

THOMAS D. SHARKEY

University Distinguished Professor
MSU DOE Plant Research Laboratory and Plant Resilience Institute
Department of Biochemistry and Molecular Biology
612 Wilson Rd., 210 Plant Biology Laboratory
Michigan State University
East Lansing, MI 48824
Email: tsharkey@msu.edu Phone: +1 (517) 353-3257

EDUCATION

Michigan State University	Biology, Lyman Briggs College	B.S. 1974
Michigan State University	Botany and Plant Pathology	Ph. D. 1980
Australian National University	Environmental Biology	Post-doctoral Fellow

ACADEMIC POSITIONS

3/21 to present – Interim Director of the Plant Resilience Institute, MSU
5/17 to present - member of the MSU-DOE Plant Research Laboratory
6/15 to present University Distinguished Professor
2/08 to present Professor, Department of Biochemistry and Molecular Biology
4/18 to 2/21 Associate Director of the Plant Resilience Institute, MSU
2/08 to 4/17 Chair, Department of Biochemistry and Molecular Biology
6/04 to 1/08 Director, Institute for Cross-college Biology Education
1/93 to 5/04 Director, UW-Madison Biotron
9/92 to 6/94 Chair of Department of Botany, University of Wisconsin-Madison
9/91 to 1/08 Professor, Department of Botany, University of Wisconsin-Madison
9/88 to 8/91 Associate Professor, Department of Botany, University of Wisconsin-Madison
8/87 to 8/88 Assistant Professor, Department of Botany, University of Wisconsin-Madison
8/86 to 5/87 Adjunct Associate Professor, Biology Department, University of Nevada-Reno
11/82 to 8/87 Assist. -Assoc. Director/ Assist. -Assoc. Research Professor, Biological Sciences Center, Desert Research Institute, Reno, Nevada

MEMBERSHIPS

American Association for the Advancement of Science (AAAS)
American Society for Biochemistry and Molecular Biology
American Society of Plant Biologists (ASPB)
International Society of Photosynthesis Research

AWARDS

Kellett Mid-Career Award for Research 1999, UW-Madison (\$60,000 research prize)
Fellow of ASPB, 2007 (inaugural class)
Fellow of AAAS, 2011
Outstanding Faculty Award, College of Natural Science, 2014
Beal Outstanding Faculty Award, MSU, 2014
University Distinguished Professor, 2015

PROFESSIONAL ACTIVITY

Research

I study the biochemistry and biophysics that underlie plant-atmosphere interactions, especially photosynthesis and isoprene emission from plants. Significant accomplishments related to photosynthesis include the measurement of carbon dioxide concentration inside leaves, measurement of the biophysical resistance to carbon dioxide diffusion within leaves, elucidation of the biochemical feedback chain that explains how limitations in starch and sucrose synthesis reduce the efficiency of photosynthesis, and demonstration that maltose is the primary metabolite exported from chloroplasts at night. Current research is focused on alternative metabolic pathways during carbon assimilation.

Significant accomplishments related to isoprene biosynthesis and emissions from plants include the genomic and transcriptomic analyses related to isoprene in plants, measurement of the concentration of isoprene in membranes, and analysis of the evolution of isoprene synthases and enzymes that make the precursor to isoprene.

<https://bmb.natsci.msu.edu/faculty/thomas-d-sharkey/sharkey-lab/>

<https://prl.natsci.msu.edu/people/faculty/thomas-d-sharkey/>

https://en.wikipedia.org/wiki/Thomas_D._Sharkey

Activities related to research

- **Current:**

- Series Co-Editor for volumes 31 to 44 (with Govindjee, founding series editor, now with Julian Eaton-Rye), *Advances in Photosynthesis and Respiration Including Bioenergy and Related Processes* Volumes 45 and 46 will be published in 2020 by SpringerNature
- Area Representative for the International Society of Photosynthesis Research (ISPR) (2016-2024)
- Editorial Board member of *Photosynthesis Research* 1992–present

- **Past:**

- *Plant, Cell and Environment* Associate Editor 1992–2001, Senior Editor 2002–2020
- Scientific Advisory Board for the biofuels group at Synthetic Genomics (2018 to 2020)
- Organizer for the between-Congress ISPR meeting “Photosynthesis from Light to Life: an ISPR Meeting Held in Conjunction with Plant Biology 2018” in Montreal, Canada
- Scientific Advisory Board for *International Flavors and Fragrances*, 2011-2016
- Founding Chair, Gordon Research Conference on Biogenic Hydrocarbons and the Atmosphere, 2000
- Gordon Research Conference on Temperature Stress of Plants, Co-Vice-Chair 1999, Co-Chair 2001
- Program committee for International Congress on Photosynthesis, 2004, 2010, 2013
- *Plant Physiology*, Monitoring Editor 1993–1997, 2000–2001
- Editorial Board Member: *Journal of Experimental Botany*, 1994–2011; *Plant Physiology*, 1986–1992
- Panel Member, NSF Physiological Processes, 1988–1991; DOE Equipment, 1994; USDA, Photosynthesis, 1999; DOE Energy Biosciences, 2000; USDA Biochemistry, 2002, 2004, and 2005; NSF Ecological and Evolutionary Physiology, 2003, 2004; NSF Global Change Biology, 2010, DOE ARPA-E, 2011; NSF Plant Processes, Structure and Integrity, 2012; USDA AFRI Biological Mechanisms for Plant Production, 2013, DOE-BES-Biosciences Virtual Panel, 2014; USDA Photosynthetic Efficiency and Nutrient Utilization, 2014, 2017, 2018
- Public Affairs Committee, American Society of Plant Biologists, 1999–2004, Chair 2002–2004
- International Review Committee, Research School of Biological Sciences, Australian National University, 1999–2001, External Reviewer 2009-2010
- International Scientific Advisory Board, Max Planck Institute for Molecular Plant Physiology, 2000–2012

Post-Doctoral Associates, current position

Rowan Sage, Prof., Univ. Toronto

Terry Vassey, Asst. Prof. Cal. Poly, San Luis Obispo

Francesco Loreto, Director, Department of Biology, Agriculture, and Food Sciences, CNR, Italy

Charles Delwiche, Professor, Univ. Maryland

Jürgen Schleucher, Professor, Dept. Medical Biochemistry and Biophysics, Umeå, Sweden

Barry Micallef, Assoc. Prof., Univ. Guelph

Marianne Laporte, Assoc. Prof., Eastern Mich. Univ.

Deming Gong, Project Manager, Health Research Council, New Zealand

Xiuyin Chen, Scientist, The New Zealand Institute for Plant and Food Research Limited, New Zealand

Tanya Falbel, Research Scientist, UW-Madison

Dennis Gray, Deceased

Ziru (James) Li, Actuarial

Sean Weise, Assistant Professor, Biochemistry and Molecular Biology

Linus Gog, Analytical Chemist, Green Thumb Industries

Thomas Wieloch, Dept. Medical Biochemistry and Biophysics, Umeå, Sweden

James Santiago, Research and Development Plant Physiologist, Soli Organic, Virginia

Sarathi Weraduwage, Assistant Professor, Bishop's University, Quebec

Abira Sahu, current

Stephanie Schmiedege, current

Mohammad Mostofa, current

Teaching

I have a keen interest in teaching at all levels from Freshmen to PhD students. I was among the first adopters of a classroom response system (Clickers) in introductory biology at the University of Wisconsin-Madison. This helped increase the learning experience because the students felt part of a community and took responsibility for the class progress in understanding. It also allowed a shift in focus to deeper understanding by encouraging group discussions during lectures. I also taught fourth-year plant physiology and graduate-level plant biochemistry in Wisconsin. Upon moving to MSU I taught in the fourth-year biochemistry for major's course and then biochemistry for non-majors in order to gain a clear understanding of the teaching in large courses in the department. I then taught in introductory biology for undergraduates to gain insights for my efforts in curriculum reform. Currently I teach biology for non-scientists. In graduate teaching I have taught plant biochemistry and "Plant Biotechnology for Health and Sustainability." In all of my teaching I emphasize competency in disciplinary knowledge, competency in the practice of science, and scientific communication. I use 'clickers' in larger lecture courses and more interactive methods in small graduate courses.

In addition to teaching, I have been deeply involved in curriculum reform at both UW-Madison and MSU. At UW-Madison I was instrumental in establishing a Biology Major that grew to be the second largest major in the University. I was co-chair of the major and Director of the Cross-College Institute for Biology Education that served as the home for the major. At MSU I have been involved in reforming the introductory biology sequence. To be sure I understood student needs I rearranged my teaching duties to teach in this course. These efforts led to the creation of the College of Natural Science BioInitiative, which was successful in getting over \$3MM in new funding for undergraduate biology teaching.

At MSU I have served on 31 PhD committees and hosted 56 undergraduates for research in my laboratory

Activities related to teaching and service

MSU:

- Bioinitiative Executive Committee, 2014-2017
- Bioinitiative Oversight Committee, 2014-2016
- Active participant in “Plant Genomics” an NSF-funded REU program that brings undergraduate students from around the country to campus for summer research experiences. The program has been very successful in bringing in students from underrepresented groups.
- Active participant in “Plant Biotechnology for Health and Sustainability”, an NIH-funded training program (T32) to prepare graduate students for careers in biotechnology.
- Scientific Co-PI of MSU Michigan Translational Research and Commercialization program, a cooperative venture between MSU and the Michigan Economic Development Corporation to accelerate commercial development of university discoveries (\$2MM total budget) 2013-2016.
- Search Committee (Chair) for Chair of the Department of Microbiology and Molecular Genetics, 2013-2014
- Department of Physiology Chair search Committee, 2011-2012
- College of Natural Science Dean search committee, 2016-2017
- Other search committees PRL Assist. Prof. 2016-2017; PRI/BMB Assist/Assoc. Prof. 2017-8; PRI/PLB Assist Prof. 2017-8

UW-Madison:

- Information Technology Committee, member, 2004–2008
- Council of Associate Deans, member, 2004–2008
- Teaching and Learning Council, member 2004–2008
- Co-Chair, Intercollege Biology Major, 1999–2003
- Member, Tenure Committee of the Biological Sciences Division, 2002–2004
- Member, University Committee (executive committee of the Faculty Senate), 1999–2001, Chair 2000–2001
- Biological Sciences Strategic Planning Committee, 1996–1999, chair 1996–1998
- Chair, Undergraduate Biology Education Committee, 1992–1996
- Co-Chair, Administrative Council for Academic Advising, 1997–1999
- Member, University Academic Advising Committee, 1993–1994
- Member, Executive Committee, Center for Biology Education, 1992–1996

Graduate Students, degree, and current position

Barry Micallef, PhD 1994, Assoc. Prof., Univ. Guelph

Daniel Tennessen, PhD 1994, Consultant

Marianne Laporte, PhD 1997, Assoc. Prof., Eastern Mich. Univ.

Eric Singaas, PhD 1997, Research Director, University of Minnesota Duluth

David Hanson, (Co-Advisor) PhD 1999, Prof., Univ. New Mexico

Sansun Yeh, PhD 2003, Patent Lawyer, Michael Best and Friedrich LLP, Madison WI

Sean Weise, PhD 2005, Assistant Professor, Mich. State Univ.

Yan Lu, PhD 2005, Assoc. Prof. Western Michigan University.

Stephen Schrader, PhD 2005, Senior Scientist, Pioneer

Eunsoo Kim, (Co-Advisor) PhD 2006, Assoc. Curator, American Museum of Natural History

Amy Wiberly, PhD 2008, Research Plant Physiologist, USDA, Madison WI

Ru Zhang, PhD 2009, Assistant Member and PI, Donald Danforth Plant Science Center

Ziru (James) Li, PhD, 2012, Actuarial

Aparajita Banerjee, PhD, 2015, Post-doc, MSU

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Chris Harvey, PhD, 2015, Post-doc, Univ. Illinois

Alexandra Lantz, PhD, 2019, KBI Biopharma

Alyssa Preiser, PhD, 2020

Alan McClain, PhD, 2022

Bianca Serda, PhD, anticipated 2025

EXTERNAL RESEARCH GRANTS

(PI except as noted)

Funding from DOE for work on photosynthesis

84–90	DOE	\$372,000	Gas Exchange Characteristics of Leaves (two 3-year grants)
90–99	DOE	\$797,000	Feedback Regulation of Photosynthetic Processes (three 3-year grants)
99–04	DOE	\$440,000	Starch Conversion to Sucrose in Plant Leaves
04–09	DOE	\$490,000	Maltose Metabolism and Transport in Plant Leaves
12–15	DOE	\$510,000	Improved Efficiency of Energy Capture and Conversion by Regulating the Interaction between ATP Synthesis and End Product Synthesis
15–17	DOE	\$350,000	The Calvin-Benson Cycle Glucose 6-phosphate Shunt (folded into the PRL grant below as of 2017)
13–23	DOE/PRL	\$1,205,943	<i>Photosynthetic Energy Capture, Conversion and Storage: From Fundamental Mechanisms to Modular Engineering (funds from the PRL core grant to my lab. Total PRL funding \$17,100,000)</i>

Other grants related to photosynthesis

84–86	NSF	\$89,000	Metabolic Limitations of Photosynthesis During Water Stress
84–86	USDA	\$100,000	Nitrogen Use Efficiency in Photosynthesis: Responses to Irradiance and Water Stress (PI: CB Osmond)
85	NSF	\$3,000	Phosphate in Chloroplasts (travel grant)
85–87	USDA	\$ 89,000	Stress Effects on the Functioning and Efficiency of CO ₂ Fixation (CoPI)
87–90	DOE	\$140,000	Measurement of Metabolically Active Inorganic Phosphate in Plants
93	Calgene	\$6,600	Measurement of Yield of Transgenic Tomatoes
01–04	Monsanto	\$153,000	Photosynthetic Manipulation for Yield Enhancement
07–10	DOE	\$440,000	GLBRC-1 Manipulation of starch metabolism for biofuels

Funding from NSF for isoprene studies

90–92	NSF	\$75,000	A Study of Isoprene Emissions from Plants
91–97	NSF	\$489,000	Physiology of Isoprene Emission from Plants (two 3-year grants)
99–01	NSF	\$223,000	Regulation of the Capacity for Isoprene Synthesis
02–05	NSF	\$390,405	Molecular Regulation of Isoprene Emission from Plants
07-14	NSF	\$1,030,625	Physiology of Isoprene Emission from Plants (two 3-year grants)
20-24	NSF	\$898,946	<i>IOS - IEP: Isoprene Emission from Plants: An Evolutionary Balancing Act</i>

Other isoprene and related grants

89–90	DOE, NSF	\$28,000	Workshop on Trace Gas Emissions from Leaves
92–92	LADCo	\$74,000	Hydrocarbon Emissions from Corn
92–92	EPA	\$48,000	Improved Isoprene Emission Inventory
93–93	EPA	\$50,000	Oxygenated Hydrocarbons from Plants
94–98	EPA	\$416,000	Isoprene Emission Inventory Studies
98	NSF	\$11,000	Conference: Biogenic Hydrocarbons and the Atmosphere (PI: J. Fuentes)

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98-00	USDA	\$112,000	Temperature and Light Effects on Basal Isoprene Emission Rate
99-00	NSF, EPA	\$23,000	Gordon Conference on Biogenic Hydrocarbons and the Atmosphere
10	DOD	\$25,000	Cloning hemiterpene synthases (pass through from UW-Stevens Point)
11-14	ZuvaChem	\$95,000	Generation of Novel Isoprene Synthases
15-18	SPG	\$478,000	Engineering Cellular Nanoreactors and Three-dimensional Scaffolds for Isoprene Production (Co-PI, Cheryl Kerfeld PI)
17-21	DOE	\$559,213	GLBRC-2 Evaluate and optimize the production of common terpene bioproducts in crops and microbes (Aim 4)(PI Tim Donohue)

Funding for work on heat stress

98-99	NSF	\$70,000	Interaction of the Small Chloroplast Heat-Shock Protein with Photosystem II
00-01	NSF	\$10,000	Gordon Conference on Temperature Stress in Plants
02-04	USDA	\$167,500	Role of ATP Status in Heat Stress Effects on Photosynthesis
04-10	USDA	\$410,000	The Sensing and Signaling of Heat Stress in Chloroplasts
18-21	MSU-PRI	\$205,639	Heat Tolerance of Common Bean Yield

Institutional grants

86-87	NSF	\$100,000	Stimulation of Competitive Research in Biological Sciences at the Desert Research Institute (part of \$1.4M EPSCoR Nevada proposal)
88	NSF	\$95,000	Department of Botany Plant Growth Chamber Facility
93	NSF	\$50,000	Experimental Lighting in the UW Biotron (Written by Ted Tibbitts)
94-98	HHMI	\$1,000,000	Biology Education at UW-Madison (PI, CoPI Doug Maxwell)
13-16	MEDC	\$2,443,000	Michigan Translational Research and Commercialization (M-TRAC)

Abbreviations: EPA, Environmental Protection Agency; GLBRC, Great Lakes Bioenergy Research Center; HHMI, Howard Hughes Medical Institute; LADCo, Lake Michigan Air Directors Consortium; MEDC, Michigan Economic Development Corporation; PRL, MSU-DOE Plant Research Laboratory; MSU-PRI, Plant Resilience Institute; SPG Strategic Partnership Grants from the MSU Foundation

PATENT PUBLICATIONS

Gray D. & Sharkey T.D. (2016) Methyl Butenol Synthase. Patent no. US 9,284,578
Sharkey T.D. & Aspland, S.E. (2013) High Efficiency Isoprene Synthases Produced by Protein Engineering. WO/2013/016591
Sharkey T.D. & Weise S.E. (2012) High Starch Accumulation in Plants. US 2012/0054914 A1
Singsaas E L; Wiberley A E; Sharkey T D. (2011) Producing Isoprene Usefully e.g. to Produce Rubber, Comprises Obtaining a Host Transgenic Microorganism Comprising Transgenes Encoding e.g. Isopentenyl Diphosphate Isomerase, and Observing the Production of Isoprene. US2011039323-A1

PUBLICATIONS

Journal and other publications by year - Books listed at the end

ORCID 0000-0002-4423-3223; Citation analysis at <http://scholar.google.com/citations?user=sstSgW8AAAAJ>, Web of Science/Publons Researcher ID B-4032-2009; ISI H-index = 81 Google Scholar H index = 97, > 39,000 citations

2023

Original research papers

- Khan D, Tatli M, Vazquez J, Weraduwege SM, Stern N, Hebert AS, Trujillo EA, Coon JJ, **Sharkey TD**, Amador-Noguez D (2023) Metabolic engineering of the MEP pathway in *Zymomonas mobilis* to enhance isoprenoid production. *mSystems* in press
- McClain AM, **Sharkey TD** (2023) Rapid CO₂ changes cause oscillations in photosynthesis that implicate PSI acceptor-side limitations. *Journal of Experimental Botany* in press
- Stallknecht EJ, Herrera CK, Yang C, King I, **Sharkey TD**, Lunt RR, Runkle ES (2023) Design of plant-transparent agrivoltaics. *Scientific Reports* 13, 1903. DOI 10.1038/s41598-023-28484-5
- Weraduwege SM, Sahu A, Kulke M, Vermaas J, **Sharkey TD** (2023) Characterization of promoter elements of isoprene-responsive genes, and the ability of isoprene to bind START domain transcription factors. *Plant Direct*, 7, e483. doi.org/10.1002/pld3.483
- McClain AM, Cruz JA, Kramer DM. **Sharkey TD** (2023) The time course of acclimation to the stress of triose phosphate use limitation. *Plant, Cell & Environment* 46, 64-75. doi.org/10.1111/pce.14476

Reviews, chapters, commentaries (peer reviewed)

- Sharkey TD** (2023) The discovery of rubisco. *Journal of Experimental Botany* 74, 510-519 doi: 10.1093/jxb/erac254
- Sharkey TD** (2023) Maximising the efficiency of RuBP (ribulose biphosphate) regeneration to optimise photosynthesis in crops (Chapter 9). In: Understanding and Improving Crop Photosynthesis (ed R. Sharwood), ISBN 978-1-80146-129-0. Burleigh Dodds Science Publishing Limited.

2022

Original research papers

- Weraduwege SM, Frame MK, **Sharkey TD** (2022) Role of guard cell- or mesophyll cell-localized phytochromes in stomatal responses to blue, red, and far-red light. *Planta* 256, 55. DOI 10.1007/s00425-022-03967-3
- Bibik J, Weraduwege SM, Banerjee A, Robertson Ks, Espinoza Corral R, **Sharkey TD**, Lundquist P, Hamberger B (2022) Pathway engineering, re-targeting, and synthetic scaffolding improves production of squalene in plants. *ACS Synthetic Biology* 11: 2121-2133. doi.org/10.1021/acssynbio.2c00051
- Wieloch T, **Sharkey TD** (2022) Compartment-specific energy requirements of photosynthetic carbon metabolism in *Camelina sativa* leaves. *Planta* 255:103 doi.org/10.1007/s00425-022-03884-5
- Xu Y, Wieloch T, Kaste JAM, Shachar-Hill Y, **Sharkey TD** (2022) Reimport of carbon from cytosolic and vacuolar sugar pools into the Calvin-Benson cycle explains photosynthesis labeling anomalies. *Proceedings of the National Academy USA* 119: e2121531119 doi:10.1073/pnas.2121531119
- Wieloch T, **Sharkey TD**, Werner RA, Schleucher J (2022) Intramolecular carbon isotope signals reflect metabolite allocation in plants. *Journal of Experimental Botany* https://doi.org/10.1093/jxb/erac028
- Dani KGS, Pollastri S, Pinosio S, Reichelt M, **Sharkey TD**, Schnitzler, J-P, Loreto, F (2022) Isoprene enhances leaf cytokinin metabolism and induces early senescence. *New Phytologist* 234(3): 961-974 DOI 10.1111/nph.17833

Reviews, chapters, commentaries (peer reviewed)

- Weraduwege SM, Rasulov B, Sahu A, Niinemets Ü, **Sharkey TD** (2022) Isoprene measurements to assess plant hydrocarbon emissions and the methylerythritol pathway. *Methods in Enzymology* vol 676 Biochemical pathways and Environmental Responses in Plants. Jez J editor, 676:211-237

De-la-Peña C, León P, & **Sharkey TD** (2022) Editorial: Chloroplast Biotechnology for Crop Improvement. *Frontiers in Plant Science* 13 <https://www.frontiersin.org/article/10.3389/fpls.2022.848034>

2021

Original research papers

- Gonzalez-Esquer CR, Ferlez B, Wijetilleke SM, Kirst H, Lantz AT, Turmo A, **Sharkey TD**, Kerfeld CA (2021) Validation of an insertion-engineered isoprene synthase as a strategy to improve terpene synthases. *RSC Advances* 11: 29997-30005 <https://doi.org/10.1039/D1RA05710C>
- Santiago JP, Soltani A, Bresson MB, Preiser AL, Lowry DB, **Sharkey TD** (2021) Contrasting anther glucose 6-phosphate dehydrogenase activities between two bean varieties suggest an important role in reproductive heat tolerance. *Plant Cell & Environment* 44: 2185-2199 DOI: <https://doi.org/10.1111/pce.14057>
- Osei-Bonsu I, McClain AM, Walker BJ, **Sharkey TD**, Kramer DM (2021) The roles of photorespiration and alternative electron acceptors in the responses of photosynthesis to elevated temperatures in cowpea. *Plant Cell & Environment* 44: 2290-2307 DOI: <https://doi.org/10.1111/pce.14026>
- Xu Y, Fu X, **Sharkey TD**, Shachar-Hill Y, Walker B (2021) The metabolic origins of non-photorespiratory CO₂ release during photosynthesis: A metabolic flux analysis. *Plant Physiology* 186: 297-314 <https://doi.org/10.1093/plphys/kiab076>
- Poudyal S, Owen JS, **Sharkey TD**, Fernandez RT (2021) Phosphorus requirement for biomass accumulation is higher compared to photosynthetic biochemistry for three ornamental shrubs. *Scientia Horticulturae* 275:109719 DOI: 10.1016/j.scienta.2020.109719

Reviews, chapters, commentaries (peer reviewed)

- Gregory LM, McClain AM, Kramer DM, Pardo JD, Smith KE, Tessmer OL, Walker BJ, Ziccardi LG, **Sharkey TD** (2021). The triose phosphate utilization limitation of photosynthetic rate: Out of global models but important for leaf models. *Plant, Cell & Environment* 44(10): 3223–3226. <https://doi.org/10.1111/pce.14153>
- Sharkey TD** (2021) Pentose phosphate pathway reactions in photosynthesizing cells. *Cells* 10: 1547. <https://doi.org/10.3390/cells10061547>
- Yin X, Busch FA, Struik PC, **Sharkey TD** (2021) Evolution of a biochemical model of steady-state photosynthesis. *Plant Cell Environ* 44: 2811-2837 DOI 10.1111/pce.14070
- Jagadish KSV, Way DA, **Sharkey TD** (2021) Scaling plant responses to high temperature from cell to ecosystem. *Plant, Cell & Environment* 44: 1987-1991 DOI: <https://doi.org/10.1111/pce.14082>
- Jagadish KSV, Way DA, **Sharkey TD** (2021) Plant heat stress: concepts directing future research *Plant Cell Environ* 44: 1992-2005 DOI: <https://doi.org/10.1111/pce.14050>
- Monson RK, Weraduwege SM, Rosenkranz M, Schnitzler J-P, **Sharkey TD** (2021) Leaf isoprene emission as a trait that mediates the growth-defense tradeoff in the face of climate stress. *Oecologia* <https://doi.org/10.1007/s00442-020-04813-7>
- Ely KS, Rogers A, ...**Sharkey TD**...Yang D (83 authors) (2021) A reporting format for leaf-level gas exchange data and metadata. *Ecological Informatics* 61:101232 <https://doi.org/10.1016/j.ecoinf.2021.101232>
- Sharkey T.D.** (2021) Photosynthetic Carbon Dioxide Fixation *Encyclopedia of Biological Chemistry, 3rd Edition*, Jez, J. Ed. p 399-412, ISBN: 9780128194607

2020

Original research papers

- Preiser AL, Banerjee A, Weise SE, Renna L, Brandizzi F, **Sharkey TD** (2020) Phosphoglucosomerase is an important regulatory enzyme in partitioning carbon out of the Calvin-Benson cycle. *Frontiers in Plant Science* 11:580726 doi: 10.3389/fpls.2020.580726
- Sharkey TD**, Preiser AL, Weraduwege SM, Gog L (2020) Source of ^{12}C in Calvin Benson cycle intermediates and isoprene emitted from plant leaves fed with $^{13}\text{CO}_2$. *Biochemical Journal* 477 (17): 3237–3252 DOI: 10.1042/bcj20200480
- Santiago JPM, Ward J, **Sharkey TD** (2020) *Phaseolus vulgaris* SUT1.1 is a high affinity sucrose-proton co-transporter. *Plant Direct* 2020;00:1–11 DOI: 10.1002/pld3.260
- Hu W, Lu Z.; Meng F, Li, X, Cong R, Ren T, **Sharkey TD**, Lu J (2020) The reduction in leaf area precedes that in photosynthesis under potassium deficiency: The importance of leaf anatomy. *New Phytologist* 227(6) 1749-1763 <https://doi.org/10.1111/nph.16644>
- Havko N, Das M, McClain A, Kapali G, **Sharkey TD**, Howe GA (2020) Insect herbivory antagonizes leaf cooling responses to elevated temperature in tomato. *Proceedings of the National Academy USA* 117(4), 2211-2217 DOI: 10.1073/pnas.1913885117 PMID 31964814 PMCID PMC6994973

Reviews, chapters, commentaries (peer reviewed)

- Sharkey T.D.** (2020) Emerging Research in Plant Photosynthesis. *Emerging Topics in Life Sciences* 4: 137–150
- McClain, AM, and **Sharkey TD**. 2020. Building a better equation for electron transport estimated from chlorophyll fluorescence: Accounting for non-photosynthetic light absorption. *New Phytologist* 225: 604-608 DOI: 10.1111/nph.16255 [PMID 31605374](https://pubmed.ncbi.nlm.nih.gov/31605374/)

2019

Original research papers

- Weise S., Liu T, Childs KL, Preiser AL, Katulski, HM, Perrin-Porzondek C, **Sharkey TD** (2019). Transcriptional regulation of the glucose-6-phosphate/phosphate translocator 2 is related to carbon exchange across the chloroplast envelope. *Frontiers in Plant Science* 10: 827 DOI 10.3389/fpls.2019.00827
- Li J, Weraduwege SM, Preiser AL, Weise SE, Strand DD, Froehlich JE, Kramer DM, Hu J, **Sharkey TD** (2019) A cytosolic bypass and G6P shunt in plants lacking peroxisomal hydroxypyruvate reductase. *Plant Physiology*, 180:783–792 DOI 10.1104/pp.19.00256
- Soltani A, Weraduwege SM, **Sharkey TD**, Lowry DB (2019) Elevated temperatures cause loss of seed set in common bean (*Phaseolus vulgaris* L.) potentially through the disruption of source-sink relationships. *BMC Genomics* 20:312 <https://rdcu.be/byw90>
- Preiser AL, Fisher N, Banerjee A, and **Sharkey TD** (2019) Plastidic glucose-6-phosphate dehydrogenases are regulated to maintain activity in the light. *Biochemical Journal* **476**, 1539-1551 <https://doi.org/10.1042/BCJ20190234>
- Lantz AT, Solomon C, McClain AM, Gog L, Weraduwege SM, Cruz JA, **Sharkey TD** (2019) Isoprene suppression by CO_2 is not due to triose phosphate utilization (TPU) limitation. *Frontiers in Forests and Global Change* **2**, 8 doi: 10.3389/ffgc.2019.00008
- Zuo Z, Weraduwege SM, Lantz AT, Sanchez LM, Weise SE, Wang J, Childs KL, **Sharkey TD**. 2019. Expression of isoprene synthase in Arabidopsis alters plant growth and expression of key abiotic and biotic stress-related genes under unstressed conditions. *Plant Physiology* **180**, 124-152 <https://doi.org/10.1104/PP.18.01391>

Reviews, chapters, commentaries (peer reviewed)

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Editor

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- Leegood, R.C., **T.D. Sharkey**, and S. von Caemmerer, eds. *Physiology and Metabolism*, **Vol. 9** of Advances in Photosynthesis, Govindjee, series ed. Kluwer Academic Publishers, Dordrecht, 2000
- Sharkey, T.D.**, E.A. Holland, H.A. Mooney, eds. *Trace Gas Emissions from Plants*, Academic Press, San Diego, 1991

Series editor

- Tcherkez, G. Ghashghaie, J. eds. *Plant Respiration: Metabolic Fluxes and Carbon Balance*, **Vol 43** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer International Publishing AG, Cham, Switzerland, 2018
- Hikosaka, K. Niinemets, Ü. Anten, N.P.R. eds. *Canopy Photosynthesis: From Basics to Applications*, **Vol 42** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2016
- Cramer, W.A. Kallas, T. eds. *Cytochrome Complexes: Evolution, Structures, Energy Transduction, and Signaling*, **Vol 41** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2016
- Demmig-Adams, B., Garab, G., Adams III, W., Govindjee eds. *Non-Photochemical Quenching and Energy Dissipation in Plants, Algae and Cyanobacteria*, **Vol 40** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2015
- Hohmann-Marriott, Martin F. ed. *The Structural Basis of Biological Energy Generation* **Vol 39** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2014
- Zannoni, D. De Phillipis, R. eds. *Microbial BioEnergy: Hydrogen Production*, **Vol 38** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2014

- Hanson, D.T. Rice, S.K. eds. *Photosynthesis in Bryophytes and Early Land Plants*, **Vol 37** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2014
- Biswal, B., Krupinska, K., Biswal, U.C. eds. *Plastid Development in Leaves during Growth and Senescence*, **Vol 36** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2013
- Bock, R. and V. Knoop eds. *Genomics of Chloroplasts and Mitochondria*, **Vol 35** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2013
- Eaton-Rye, J.J., B.C. Tripathy, and **T.D. Sharkey**, eds. *Photosynthesis: Plastid Biology, Energy Conversion and Carbon Assimilation*, **Vol 34** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2012
- Burnap, R.L., W.F.J. Vermaas, eds. *Functional Genomics and Evolution of Photosynthetic Systems*, **Vol 33** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2012
- Raghavendra, A.S., R.F. Sage eds. *C₄ Photosynthesis and related CO₂ Concentrating Mechanisms*, **Vol 32** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2011
- Rebeiz, C.A., C. Benning, H.J. Bohnert, H. Daniell, J.K. Hooper, H.K. Lichtenthaler, A.R. Portis, B.C. Tripathy, eds. *The Chloroplast Basics and Applications*, **Vol 31** of Advances in Photosynthesis and Respiration, Govindjee and **T.D. Sharkey** Series eds. Springer Academic Publications, Dordrecht, 2010

SEMINARS AND PRESENTATIONS (last 10 years)

- 7/22 “Isoprene and the environment” Keynote speaker, Annual Meeting of the Phytochemical Society of North America, Virginia Tech, Blacksburg Virginia
- 6/22 Discussion leader Emerging Sources and Sinks, Gordon Research Conference on Biogenic Hydrocarbons and the Atmosphere, Oxnard California
- 6/22 “Hydrocarbon Emissions from Plants: At the Interface of Biochemistry and Ecology” Presentation at the Research Experiences for Undergraduates Program Michigan State University
- 5/22 “Isoprene signaling and plant resilience to climate change”, Interdisciplinary Plant Group Symposium, University of Missouri
- 4/22 “Isoprene signaling and plant resilience to climate change” Cornell School of Integrative Plant Science Plenary Seminar
- 3/21 “Photosynthetic carbon metabolism: Roles of gluconeogenesis and pentose phosphate pathways”, 1 hr lecture, Istanbul University 18th Winter School
- 2/21 “Shining light on the dark reactions of photosynthesis” Texas Tech University (by Zoom)
- 11/19 “Will global climate change affect isoprene emission from plants?” Institut für Bio- und Geowissenschaften, Jülich
- 11/19 “Will global climate change affect isoprene emission from plants?” Heinrich-Heine-Universität Düsseldorf
- 10/19 “Will global climate change affect isoprene emission from plants? Western University, London, Ontario
- 9/19 “How will global climate change affect isoprene emission from plants?”, John Innes Centre, Norwich
- 8/19 “Isoprene emission affects growth-defense tradeoffs in plants” ASPB, San Jose
- 3/19 “Recent Insights into the Calvin-Benson Cycle and Related Metabolism of Photosynthesis” Invited Seminar, Dept. Horticulture, MSU
- 9/18 “Auxiliary pathways of the Calvin-Benson cycle”, Estonian University of Life Sciences
- 7/18 “Elaborations of the Calvin-Benson cycle: Historical concerns and new insights”, International Society of Photosynthesis Research 2018 meeting, Montreal
- 1/18 “Elaborations of the Calvin-Benson Cycle: Historical Concerns and New Insights”, Western Photosynthesis Conference, Biosphere2, Arizona

- 11/17 “What Gas Exchange Measurements Tell Us About Photosynthesis Metabolism”, Invited talk, Washington State University
- 10/17 “Carbon Export from the Calvin-Benson Cycle”, Invited talk, Greenhouse Gas Flux Workshop, Potsdam, Germany
- 10/17 “Carbon Export from the Calvin-Benson Cycle”, Invited talk, Max Planck Institute for Molecular Plant Physiology, Golm, Germany
- 6/16 Diversity of Sources, Sinks, and Impacts of Atmospheric Organics, Keynote session discussion leader, Gordon Research Conference, Girona, Spain
- 10/16 “The Calvin-Benson Cycle in a Stochastic Light Environment”, 25 min talk, Montana State University, USDA NC1200 project report
- 11/15 “The Calvin-Benson Cycle of photosynthesis: historical insights and new hypotheses”, Seminar, Western Michigan University
- 6/15 “The glucose 6-phosphate shunt around the Calvin-Benson Cycle”. Invited talk, Steven Long symposium, University of Essex, Colchester, UK
- 6/15 “Building toward an understanding of the mechanism of action of isoprene” Invited talk, Terpnet 2015, Vancouver, Canada
- 4/15 “Isopentenyl Diphosphate Inhibition of Thiamin Diphosphate Enzymes, Especially Deoxyxylulose 5-Phosphate Synthase” Invited talk, ASBMB national meeting, Boston, MA
- 3/15 “The glucose 6-phosphate shunt around the Calvin-Benson Cycle: Connecting carbon metabolism and cyclic photophosphorylation.” Invited seminar, Univ. Illinois
- 10/14 “When photosynthesis becomes insensitive to CO₂ – what triose-phosphate-use tells us about photosynthetic metabolism”, Invited speaker, PRL Retreat
- 7/14 “Exploring chloroplast terpene metabolism using metabolomics of isoprene synthesis” Third International Conference on Plant Metabolism, Xiamen, China
- 7/14 “Why plants make so much isoprene?” Invited seminar, Nanjing University
- 6/14 “Control of Carbon metabolism”, Gordon Conference,
- 5/14 “Molecular and metabolic understanding of isoprene emission from trees” Molecular and Environmental Plant Sciences Symposium. TAMU College Station Texas
- 6/13 “Isoprene Synthase Genes Form a Monophyletic Clade of Acyclic Terpene Synthases in the Tps-B Terpene Synthase Family” Terpnet, Crete
- 3/13 “Recent Insights into Isoprene Synthesis” Eurovol Conference on Plant Terpenoids, Florence
- 11/12 “Engineering End Products of Photosynthesis To Increase Yield and Efficiency” AgBioResearch Brazil workshop, East Lansing
- 10/12 “High Temperature Effects on Photosynthesis and Protection by Isoprene” Academia Sinica, Tapei, Taiwan
- 5/12 “Omics of Isoprene Emission from Plants” Interdisciplinary Plant Group, Univ. Missouri, Columbia
- 12/11 “Novel Isoprene Synthases” ZuvaChem presentation, Baltimore, MD
- 5/11 “Optimizing End Products of Photosynthesis To Increase Yield and Efficiency” Gordon Research Conference, Les Diableret, Switzerland
- 8/10 “Leaf Starch Metabolism in C₃, C₄, and CAM Plants and Molecular Approaches to Engineering” Invited talk, International Photosynthesis Congress, Beijing
- 8/10 “Biology and Chemistry of Isoprene” Chinese Academy of Science, Shanghai
- 5/10 “BVOC Research: Past, Present, and Future” Gordon Research Conference *Biogenic Hydrocarbons and the Atmosphere*. Switzerland
- 1/10 “Improved Isoprene Synthases” Invited talk, ZuvaChem Inc. Baltimore MD
- 11/09 “Isoprene and Methyl Butenol: Biology, Biochemistry, and Molecular Biology” Invited seminar, Genencor, Palo Alto CA
- 8/09 “The frustrating biology underlying isoprene emission models” Talk at Gordon Conference on Atmospheric Chemistry
- 5/09 “The Evolution of Methylbutenol Emission in Pinus” Poster at Terpnet meeting, Tokyo, Japan

Thomas D. Sharkey c.v.

5/09 "Increasing the Yield of Starch and other Easily Degraded Polymers in Leaves" Invited talk at GLBRC retreat
2/09 "Leaf Starch Mobilization" Invited seminar, Washington State University