Fan, Mohammad Irfan, Xinyu Yuan
    - **Graduate students:** Elizabeth Mahood, Kanza Arshad, Bhaswati Sarmah, Nathaniel Smith, Szu-Ping Chen, Teresa Alvarado Parra

- ▪ **Secondary advisor for:** Arielle Johnson (2021-2022)
  - o **Lab technicians:** Alexandra Bennett
  - o **Undergraduate students:** Chenab Khakh, Se Jin Park, Nandita Nagarajan, Sonia Lulla, Jiho Lee, Arden Lee, Taelor Matos, Mac Flanagan, Jason Novozhenets, Aidan Larson, Pradhi Pakkerakari, Garret Bouvier, Chesney Melissinos, Crystal Grissom, Archawin Kittirattanapaiboon, Leena Jalees
  - o **REU students:** Jason Chobirko, Elena Lazarus, Ana Mata Acosta
- Over 20 students from CALS and CAS, through the BIO Advising program and the Plant Science major mentoring program.
- Mentored two REU students, both of whom contributed significantly to be authors on publications.
- On dissertation committees of ten graduate students.

Pre-faculty:
- Mentored graduate students (2), undergraduates (6) and high school students (2).

LEADERSHIP AND SERVICE

COMMITTEES AND ORGANIZATIONS

External:

1. Data Management Committee, C-SPIRIT (2025-)
2. Initiated work on creating a national faculty network Plant Biologists of Indian Origin in North America (PBIO-NA) aimed at providing mentoring and career advice to early career faculty and (in the future) postdocs of Indian origin, given this group's many challenges with securing funding, immigration security and visibility opportunities.
3. Plant Cell Atlas – Member, Metabolomics Subcommittee (2023-)
4. Elected President, Phytochemical Section of the Botanical Society of America (2022-)
5. Co-founder, PhytochemTalks – a biweekly online seminar series organized on behalf of the BSA Phytochemistry section and PSNA. The goal of this series is to highlight early career plant biochemists including graduate students, postdocs and early career faculty. So far, over 30 scientists from North America and Europe have spoken at this well-attended forum.
6. Co-founder (with Dr. Stacey Smith), Botanical Society of America Phytochemistry section (2020, 2021). This section aims to bring together scientists with phytochemical interests at the Botany meeting and beyond, through organization of symposia, colloquia, workshops, travel awards and off-conference meetings such as the PhytochemTalks. Through this forum, we aim to create a networking and presentation opportunity for grad students and postdocs attending the Botany meeting.
7. Co-organizer of Botany 2023 symposium "Standing your ground: Understanding plant defense from molecules to morphology"
8. Co-organizer (with Dr. Rob Raguso) of a Botany 2021 colloquium "Phytochemistry: From atoms to ecosystems"
9. *Ex-officio* member, ASPB Early Career Award Committee (2019)

At Cornell:

1. CALS Access and Community Empowerment (2024-)
2. Plant Science Honors Program Faculty Committee (2024-)
3. Lead PI and co-organizer of Cornell-Weill Cornell symposium on "Drug discovery from nature's metabolites" May 2023.
4. Member, Plant Medicinal Science Undergraduate Minor application committee (2023-)
5. Member, Graduate students admissions committee (2020, 2021, 2023)
6. Member, Synthetic Plant Biology faculty search committee (2019)
7. Member, Cornell Institute of Biotechnology Metabolomics Advisory Board (2017-)
8. Faculty co-founder, Cornell Ents Club (monthly plant biology journal club, retired)

Pre-faculty:

- Member, Biochemistry Department Awards Committee (2015)
- President of Genetics Student Organization (2012)
- Member of Genetics Director Search Committee (2012), Genetics Program Executive Committee (2012), Genetics Student Organization (2011), Genetics Admissions Committee (2010)
- Representative for Dean's Student Advisory Council and Faculty Advisory Council (2011)

JOURNAL EDITORSHIP AND PEER REVIEW

- Co-editor, Phytochemistry Special Issue (Journal: Applications in Plant Sciences)
- Guest editor, American Journal of Botany (2022)
- Editorial Board, Plant Direct (2017-)
- Manuscript review – multiple journals
- Grant review – National Science Foundation, France ANR, Estonian Research Council, USDA NIFA, UK Research and Innovation

OUTREACH AND COMMUNITY CONTRIBUTIONS

- In 2019, wrote an article on the Plantae Website advocating for a greater understanding of the problem of dual career couples, especially in faculty hiring (The two-body problem: Perspectives of an early career researcher (moghelab.org)). Presented the gist of this article at the ASPB Presidential Session, where I was an invited speaker. Implemented the suggestions in my own advising.
- In 2020, presented research to sweet potato growers at the NYS Producers Expo, conducted survey and initiated frequent engagement with Cornell Cooperative Extension to understand grower needs.
- Since 2021, through PhytochemTalks, consciously gave platform to many early career researchers from diverse national and cultural backgrounds to highlight their research through virtual talks and YouTube.
- Since 2022, associated with fundraising for Seva Sahayog – an NGO in India engaged in improving the educational outcomes of children from impoverished families.
- Since 2023, as Broader Impacts activity of our NSF-sponsored project, taught coding and robotics to 4th and 5th graders in Northeast Elementary School, Ithaca, following the curriculum of "Girls Who Code" and "Code.org".