***Curriculum Vitae***

**David Mark Kramer, Ph.D.**

**Hannah Distinguished Professor**

**Department of Biochemistry and Molecular Biology**

**MSU-DOE-Plant Research Lab**

**Michigan State University, East Lansing, MI 48824**

## Education

Department of Biology, University of Dayton, Ohio B.S., Biology 1984

Department of Biology, University of Dayton, Ohio M.S., Cell Biology 1986

Department of Physiology and Biophysics,

University of Illinois, Urbana, Illinois Ph.D., Biophysics 1990

## Positions

2013- Founder and Director of MSU Center for Advanced Algal and Plant Phenotyping

2010- Hannah Distinguished Professor, MSU-DOE Plant Research Lab and Department of Biochemistry, Michigan State University

2006 Visiting scientist, Laboratoire de Bioénergétique et Ingénierie des Protéines

Institut de Biologie Structurale et Microbiologie, CNRS, France

2005-2008 Chair, Graduate Program in Molecular Plant Sciences

2004- Professor/Fellow, Institute of Biological Chemistry, Washington State University, Pullman, WA. Associate Faculty, School of Molecular Biosciences, Washington State University Associate Faculty, Department of Chemistry, Washington State University

2000- Associate Professor/Associate Fellow, Institute of Biological Chemistry, Washington State University, Pullman, WA

Associate Faculty, School of Molecular Biosciences, Washington State University

Associate Faculty, Department of Chemistry, Washington State University

1995- Assistant Professor/Assistant Fellow, Institute of Biological Chemistry, Washington State University, Pullman, WA

Graduate Faculty, Biochemistry/Biophysics and School of Molecular Biosciences, Washington State University, Pullman, WA

1994-95 Research Assistant Professor of Biophysics, U. of Illinois

1993-94 NSF/NATO Postdoctoral Fellow, Institute de Biologie Physico-Chimique, Paris

1991-93 Postdoctoral Research Associate, Biophysics Division, University of Illinois, Urbana-Champaign

1990-91 McKnight Foundation Postdoctoral Fellow, Dept. of Physiology and Biophysics, University of Illinois, Urbana-Champaign

1988-90 McKnight Research Fellow, Department of Physiology and Biophysics, University of Illinois , Urbana-Champaign.

1987-88 Graduate Research Assistant, University of Illinois

1986-87 Research Assistant, Battelle-C. F. Kettering Research Laboratory, Yellow Springs, Ohio.

1984 Research Assistant, Biology Department, University of Dayton, Dayton, Ohio.

### Honors, Awards and Fellowships

2016 Charles F. Kettering Award for Photosynthesis Research, American Society for Plant Biology “This award was established by an endowment from the Kettering Foundation in 1962 to recognize excellence in the field of photosynthesis.”

2016 Innovation Award, International Society for Photosynthesis Research

“The Award recognizes outstanding achievement in the transfer of photosynthesis research to the benefit of society at large, enhancing the visibility of the discipline in the process.”

2016 Plenary Lecture: 17th International Congress of Photosynthesis (Maastricht, The Netherlands, August, 2016

2016 Keynote Address: ENCAPP (European Networks on Algal and Plant Photosynthesis), April, 2016

2016 Plenary Lecture: European Bioenergetics Conference, July, 2016, Italy

2016 Plenary Lecture: Pan African Grain Legume and World Cowpea Conference, Livingstone, Zambia, Feb., 2016

2015 MSU Academy for Global Engagement

2015 White House Office of Science and Technology Policy (2015) Raising the Profile of Agriculture panel member,

2014-16 MSU Global Innovation Fellow

2014 Chair, Gordon Conference on Photosynthesis

2013 MSU Global Founding Innovation Fellow (<http://msuglobal.com/2013/12/msuglobal-names-2013-14-innovation-fellows/>)

2013 External Advisory Committee, Department of Energy, Energy Frontier Research Center grant, Donald Danforth Plant Science Center-led “Center for Algal Bioenergy Systems”

2012 Keynote Lecture: France Society of Photosynthesis Research Congress

2012 Annals of Botany Lecture

2010 Patriotic Employer Award, Washington National Guard

2010 Keynote Speaker, Fourth International Symposium on Signals, Sensing and Plant Primary Production, Potsdam 10/2010

2010 External Advisory Committee, Department of Energy, Energy Frontier Research Center grant, ASU has established the Center for Bio-Inspired Solar Fuel Production, Arizona State University

2010 Keynote speaker, 10th Nordic Photosynthesis Congress in Tartu, Estonia

2009 Keynote speaker, Integrated Plant Sciences Retreat, Feb., 2009 Washington State University

2009WSU Innovator Award, Washington State. October 20, 2009

2008 Plenary Lecture, Arizona Symposium on Renewable Energy

2007 Plenary Lecture, International Congress on Photosynthesis

2006 Washington Technology Tour (TVW)

1997 Herman Frasch Young Investigator Award

1995 Distinguished visiting scientist, CNR, Italy

1993 College de France Lecturer

1992 NATO-NSF Post-doctoral Fellow

1991 McKnight Foundation Postdoctoral Fellow

1987 McKnight Foundation Graduate Fellows

1979 Scholarship for Academic Excellence, U. of Dayton,

1979 Hallmark Award for fine arts

**Editorial**

1998-2001 Editorial Board, Archives of Biochemistry and Biophysics

2006-2009 Editorial Board, Plant Science

2006- Editorial Board, Plant Cell and Environment

2007- Coordinating Editor, Photosynthesis Research

2011- Review Editor, Frontiers in Plant Biology

2012- Editorial Board, Algal Research

2014- Editorial Board, New Negatives in Plant Science

**Selected Academic Service**

1999-2000 Biochemistry/Biophysics graduate enrollment selection committee

1995-2000 Chair of Plant Biology Research Training Grant and Plant Physiology Seminar series selection committee

1997 Search Committees for Assistant Professor at IBC (1997)

1996 Biotechnology Curriculum Committee, WSU

1997-1998 Plant Physiology Program graduate enrollment selection committee

1999 Organizer, Photosynthesis section of 1999 Summer Plant Biochemistry Course (Pullman, WA)

2001 Organizer, Photosynthesis section of 2001 Summer Plant Biochemistry Course (Pullman, WA)

2002-2005 Chair, Web site committee for IBC and the Plant Physiology program

2005 Initiated Molecular Biophysics option in the School of Molecular Biosciences at WSU

2005-2008 Chair, Graduate Program in Molecular Plant Sciences

2005 Tenure and Promotion committee (WSU)

2006-2010 Chair and Organizer, WSU Integrative Plant Sciences Retreat

2005-2009 Chair, Molecular Plant Sciences graduate student recruitment Committee (WSU)

2007-2008 Graduate Committee on Interdisciplinary Education (WSU)

2007-2010 Director, WSU Global Plant Sciences Initiative

2008-2010 Director, Molecular Plant Sciences Area of Excellence in Plant Energy and Productivity

2006-2010 Served on three WSU faculty mentoring committees

1996 Assistant/Associate/Full Professor, Institute of Biological Chemistry, WSU

2003 Search Committee Chair, School of Molecular Biosciences, NMR Center Position

2005 Search Committee, Assistant/Associate/Full Professor, Assistant/Associate/Full Professor search, Institute of Biological Chemistry

2003 Search Committee Chair, School of Molecular Biosciences, Biochemistry search

2006 Search Committee, Assistant/Associate, Institute of Biological Chemistry

2007 Search Committee, Assistant/Associate, Institute of Biological Chemistry

2008-2010 Vice President’s committee for Research Infrastructure (WSU)

2011 Chair, Faculty search committee (PRL, MSU)

2012 Chair, Faculty search for Assistant or Associate Professor, Plant Research Lab

2012- Director, Center for Advanced Algal and Plant Phenotyping

2103- Faculty Mentoring Committee (PRL, MSU)

2014 PRL Retreat Organizer (PRL, MSU)

2015 Chair Search Committee for PRL Director (PRL, MSU)

2015- Personal Affairs Committee Chair (PRL, MSU)

2016 Search Committee, Global Impact Initiative GII Quantitative & Computational Plant Sciences Cluster Hire (MSU)

**Grant Support (chronological order)**

**Photosynthesis in Intact Plants**

U.S. Department of Energy (Co-PI with A.R. Crofts)

$483,177

8/15/95-8/14/98

**Control and Regulation of Photosynthesis**

U.S. Department of Agriculture/Washington State Funds

$64,000

12/31/97-12/31/05

**Inhibition of chloroplast cytochrome b6f complex by metals:**

**Agricultural, physiological and biochemical significance**

Frasch Young Investigator Award, American Chemical Society

$157,000

7/1/97-6/30/02

**The Energy Budget of Steady-State Photosynthesis**

U.S. Department of Energy

$296,000

7/1/98-6/3/01

**Field Deployable, Real‑Time Sensors for Early Detection of Crop Stress**

Motorola, Inc

$187,010

08/16/98-12/31/01

**Critical roles of transthylakoid pH in the energetics and regulation of photosynthesis**

National Science Foundation

$100,000

4/15/99-4/14/01

**Photosynthetic Electron Transfer in Cold-Tolerant and Cryophilic Algae**

U.S. Department of Agriculture

$96,600

10/96-9/99

**Understanding and Controlling Specific Gravity in Potatoes**

Washington State Potato Commission

$22,611

3/1/99-4/28/00

**Early Detection of Crop Stress Using in Vivo Spectroscopy**

Motorola, Inc

$89,000

1/1/00-12/31/00

**Crop Microwave Moisture Meter**

Motorola, Corp.,

$5,000

1/1/00-12/31/00

**The Energy Budget of Steady-State Photosynthesis (Renewal)**

U.S. Department of Energy

$316,607

7/1/01-6/3/04

**An Annotated Portable Non-focusing Optics Spectrophotometer (NoFOSPec) for Non-invasive field Measurements of Plant Physiological Status.**

Motorola, Inc.

$60,000

2/10/01-2/9/02

**Regulation of the Light and Dark Reaction of Photosynthesis**

U.S. Department of Agriculture/Washington State Funds

$64,000

1/01/06-12/31/07

**Detection of crop stress using portable photosynthesis monitors**

Motorola, Inc

$30,000

10/02-10/03

**Exploration of metal binding and protein domain contributions to catalysis**

National Institutes of Health **(**NIH, via subcontract from Pacific Northwest National Laboratories) Co-PI with Dr. Michael Bowman

$1,058,721

1/1/02-12/31/05

**Protein Biotechnology Training Grant**

National Institutes of Health

(with 28 others)

$2,150,353

07/01/04-06/30/09

**The Energy Budget of Steady-State Photosynthesis (Renewal)**

U.S. Department of Energy

$550,781

7/1/04-6/3/08

**Integrated Plant Sciences Retreat**

Washington State University Office of Research, ‘Initiation of Collaboration Grant’

$12,000

1/1/06-12/31/06

PI with 5 other co-PIs

**Tanalyzer-A hands-on tannin analyzer**

State of Washington Technology Gap Funding

$42,295

1/3/06-6/31/06

**Accelerated Research Ph.D. Program in Molecular Plant Sciences**

Competitive Washington State Program in Graduate Education

$246,240

9/1/08-8/31/10

**Global Plant Sciences Initiative at WSU**

Anonymous private donor

$560,000

1/1/08-12/31/12 (my participation ended when I left WSU)

**Protein Biotechnology Training Grant (renewal)**

National Institutes of Health

(with 28 others)

$2,900,000

7/01/09-06/30/14 (my participation ended when I left WSU)

**Accelerated Research Ph.D. Program in Molecular Plant Sciences**

Competitive Washington State Program in Graduate Education

$1,108,080

9/1/06-8/31/12 (my participation ended when I left WSU)

**Integrated Plant Sciences Retreat**

Washington State University Office of Research, ‘Initiation of Collaboration Grant’

$48,000

1/1/08- 12/31/12

**U.S. Department of Energy Interdisciplinary Research and Training in the Plant Sciences**

$8M total award to PRL

06/16/10-08/31/11

**Regulation of the Light and Dark Reaction of Photosynthesis**

U.S. Department of Agriculture/Washington State Funds

$64,000

1/01/08-12/31/11

**Rieske Headgroup Cytochrome Complexes - Metal Ion Probes Membrane Protein Structure and Function**

National Institutes of Health (Co-PI with Dr. Michael Bowman)

$2,057,830

1/1/06-12/31/11

**The Energy Budget of Steady-State Photosynthesis**

U.S. Department of Energy

$540,000

7/1/08-6/30/11

**Co-regulation of the Light and Dark Reactions of Photosynthesis**

USDA, Plant Biology (C): Biochemistry

$400,000

1/01/09-12/31/12

**Biofuels Prospects: *Aegilops Cylindrica* (Jointed Goatgrass)**

USDA (Co-PI with four others)

$243,536

8/1/11-7/30/13

**The National Alliance for Advanced Biofuels and Bioproducts– an Algal Biofuels** Consortium (Lead Consortium Lead: The Donald Danforth Plant Science Center, Executive Director: Jose Olivares, Los Alamos National Lab and Donald Danforth Plant Science Center) (RC100028)

$49,000,000 ($660,000 to MSU)

4/1/10-6/30/13

**Photosynthetic Phenotyping Array (PPA): A new direction for plant sciences**

RAGE equipment program, Washington State

$246,000 (with 3 Co-P.I.s)

**Using chloroplast thylakoid membrane structure as a probe of energy storage**

U.S. Department of Energy

User proposal for Small Angle Neutron Scattering Facility

ORNL Neutron Sciences

1/1/11-5/1/2011 (ORNL facilities)

**Plant Research Laboratory: Interdisciplinary Research and Training in the Plant Sciences** U.S. Department of Energy

$760,000 direct funds from total award of ~ $7Mto PRL

06/16/10-08/31/13

**Plug and Play Photosynthesis for RuBisCO Independent Fuels**

National Science Foundation (RC100150)

$3.6M for 7 co-P.I.s, $300,599 to MSU

06/01/11-05/31/14

**Center for Advanced Camelina Oil (CECO)**

ARPA-E, U.S. Department of Energy (RC101328)

$9.3M (with 5 co-P.I.s, $860,000 to MSU)

1/1/12-12/31/14

**MSU Center for Advanced Algal and Plant Phenotyping**

Michigan State funds

$5.0M (With 24 participants)

2012-2017

**The Energy Budget of Steady-State Photosynthesis**

U.S. Department of Energy (RC100185)

$690,000

9/1/12-8/31/15

**Exceeding Evolution in Photosynthesis (Photosynthesis Ideas Lab Meeting)**

National Science Foundation (RC102287)

$56,000

10/1/12-3/1/13

**Photosynthetic Energy Capture, Conversion and Storage: From Fundamental Mechanisms**

**to Modular Engineering**

U.S. Department of Energy, Basic Energy Sciences (RC063200)

Co-P.I. with ten others

$7.5M

4/1/14-3/30/17

**Center for Advanced Camelina Oil (CECO) (1-year extension)**

ARPA-E, U.S. Department of Energy (RC101328)

$1.4M (with 5 co-P.I.s, $860,000 to MSU)

1/1/14-12/31/15

**Collaborative Research:** **Plug and Play Photosynthesis for RuBisCO Independent Fuels**

National Science Foundation (RC103769) (Renewal)

$3.6M for 7 co-P.I.s, $459,999 to DMK

06/01/14-05/31/17

**2014 Photosynthesis Gordon Research Conference**

DOE Basic Energy Sciences

$10,000

8/2014

**2014 Photosynthesis Gordon Research Conference**

National Science Foundation

$14,060

8/2014

**2014 Photosynthesis Gordon Research Conference**

Funds from 10 Corporations and Societies (BASF, Inc.; LiCor, Inc.; Agrisera; Benson-Hill BioSystems, Inc.; BioChambers, Inc.; Elsevier Science, Ltd.; ExxonMobil Inc.; Geneva Scientific; International Society of Photosynthesis Research; Opotek, Inc.;

Total: $51,102

8/2014

**USAID Global Center for Food Systems Innovation: MultispeQ: A Deployable Sensor for the PhotosynQ Network to Enable Critical Plant and Soil Measurements for Breeders in East Africa** (RC102194-PHOTO)

Agency for International Development

$100,000

3/14-3/15

**MultispeQ: Photosynthetic Energy Capture, Conversion and Storage: From Fundamental Mechanisms to Modular Engineering** (RC104313)

McKnight Foundation

$300,000

09/01/14-08/30/16

**Realization of Algae Potential (REAP)**

U.S. Department of Energy, Advancements in Algal Biomass Yield (ABY) Program

(P. Lammers, NMSU, lead, (MSU project funded by sub-contract to DMK) (RC104632)

$120,000

9/14-8/15

**Venture Development Workshop**

VentureWell (RC104641)

$5,000

01/01/15-08/31/15

**MSU-EMRE Collaboration**

ExxonMobil Chemical Co. (RC104821)

$1,000,000

04/01/15-03/31/17

**ABI Innovation: A New Framework to Analyze Plant Energy-related Phenomics Data**

National Science Foundation (RC104995)

$641,429

10/01/15-09/30/18

**Scalable and Sustainable Biological Solutions for Pest Management of Insect Pests of Cowpea in Africa**

Agency for International Development

$498,108

3/10/15-09/30/17

**Legume Scholars Program Graduate Training Cohort 2015**

Agency for International Development

$213,810

08/16/15-08/15/19

**G Protein Regulation of Energy Perception, Conversion and Storage (sub-award)**

U.S. Department of Energy, Basic Energy Sciences

39,288

**The Dynamic Energy Budget of Photosynthesis**

U.S. Department of Energy (renewal of RC100185)

$690,000

9/1/16-8/31/19

Application of high throughput phenotyping tools for photosynthetic traits to select heat tolerant beans

USAID US-CGIAR Linkage Program

$25,000

**Pending**

**Distributed Plant Phenotyping for Proscriptive Analytics using the PhotosynQ Platform** (pending)

McKnight Foundation

$300,000 (pending)

**Plant Phenotyping for Proscriptive Analytics using the PhotosynQ Platform** (concept note submitted)

U.S. Department of Energy, ARPA-E

$500,000 (pending)

**Contributions to disseminating scientific technologies**

**WSU Advanced Biochemical Instrumentation Center** **(1997-2010)** was established at WSU to develop new instrumentation for biochemical applications. This group developed at more than 12 instruments for work in WSU and external laboratories.

**WSU Electron Paramagnetic Resonance (EPR) Center (1999-2010)** was established to oversee the two on-campus EPR spectrometers.

**Center for Advanced Algal and Plant Phenomics (CAAPP, 2012-)** Founder, P.I. and Director. CAAPP was established at MSU to develop and apply new, high throughput tools to understand the efficiency of plant and algal photosynthesis.

**PhotosynQ.org. (2013-)** Founder and Director. This Company was established in 2015 to manufacture, distribute and service the PhotosynQ.org devices, contract data analysis and catalyze new research directions.

**Phenometrics, Inc. (**[**www.phenometricsinc.com**](http://www.phenometricsinc.com)**)** Founder and Scientific Advisor, Established in 2010.

**Publications** (**H-index = 51 (Google Scholar)**; **I-10 index = 110; Citations = 7207)**

**Submitted**

[1] L.R. Carrillo, J.E. Froehlich, J.A. Cruz, L. Savage., D.M. Kramer (2016) The chloroplast NADPH thioredoxin reductase C (NTRC) is required for redox regulation of the chloroplast ATP synthase specifically under low irradiance. **Proc. Natl Acad Sci USA** submitted.

[2] J. Cruz, L. Savage, R. Zegarac, W.K. Kovac, C.C. Hall, J. Chen, D.M. Kramer (2016) Dynamic Environmental Photosynthetic Imaging (DEPI): Continuous monitoring of genetic variations in photosynthetic response under dynamic growth environments. **Cell Systems** submitted (in revisions).

[3] G.A. Davis, A. Kanazawa, M.A. Shoettler, K. Kohzuma, J.E. Froehlich, M. Satoh-Cruz, D. Minhas, A. Dhingra, D.M. Kramer (2016) Limitations to photosynthetic efficiency caused by proton motive force-mediated Photosystem II photodamage **Science Advances** submitted.

[4] K. Kohzuma, J.E. Froehlich, J.A. Temple, D. Minhas, J.A. Cruz, A. Kanazawa, D.M. Kramer (2016) The role of light-dark regulation of the chloroplast ATP synthase. **Plant Journal** submitted (in revisions).

[5] D.D. Strand, N. Fisher, D.M. Kramer (2016) The higher plant plastid complex I (NDH) is a reversible proton pump that increases ATP production by cyclic electron flow around photosystem I. **eLife** submitted (in revisions).

[6] D.D. Strand, A.K. Livingston, M. Satoh-Cruz, T. Koepke, H.M. Enlow, N. Fisher, J.E. Froehlich, J.A. Cruz, D. Minhas, K.K. Hixson, K. Kohzuma, M. Lipton, A. Dhingra, D.M. Kramer (2016) Defects in expression of chloroplast proteins leads to H2O2 accumulation and activation of cyclic electron flow around photosystem i. **Biochim Biophys Acta** submitted (In revisions).

[7] D. TerAvest, G. Austic, S. Kuhlgert, R. Zegarac, P. Weebadde, D.M. Kramer (2016) PhotosynQ: Community-driven plant phenotyping for understanding plant responses to environment. **submitted**.

[8] L. Xu, Y. Yang, J. Cruz, L. Savage, D. Kramer, C. J (2016) PhenoCurve: Inter-functional analysis on dynamic phenotype-environment relationships in plants. **Bioinformatics** Submitted.

[9] S. Kuhlgert, G. Austic, R. Zegarac, I. Osei-Bonsu, W. Prabode, D. TerAvest, D.M. Kramer (2016) MultispeQ – A tool for large-scale plant phenotyping connected to the PhotosynQ network. **Frontiers in Plant Science** submitted.

**Published (Peer-reviewed Journals)**

[10] Q. Gao, E. Ostendorf, J.A. Cruz, R. Jin, D.M. Kramer, J. Chen (2016) Inter-functional analysis of high-throughput phenotype data by non-parametric clustering and its application to photosynthesis. **Bioinformatics** 32, 67-76.

[11] N. Fisher, M.K. Bowman, D.M. Kramer, Electron transfer reactions at the Qo site of the cytochrome bc1 complex: the good, the bad, and the ugly, in: T. Kallas, W.A. Cramer (Eds.), Cytochromes and Cytochromes Complexes, vol. In Press, 2016.

[12] M. Agostoni, B.F. Lucker, M. Smith, A. Kanazawa, G.J. Blanchard, D.M. Kramer, B.L. Montgomery (2016) Competition-based phenotyping reveals a fitness cost for maintaining phycobilisomes under fluctuating light in the cyanobacterium *Fremyella diplosiphon* **Algal Research** In Press.

[13] L. Xu, J.A. Cruz, L.J. Savage, D.M. Kramer, J. Chen (2015) Plant photosynthesis phenomics data quality control. **Bioinformatics** 31, 1796-1804.

[14] O. Tsabari, R. Nevo, S. Meir, L.R. Carrillo, D.M. Kramer, Z. Reich (2015) Differential effects of ambient or diminished CO2 and O2 levels on thylakoid membrane structure in light-stressed plants. **Plant Journal** 81, 884-894.

[15] D.D. Strand, A.K. Livingston, M. Satoh-Cruz, J.E. Froehlich, V.G. Maurino, D.M. Kramer (2015) Activation of cyclic electron flow by hydrogen peroxide in vivo. **Proceedings of the National Academy of Sciences** 112, 5539-5544.

[16] D.D. Strand, N. Fisher, D.M. Kramer, Cyclic electron flow in chloroplasts, in: H. Kirchhoff (Ed.), Chloroplasts: Current Research and Applications, vol. In Press, Horizon Press, 2015.

[17] H. Scharr, M. Minervini, A.P. French, C. Klukas, D.M. Kramer, X. Liu, I. Luengo, J.-M. Pape, G. Polder, D. Vukadinovic (2015) Leaf segmentation in plant phenotyping: a collation study. **Machine vision and applications**, 1-22.

[18] M.T. Juergens, R. Deshpande, B.F. Lucker, J.J. Park, H. Wang, M. Gargouri, F.O. Holguin, B. Disbrow, T. Schaub, J.N. Skepper, D.M. Kramer, D.R. Gang, L.M. Hicks, Y. Shachar-Hill (2015) The Regulation of Photosynthetic Structure and Function During Nitrogen Deprivation in Chlamydomonas reinhardtii. **Plant Physiol** 167, 558-573.

[19] S. Dutta, J.A. Cruz, Y. Jiao, J. Chen, D.M. Kramer, K.W. Osteryoung (2015) Non‐invasive, whole‐plant imaging of chloroplast movement and chlorophyll fluorescence reveals photosynthetic phenotypes independent of chloroplast photorelocation defects in chloroplast division mutants. **The Plant Journal** 84, 428-442.

[20] J.A. Cruz, X. Yin, X. Liu, S.M. Imran, D.D. Morris, D.M. Kramer, J. Chen (2015) Multi-modality imagery database for plant phenotyping. **Machine Vision and Applications**, 1-15.

[21] X. Yin, X. Liu, J. Chen, D.M. Kramer, Multi-leaf alignment from fluorescence plant images, IEEE Conference on Applications of Computer Vision (WACV’14) (Peer reviewed), Steamboat Springs, CO 2014.

[22] X. Yin, X. Liu, J. Chen, K. D.M., Multi-leaf tracking from fluorescence plant videos IEEE International Conference on Image Processing (ICIP’14) (Peer reviewed), Paris, France, 2014.

[23] B.J. Walker, D.D. Strand, D.M. Kramer, A.B. Cousins (2014) The response of cyclic electron flow around photosystem I to changes in photorespiration and nitrate assimilation. **Plant physiology** 165, 453-462.

[24] B. Tamburic, S. Guruprasad, D.T. Radford, M. Szabó, R.M. Lilley, A.W. Larkum, J.B. Franklin, D.M. Kramer, S.I. Blackburn, J.A. Raven (2014) The effect of diel temperature and light cycles on the growth of Nannochloropsis oculata in a photobioreactor matrix. **PloS one** 9, e86047.

[25] W. Sun, N. Ubierna, J.-Y. Ma, B.J. Walker, D.M. Kramer, A.B. Cousins (2014) The Coordination of C4 Photosynthesis and the CO2-Concentrating Mechanism in Maize and Miscanthus× giganteus in Response to Transient Changes in Light Quality. **Plant physiology** 164, 1283-1292.

[26] D.D. Strand, D.M. Kramer, Control of non-photochemical exciton quenching by the proton circuit of photosynthesis, Non-Photochemical Quenching and Energy Dissipation in Plants, Algae and Cyanobacteria, Springer Netherlands, 2014, pp. 387-408.

[27] B.F. Lucker, C.C. Hall, R. Zegarac, D.M. Kramer (2014) The environmental photobioreactor (ePBR): An algal culturing platform for simulating dynamic natural environments. **Algal Research** 6, 242-249.

[28] H.-H. Kunz, M. Gierth, A. Herdean, M. Satoh-Cruz, D.M. Kramer, C. Spetea, J.I. Schroeder (2014) Plastidial transporters KEA1,-2, and-3 are essential for chloroplast osmoregulation, integrity, and pH regulation in Arabidopsis. **Proceedings of the National Academy of Sciences** 111, 7480-7485.

[29] A. Kanazawa, G.J. Blanchard, M. Szabó, P.J. Ralph, D.M. Kramer (2014) The site of regulation of light capture in Symbiodinium: Does the peridinin–chlorophyll a–protein detach to regulate light capture? **Biochimica et Biophysica Acta (BBA)-Bioenergetics** 1837, 1227-1234.

[30] Y.J. Im, C.M. Smith, B.Q. Phillippy, D. Strand, D.M. Kramer, A.M. Grunden, W.F. Boss (2014) Increasing phosphatidylinositol (4, 5)-bisphosphate biosynthesis affects basal signaling and chloroplast metabolism in Arabidopsis thaliana. **Plants** 3, 27-57.

[31] N. Fisher, D.M. Kramer (2014) On the origin of ferredoxin-induced fluorescence changes in thylakoids. **BBA-Bioenergetics**, e121.

[32] N. Fisher, D.M. Kramer (2014) Non-photochemical reduction of thylakoid photosynthetic redox carriers in vitro: Relevance to cyclic electron flow around photosystem I? **Biochimica et Biophysica Acta (BBA)-Bioenergetics** 1837, 1944-1954.

[33] E. Attaran, I.T. Major, J.A. Cruz, B.A. Rosa, A.J. Koo, J. Chen, D.M. Kramer, S.Y. He, G.A. Howe (2014) Temporal dynamics of growth and photosynthesis suppression in response to jasmonate signaling. **Plant Physiology** 165, 1302-1314.

[34] U. Armbruster, L.R. Carrillo, K. Venema, L. Pavlovic, E. Schmidtmann, A. Kornfeld, P. Jahns, J.A. Berry, D.M. Kramer, M.C. Jonikas (2014) Ion antiport accelerates photosynthetic acclimation in fluctuating light environments. **Nat Comm** 5, 5439.

[35] P.R. Vennam, N. Fisher, M.D. Krzyaniak, D.M. Kramer, M.K. Bowman (2013) A Caged, Destabilized, Free Radical Intermediate in the Q‐Cycle. **Chembiochem : a European journal of chemical biology** 14, 1745-1753.

[36] N. Ubierna, W. Sun, D.M. Kramer, A.B. Cousins (2013) The efficiency of C4 photosynthesis under low light conditions in Zea mays, Miscanthus x giganteus and Flaveria bidentis. **Plant, Cell & Environment** 36, 365-381.

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**Publically available software packages and computational approaches: (2010-)**

* DEPItrol [6] (control software for the DEPI instrument)
* Visual Phenomics (dynamic environment phenotype visualization package) [7]
* PhenoMath (integrative analyses of photosynthetic phenotypes) [8]
* OLIVER (multi-dimensional visualization of photosynthetic phenotypes) [9]
* CAAPP-LIMS. The high throughput data afforded by DEPI requires careful experimental planning and record keeping. We have thus developed a Laboratory Information Management System (LIMS) to record the complete history of each plant, from its genomic information, to its planting and growth conditions, to its ultimate phenotypic behaviors. This tool is available on-line to the community of MSU researchers to plan experiments and track the results.
* PhotosynQ-App Android App for control of PhotosynQ MultispeQ instrument in the field (www.photosynq.org)
* PhotosynQ-Chrome, Chrome App for control of PhotosynQ MultispeQ instrument in the lab (www.photosynq.org)
* PhotosynQ Analysis platform (open-source analytical tools for PhotosynQ)
* PhenoCurve platform for characterizing complex multi-parameter photosynthetic phenotypes [10]
* DynamicFilter, a phenotype data cleaning package [11]
* A platform for characterizing and quantifying high-dimensional phenotype data [12]
* Method, hardware and software for visualization and quantification of chloroplast movements [13]
* Methods for tracking and characterizing individual plant leaves [14, 15]

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2. Kramer DM, Cruz J, Thomashow M, Savage L, Chen J, inventorsA method for identifying plant genes important for efficient photosynthesis under dynamic environmental conditions, and identification of a family of plant genes that controls photosynthesis under fluctuating fluctuating environmental conditions. U.S.A.2014.

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8. Macaluso S, Chen J. PhenoMath: A software package for deep analysis of high througput photosynthesis data. 2014.

9. Kramer DM, Chen J, Tessmer OL. OLIVER (Observe, Link, Integrate, Validate, Explore and Reveal): A platform for visualization and mining of high-resolution, high-throughput phenomics and genomics data. MSU invention disclosure. TEC2015-0045.2014.

10. Xu L, Yang Y, Cruz J, Savage L, Kramer D, J C. PhenoCurve: Inter-functional Analysis on Dynamic Phenotype-Environment Relationships in Plants. 2015.

11. Xu L, Cruz JA, Savage L, Kramer DM, Chen J. Plant photosynthesis phenomics data quality control. Bioinformatics. 2015;31:1796-804.

12. Gao Q, Ostendorf E, Cruz JA, Jin R, Kramer DM, Chen J. Inter-functional analysis of high-throughput phenotype data by nonparametric clustering and its application to photosynthesis. Bioinformatics. 2015;pii: btv515.

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**Invited lectures**

"Inhibition of plastocyanin to P700+ electron transfer by osmotic stress in *Chlamydomonas reinhardtii*” Jan. 1996 Western Regional Photosynthesis Congress, Asilomar, CA

“New approaches to the study of photosynthesis” October, 1997, Department of Physics, Washington State University

“Photosynthetic electron transfer: an overview” Jan. 1997 Western Regional Photosynthesis Congress, Asilomar, CA

“Steady-State Photosynthesis” March, 1997, Center for the Study of Early Events in Photosynthesis, Arizona State University

“The photosynthetic steady-state: New tools and interpretations” March, 1997, Center for the Study of Early Events in Photosynthesis, Arizona State University.

“New techniques for probing photosynthetic energy storage” Department of Biochemistry and Biophysics, WSU Feb., 1996

“Novel Techniques for measuring photosynthetic reactions in intact plants” Department of Horticulture, WSU April, 1996

“Towards an understanding of the cytochrome *b6f* complex *in vivo* and in the steady-state: roles of ΔpH and Δϕ in the control of cytochrome *b6f* turnover” Aug. 1997 Workshop of the cytochrome *b6f* complex Sponsored by the European Science Commission, Regensburg, Germany.

“Energy storage in the photosynthetic steady-state: Mechanistic and evolutionary implications” Feb. 1997, Biology Department, Oregon State University.

"The energy budget and control of steady-state photosynthesis" June, 1999, Department of Plant Biology, Ohio State University

"The binding site for inhibitory copper ions on the spinach cytochrome *b6f c*omplex: Implications for structure and function" July, 1999 Environmental Molecular Sciences Symposium and 1st EMSL Users Meeting. Pacific Northwest National Laboratories, Richland, WA

"Living plants and metal ions as probes of molecular events at the cytochrome *b6f* complex, the central proton pump of photosynthesis" Sept, 2000 Pennsylvania State University

"Probing the chemistry of quinol oxidation by cytochrome *bc* complexes with molecular oxygen, metal ions and living plants." Department of Chemistry Washington State University April, 2001

"Probing quinol oxidation by cytochrome *bc* complexes with molecular oxygen, metal ions and living plants." University of Illinois at Urbana-Champaign April, 2001

"How do chloroplasts store chemiosmotic energy? Implications for electron and proton transfer reactions, lumenal enzyme stability and regulation of photosynthesis." University of Illinois at Urbana-Champaign April, 2001

"Probing the chemistry of quinol oxidation by cytochrome *bc* complexes with molecular oxygen, metal ions and living plants." Department of Chemistry Washington State University April, 2001

"Probing quinol oxidation by cytochrome *bc* complexes with molecular oxygen, metal ions and living plants." University of Illinois at Urbana-Champaign April, 2001

"How do chloroplasts store chemiosmotic energy? Implications for electron and proton transfer reactions, lumenal enzyme stability and regulation of photosynthesis." University of Illinois at Urbana-Champaign April, 2001

"The chemistry of quinol oxidation by cytochrome *bc* complexes probed with molecular oxygen, metal ions and living plants." Intermediate Electron Transfer Satellite Meeting, Australia 2001

"A model for regulation of the light reactions based on *in vivo*, steady-state observations of both electron and proton fluxes in higher plants." International Photosynthesis Congress, Australia 2001

“Quinol oxidation by cytochrome *bc*1 and *b6f* complexes: Chemistry, energy transduction and reactive oxygen generation” U. Washington, Oct, 2002

“The energy conserving reactions of the cytochrome *bc*1 and *b6f* complexes” Gonzaga University, Feb. 2003

“Modulation of photosynthetic regulation.” Invited Speaker, 2002 Gordon Conference on Photosynthesis, Sept, 2002

“An introduction to the WSU electron paramagnetic resonance center for plant physiologists and biochemists” Washington State University Plant Physiology Series, September, 2003.

“Proton coupled electron transfer during quinol oxidation in cytochrome *bc* complexes and biomimetic systems, with an introduction to the WSU Electron Paramagnetic Resonance Center” Washington State University Chemistry Department, November 2003.

“Proton coupled electron transfer at the quinol oxidase site of cytochrome *bc* type complexes and biomimetic systems” Invited lecture at the Gordon Conference on Isotope Effects in Chemistry and Biology. Feb., 2004

“An introduction to the WSU electron paramagnetic resonance center for the School of Molecular Biosciences” Washington State University Plant Physiology Series, April, 2004.

“Proton-coupled electron transfer during hydroquinone oxidation in *bc* complexes and in a biomimetic system 13th International Congress on Photosynthesis, Montreal, Canada, Aug., 2004

“The central roles of the proton circuit in maintaining and regulating photosynthesis” American Society of Plant Biology, Seattle Sept. 2005

“The mechanisms of the cytochrome *b6f* and *bc*1 complexes” Photosynthesis Gordon Conference, 2005

“The Plumbing of Photosynthesis,” Molecular Plant Sciences, Washington State University, Dec. 2005

“Superoxide production and the cytochrome *bc* complexes” Molecular and Cellular Bioenergetics Gordon Conference, 2006

“Balancing the light and dark reactions of photosynthesis” Max Planck Institute for Plant Physiology, Golm, Germany, 2007 “The cytochrome *bc* complexes as anti-Pauling Enzymes” Institut de Biologie Structurale et Microbiologie, CNRS, Marseille, France

“The Plumbing of Photosynthesis,” Plenary Lecture, International Congress on Photosynthesis Research, Glasgow, Scotland, 2007

“A plumbers view of photosynthetic efficiency,” Center for Bioenergy and Photosynthesis, Arizona State University, 2007

“Why photosynthesis is so inefficient and what (if anything) we can do about it” Gordon conference on Photosynthesis, July 2008.

“Co-regulation of the light and dark reactions of photosynthesis: Strategies for plant productivity and responses to environmental challenges” September 2008: BODEN CONFERENCE "PLANT ENERGY AND WATER PRODUCTIVITY. Canberra, Australia

Probing the Energetics of Photosynthesis in vivo. Nov., 2008 University of Technology, Sydney Australia

Natural photosynthesis: fitness and inefficiency Arizona Workshop on Renewable Energy November 17-19, 2008, Memorial Union, Tempe Campus,  
Arizona State University, Tempe, Arizona (Plenary Speaker)

Why aren't the light reactions of photosynthesis more efficient, and what (if anything) can we do about it? A view of biochemistry and biophysics of bioenergy storage from the perspective of the living plant." Department of Chemistry, U.C. Davis, April, 2008

“Why certain enzymes do not act like enzymes” Applied Mathematics, WSU, April 2008

“Natural Photosynthesis: Fitness and Inefficiency” Keynote speaker: Integrative Plant Sciences Retreat, WSU Feb., 2009

“Natural Photosynthesis: Fitness and Inefficiency” Woody Plants Biotechnology Symposium Nissan Science Foundation Tokyo, Japan Feb., 2009

“Probing photosynthesis *in vivo*.” Woody Plants Biotechnology Symposium Nissan Science Foundation Tokyo, Japan Feb., 2009

“A central role for the chloroplast ATP synthase in regulating the balacne between photosynthetic efficiency and photoprotection.” Tokyo Institute of Technology, Tokyo, Japan 2008.

“Why is photosynthesis so inefficient? “ Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan, Feb., 2009

“Writing scientific papers in English: Crafting the question.” Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan, Feb., 2009

“Balancing the in vivo Energy Budget of Photosynthesis” Nara Institute of Science and Technology, Feb., 2009

“The IDEA: Integrated Diode Emitter Array Spectrometer/Fluorometer” Nara Institute of Science and Technology, Feb., 2009

“Is Photosynthesis limited by ‘Legacy Biochemistry’”? U.S. Department of Energy workshop on Photosynthetic efficiency, March, 2009

“Balancing Photosynthesis” Donald Danforth Plant Science Center, March, 2010

“Photosynthetic Phenomics: Energy balance and productivity of photosynthesis” U.S. Department of Energy Biomass Program, March, 2011

“Environmental Photobioreactors”, Sapphire Energy Inc., April, 2011

“Cyclic electron transfer and photosynthetic energy balance” Northwest ACS meeting, Pullman WA, August, 2010

“Synchronization of the light and dark cycles of photosynthesis” Gordon Research Conference on CO2 assimilation, June, 2011

“Electron Transfer Pathways” Gordon Research Conference on Photosynthesis, June, 2011

“Dynamic Regulation of Photosynthesis” Wageningen University, The Netherlands, Aug. 2011 (Part of the International Summer Course on Increasing Photosynthesis)

“Photosynthetic Phenometrics” ExxonMobil, Dec. 2011

“Dynamic Photosynthetic Phenometrics” BASF, August, 2012

“Are the Cytochrome bc Complexes Anti-Pauling Enzymes?” Wright State University, June, 2012

“Proton Stripping and the Avoidance of ROS in cytochrome bc1 complexes” Gordon Research Conference on Photosynthesis, July, 2012

“Dynamic Regulation of Photosynthesis to Dynamic Photosynthetic Phenometrics” Carnegie Institute, April, 2012

“Dynamic regulation of photosynthesis to dynamic photosynthetic phenometrics” Max Planck Institute for Plant Physiology, May, 2012

“Advanced Phenometrics” Presentation to Intrexon, Inc., Aug. 2012

“Next Generation Phenotyping: Dynamic Photosynthetic Responses” Electronics and Computer Engineering, Michigan State University, Jan. 22, 2013

“Next Generation Plant Phenotyping” Donald Danforth Plant Science Center, Jan. 29, 2013

“Next Generation Phenometrics”, Scotts MiracleGro, Feb., 20, 2013

“Next Generation Phenometrics and the Center for Advanced Algal and Plant Phenotyping”, Michigan State University, Crops and Soils, Feb. 21, 2013

“Next Generation Phenometrics: Emergent Phenotypes and the Productivity and Robustness of Photosynthesis” Food and Fuels for the 21st Century Symposium, .C. Dan Diego.

“Next Generation Phenometrics: Emergent Phenotypes and the Productivity and Robustness of Photosynthesis” International meeting of the Algal BioEnergy Biomass and Bioproducts, Toronto, Canada, July, 2013

“Photosynthetic Phenometrics, Emergent Phenotypes, Ancillary Functions, Critical for Efficient and Robustness Photosynthesis” Phenodays: Imaging and Robotics for 21st Century Science, St. Louis, Mo. Sept., 2013

“Next Generation Photosynthetic Phenometrics” 16th International Congress on Photosynthesis, St. Louis, Mo., Sept, 2013

“How Does the Biophysical and Biochemical Machinery of Photosynthesis Operate the Living Organism” Biochemistry and Molecular Biology Department Retreat, Sept., 2013

“Towards Genotype-Phenotype Map: Environmental Phenometrics, Emergent Phenotypes, Ancillary Functions Critical for Efficient and Robustness Photosynthesis” Cold Springs Harbor Lab, New York, Dec. 2103

“Environmental Phenometrics and Efficient and Robustness Photosynthesis” University of Illinois Urbana-Champaign” Feb, 2014

“Evolution of Photosynthesis and Dynamic Photosynthetic Phenotypes” Paris Dynamo Conference, Paris, France March, 2014”

“Photosynthetic Phenometrics, Emergent Phenotypes, Ancillary Functions, Critical for Efficient and Robustness Photosynthesis” University of Missouri, April, 2014

“Phenotyping for Photosynthetic Traits: A Strategy for Increasing Genetic Yield Potential in Grain Legumes” Legume Innovation Lab Workshop, Athens, Greece, May, 2014

“Photosynthetic Phenometrics and Dynamic Responses to Environmental Fluctuations” Max Planck Institute for Molecular Plant Physiology, Golm, Germany, June, 2014

“Photosynthetic Phenometrics and Dynamic Responses to Environmental Fluctuations” Society for Experimental Biology (SEB) Conference, Manchester, UK, June 2014

“PhotosynQ: A Platform for Distributed Photosynthetic Phenotyping to Connect Field and Lab.” European Plant Phenotyping Conference and Workshop, Wageningen, The Netherlands, June 2014

“Dynamic Responses of Photosynthesis to Environmental Fluctuations: How the thylakoid proton motive force controls photoprotection and photoinhibition.” Vrije Universiteit Amsterdam, June 2014

“Dynamic Phenotyping: From Complexity to Elegance” MSU Biomolecular Sciences Retreat Keynote Faculty Talk

“PhotosynQ and Emergent Photosynthetic Phenotypes” Western Photosynthesis Conference, Jan., 2015, Asilomar, CA

“PhotosynQ” LiCor Corp., May, 2015

“PhotosynQ and AquaspeQ” Algal Biomass, Bioenergy and Biofuels Conference, San Diego, CA, June, 2015

“MSU Center for Advanced Algal and Plant Phenoptyping”, Pacific Northwest National Lab, March, 2015

“Is Photosynthesis Enabled or Limited by Complexity?” BioSolar Cells Symposium, Wageningen University, The Netherlands.

“Life, Death, electrons and the PMF” Photosynthesis Gordon Research Conference, June, 2015, Bentley University

“Plant Phenotyping Tools that You Can Use in your Research Right Now.” MSU Plant Genomics Research Experience for Undergraduates Summer Series, May 28, 2015

“Innovation, Exploration and New Directions in Science” MSU Study Abroad Program, Invited presentation to students traveling to China, May 2015

“The Tightrope of Photosynthesis” Colin Wraight Memorial Lecture, University of Illinois, Urbana, Illinois, Sept., 2015

“Electrons, Protons and the Tightrope of Photosynthesis” Yamada Symposium, Nara, Japan, Colin Wraight Memorial Lecture, University of Illinois, Urbana, Illinois, Sept., 2015

“PhotosynQ and CoralpeQ” , National Institute of Basic Biology, Okazaki, Japan, Sept., 2015

“Robust Photosynthesis in Dynamic Environments: PRL 50th Anniversary”, Michigan State University, Oct., 2015

“The Dynamic Energy Budget of Photosynthesis” U.S. Department of Energy Photosynthetic Systems PI Retreat, Oct., 2015

“PhotosynQ.org: Community-driven plant phenotyping for understanding plant responses to climate change”, Jan., 2016