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PMN
PLANT METABOLIC NETWORK
Winter 2025

The Plant Metabolic Network (PMN) is your go-to resource for curated metabolic pathway data, genome annotations, and analysis tools that support plant research and enhance understanding of plant metabolism. This newsletter will keep you informed about the latest developments, events, and resources from PMN, including database updates, feature enhancements, tutorials, workshops, and research highlights.

PMN 17 Release!

We are super excited to announce the release of PMN 17! PMN 17 is the largest release in the history of PMN. Enabled by our new backend pipeline, PMN 17 includes 583 single-species databases, including updated versions of the 155 databases from PMN 16. The new pipeline allowed us to make use of all plant genomes from Phytozome, Ensembl Plants, and RefSeq plants that met our quality metrics. In addition, PMN 17 includes databases based on many of the genomes the Yang lab has published of plants in the Caryophyllales order. All databases were (re)generated using our internal pipeline, making use of Pathway Tools 29.0, E2P2 version 5, and updated SAVI validation lists (SAVI 3.3). New enzyme data from our collaboration with the labs of Hiroshi Maeda (UW-Madison) and Philipp Zerbe (UC Davis) are also incorporated into this release, with more to come!

Click here to start using PMN 17!

New Website Launch!

Our new website is live! We've refreshed the look and improved navigation to better serve our community. We'd love for you to check it out.

Visit our website here!

Collaborator Spotlight

Dr. Hiroshi Maeda

University of Wisconsin-Madison

Dr. Hiroshi A. Maeda is a professor at the University of Wisconsin-Madison, where students and scientists in his lab aim to unravel the intricate workings of plant metabolism.

After graduating from the University of Osaka, Japan, Dr. Maeda went on to receive his PhD in Cell and Molecular Biology from Michigan State University, where he was also a Postdoctoral Research Assistant. He then continued his Postdoctoral work at Purdue University before moving to the University of Wisconsin-Madison.

Dr. Maeda's lab studies evolutionary diversification of core metabolic pathways (such as primary metabolism) in various plants through chemical, biochemical, genetic, and evolutionary analyses. By understanding these complex processes in various plants, his lab strives to redesign the plant metabolic network and improve chemical compositions of agricultural and bioenergy crops, such as for improved food nutrition, plant-based bioenergy and pharmaceutical production.

Dr. Maeda is one of our collaborators whose recent publication, *Mapping multi-substrate specificity of Arabidopsis aminotransferases* lays the groundwork for engineering crops that use nitrogen more efficiently, reducing our dependence on harmful fertilizers. It also helps scientists better predict and model plant behavior under different environmental conditions.

Learn More About Dr. Maeda Here

Become A Collaborator

New Course at UC Davis Uses PMN

A new course was added in the spring of 2025 at the University of California, Davis led by PMN members Philipp Zerbe and Farida Yasmin, that focuses on mapping the chemistry of Arboretum plants in the UC Davis Arboretum and Public Garden.

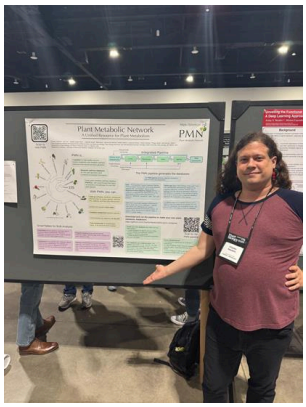
As part of UC Davis' new Course-based Undergraduate Research Experience (CURE), this course offers undergraduates the chance to contribute to real-time research, receive impactful mentorship, and be able to share research results with stakeholders.

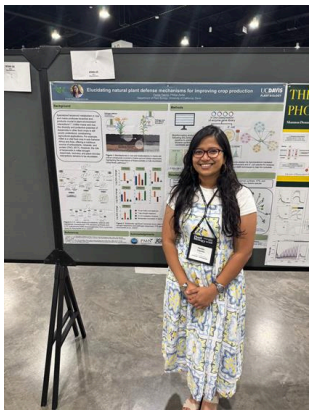
In the course, Professor Zerbe's students would collect samples from the arboretum, photograph the plants they took the samples from, and note the plant's GPS coordinates. The students would then take the samples to the lab, where they would use chemical solvents to extract metabolites from the plant sample. They would then use a gas chromatography mass spectrometer to separate the different metabolites. The extracted metabolites would then get compared to the Plant Metabolic Network to identify the most common metabolites in each sample. By the end of the semester, the class catalogued metabolites from a total of 36 species.

Professor Zerbe hopes to keep the momentum going, by offering this class on an annual basis and hopes to help expand the network to include more diverse species.

For more information on this course, visit the UC Davis College of Biological Sciences.

PMN at Recent Conferences





PMN members **Charles Hawkins** (above) and **Farida Yasmin** (below) presented posters at the ASPB Conference in Milwaukee July 26-30, 2025.

Charles presented: "Plant Metabolic Network: A Unified Resource for Plant Metabolism" and Farida presented: "Elucidating Natural Plant Defense Mechanism for Improving Crop Production"

Dr. Philipp Zerbe gave a talk at the **Advanced Multidisciplinary Agricultural Biotechnology Conference** at NCHU Taiwan in October.

Dr. Sue Rhee attended the **21st SMB Plant Biology Congress and 4th ASPB México section meeting** on October 20-24, 2025.

Dr. Sue Rhee gave a seminar at the University of Florida in October on *Cell-type-specific response to drought in Sorghum bicolor reveals novel targets for improving water use efficiency.*

Are you interested in using the Plant Metabolic Network for your research?

Click below to get started!

Start Building

Outreach

Gaëlle Cassin-Ross (left) smiles as she presents information on PRI and PMN to a conference

PMN attends the first annual Great Lakes Plant Science Conference

During the first annual Great Lakes Plant Science Conference (GLPSC), held September 12-14, PMN members Gaëlle Cassin-Ross and Johanna Murray, along with other Plant Resilience Institute (PRI) members, set up booths to provide information on the different PRI Center Grants, including the Plant Metabolic Network.

attendee at the GLPSC.

Johanna Murray (left) and Ashley Stender (right) sit at the PRI Center Grants booth at the GLPSC.

GATE uses PMN Activity

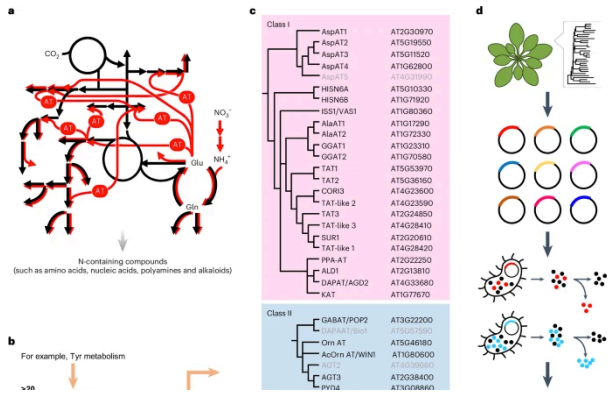
Over the summer, the Michigan State University Gifted and Talented Education (GATE) program used PMN's "Why Do Bananas Smell so A-Peeling" activity during their summer program.

The GATE program allows middle school students to take curriculum at the high school level and the summer programs allow hands-on learning for students as young as third grade.

During this PMN activity, students in the GATE program got to participate in a guessing game where they matched scents to their plants of origin. They also learned about how the different molecules produced by plants give each of them their distinct smell.

Publication Spotlight

Fig. 1: Characterization of the *Arabidopsis* AT enzyme family.



Mapping multi-substrate specificity of *Arabidopsis* aminotransferases

Kaan Koper, Marcos V. V. de Oliveira, Sebastian Huß, Shogo Hataya, Fayaz Soleymani, Charles Hawkins, Seung Y. Rhee, Taichi E. Takazuka, Zoran Nikoloski, and Hiroshi A. Maeda

Published: 12 September 2025

Abstract: Nitrogen is an essential element in all organisms, and its availability and use efficiency directly impact organismal growth and performance, especially in plants. Aminotransferases are core enzymes of the nitrogen metabolic network for synthesizing various organonitrogen compounds. Although each aminotransferase can potentially catalyse hundreds of transamination reactions with different combinations of amino and keto acid substrates, the full functionality of many aminotransferases remains elusive. Here we employed high-throughput gene synthesis and enzyme assay platforms to determine the substrate specificities of 38 aminotransferases of *Arabidopsis thaliana* and unveiled many previously unrecognized activities among a total of 4,104 reactions tested. The integration of these biochemical data in an enzyme-constrained metabolic model of *Arabidopsis* and in silico simulation further revealed that the promiscuity of aminotransferases may alter nitrogen distribution profiles and contribute to the robustness of the nitrogen metabolic network. This study provides foundational knowledge for deciphering the plant nitrogen metabolic network and improving nitrogen use efficiency in crops.

Read The Article Here

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