**Dr. JOHN E. FROEHLICH, Ph.D.**

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East Lansing, MI 48824 E-mail: froehli5@msu.edu

**PROFESSIONAL INFORMATION­­­­**

# Education

Ph. D.: 1990, Biochemistry

Miami University, Oxford, OH 45056

Advisor: Dr. Jan G. Jaworski

Thesis Title: Purification and Characterization of Acyl Carrier Protein from Two Different Cyanobacteria

B. S.: 1985, Chemistry

Gannon University, Erie, Pa. 16505

# Appointments

Research Assistant Professor (Sept. 2003-present)

MSU-DOE Plant Research Laboratory

Michigan State University

East Lansing, MI 48824-1312

Post-Doctoral Position (Feb. 1993-Sept. 2003)

MSU-DOE Plant Research Laboratory

Michigan State University

East Lansing, MI 48824-1312

Post-Doctoral Position (Sept 1990-Aug 1992)

Department of Cell Biology & Anatomy

Mount Sinai School of Medicine

One Gustave Levy Place

New York, N.Y. 10029

Teaching Fellowship (September 1988-90)

Teaching Assistantship (September 1985-88)

Department of Chemistry

Miami University, Oxford OH 45056

**Membership in Professional Societies**

American Society of Cell Biology

American Society of Plant Physiology

# Awards *Miami University (Ohio):*

Percy and Isabella Mundell Outstanding Teaching Award (1989)

Departmental Teaching Assistant Award (1989)

Teaching Assistant Award (1987)

*Michigan State University (Michigan)*

Anton Lang Memorial Award for Research Excellence, MSU-DOE Plant Research Laboratory (2001)

**Departmental Committees**

Academic Personnel Council (APC) 1993-94; 95-96; 96-97; 97-98, 2011-present

Personnel Affairs Committee (PAC) 2000-01; 2003-2014

PRL Seminar Committee (SEM) 2015-2016

PRL Retreat Committee 2014/2015

**Outside Committee**

Biochemistry and Molecular Biology Chair Search Committee 2015-2016

**Teaching Experience (MSU)**

Plant Biochemistry 864 (Team Taught: 1 week session on protein targeting to organelles 2003)

Plant Biochemistry 864 : (Team Taught: 1 session on protein targeting to organelles in 2004, 2005, 2006 and 2008

## PUBLICATIONS

1. L. Ruby Carrillo, **John E. Froehlich**, Jeffrey A. Cruz, Linda Savage and David M. Kramer(2016) The chloroplast NADPH thioredoxin reductase C (NTRC) is required for redox regulation of the chloroplast ATP synthase specifically under low irradiance. *(Accepted by The Plant J.)*

2. Geoffry A. Davis, Atsuko Kanazawa, Mark Aurel Schöttler, Kaori Kohzuma, **John E. Froehlich**, A. William Rutherford, Mio Satoh-Cruz, Deepika Minhas, Stefanie Tietz, Amit Dhingra, David M. Kramer (2016) Limitations to Photosynthesis by Proton Motive Force-Induced Photosystem II Photodamage. (*Accepted eLife)*

3. Deserah D. Strand, Aaron K. Livingston, Mio Satoh-Cruz, Tyson Koepke, Heather M. Enlow, Nicholas Fisher, **John E. Froehlich**, Jeffrey A. Cruz, Deepika Minhas, Kim K. Hixson, Kaori Kohzuma, Mary Lipton, Amit Dhingra, David M. Kramer (2016) Defects in Expression of Chloroplast Proteins Leads to H2O2 Accumulation and Activation of Cyclic Electron Flow around Photosystem I. *(Submitted to BBA)*

4. Marcelo L. Campos, Yuki Yoshida, Ian Major, Dalton de Oliveira Ferreira, Sarathi M. Weraduwage,**John E. Froehlich**, Brendan F. Johnson, Georg Jander, Thomas D. Sharkey, & Gregg A. Howe(2016) Rewiring of jasmonate and phytochrome signaling uncouples plant growth-defense tradeoffs (*Accepted Nature Comminications*)

5. Kaori Kohzuma, **John E. Froehlich**, Geoffry A. Davis, Joshua A. Temple, Deepika Minhas, Amit Dhingra, Jeffrey A. cruz and David M. Kramer (2016) The Role of Light-Dark Regulation of the Chloroplasrt ATP Synthase (*Submitted to The Plant J.)*

6. Min Zhang, Cheng Chen, **John E. Froehlich**, Allan Terbush, and Katherine W. Osteryoung (2015) Roles of Arabidopsis PARC6 in coordination of the chloroplast division complex and negative regulation of FtsZ assembly. *Plant Phys.* 170:250-262.

7. Deserah D. Strand, Aaron K. Livingston, Mio Satoh-Cruz, **John E. Froehlich**, Ryan C. Vink, Veronica G. Maurino and David M. Kramer (2015) Activation of Cyclic Electron Flow by Hydrogen Peroxide *in vivo*. *PNAS* 112:5539-5544.

8. Tatyana Savchenko,Venkat A. Kolla, Chang-Quan Wang, Zainab Nasafi, Bpantamars Phadungchob, Wassim E. Chehab, Federica Brandizzi, **John E. Froehlich**, Katayoon Dehesh (2014**)** Functional convergence of oxylipin and ABA pathways controls stomatal closure in response to drought. *Plant Phys.* 164:1151-1160*.*

9. Guangyong Li,, **John E. Froehlich**, Christian Elowsky, Joseph Msanne,, Andrew Ostosh, Chi Zhang,f, Tala Awada,and James R. Alfano (2014) Distinct Pseudomonas type III effectors utilize a cleavable transit peptide to target chloroplasts. *The Plant J.* 77:310-321.

10. Payam Mehrshahi, Giovanni Stefano, Joshua M. Andaloro, Federica Brandizzi, **John E. Froehlich**, and Dean DellaPenna1 (2013) Trans-organellar Complementation Redefines Biochemical Continuity Between the

ER and Chloroplast. *PNAS* 110:12126-12131*.*

11. Bagyalakshmi Muthan, **John E Froehlich**, Rebecca L. Roston, and Christophe Benningm (2013) Probing Arabidopsis chloroplast diacylglycerol pools by selectively targeting bacterial diacylgylcerol kinase to suborganellar membranes. *Plant Phys.* 163:61-74.

12. **John E. Froehlich** and Kenneth Keegstra (2011) The role of the transmembrane domain in determining the targeting of integral membrane proteins to either the inner envelope or thylakoid membrane. *The Plant J.* 68:844-856*.*

13. Yue Yang, Tammy L. Sage, Yi Liu, Tiara Ahmad, Shin-Han Shiu, **John E. Froehlich**, Kathleen M Imre and Katherine W. Osteryoung (2011) CLUMPED CHLOROPLASTS 1 encodes a novel protein required for plastid separation in Arabidopsis. *PNAS* 108:18530-18535*.*

14. Imad Ajjawi, Ardian Coku, Yue Yang, **John E. Froehlich**, Kathy W. Osteryoung, Christoph Benning, and Robert Last (2011) A J-like protein influences fatty acid composition of chloroplast lipids in Arabidopsis. *PLoS* 6(10):e25368

15. Neil D. Adhikari, **John E. Froehlich**, Deserah D. Strand, Stephanie M. Buck, David M. Kramer, and Robert M. Larkin (2011)GUN4-Porphyrin Complexes Bind the ChlH/GUN5 Subunit of Mg-Chelatase and Promote Chlorophyll Biosynthesis in Arabidopsis. *Plant Cell* 23: 1449-1467*.*

16. Niel Adhkari , Rob Orler, Joann Chory **, John E. Froehlich ,** Larkin RM (2009) Porphyrins stabilize the association of genome uncoupled 4 and a Mg-chelatase subunit with chloroplast membranes. *J. Bio.l Chem.* 284:24783-24796.

17. Jinpeng Gao, Imad Ajjawi, Arthur Manoli III, Andrew Sawin, Changcheng Xu, **John E.** **Froehlich**, Robert L. Last, and Christoph Benning(2009) *FATTY ACID DESATURASE 4* of *Arabidopsis* encodes a protein distinct from classic fatty acid desaturases. *Plant J.* 60:832-839*.*

18. Andrea Bräutigam, Roshan P. Shrestha, Doug Whitten, Curt G. Wilkerson, Kevin M. Carr, **John E. Froehlich**, John B. Ohlrogge, Andreas P.M. Weber (2008) Massively-parallel pyrosequencing of cDNAs Enables Proteomics in Non-model Species: Comparative Analysis of a Species Specific Database Generated by Pyrosequencing and Non-species Specific Databases for Proteome Analysis of Pea Chloroplast Envelopes. *J Biotechnol.* 136:44-53.

19. John M. Glynn , **John E Froehlich**, Katherine W. Osteryoung (2008) Arabidopsis ARC6 coordinates the division machineries of the inner and outer chloroplast membranes through interaction with PDV2 in the intermembrane space. *Plant Cell.* 20:2460-2470*.*

20. Rosemary S. McAndrew, Bradley J.S.C. Olson, Cecilia L. Chi-Ham, Stanislav Vitha,**John E. Froehlich**, and Katherine W. Osteryoung (2008) *In vivo* Quantitative Relationship between Plastid Division Proteins FtsZ1 and FtsZ2 and Identification of ARC6 in a Native FtsZ Complex. *Biochem. J.* 412:367-378.

21. Joanna Tripp, Kentaro Inoue, Kenneth Keegstra, **John E. Froehlich†** (2007)A novel Serine/Proline-rich Domain in Combination with a Transmembrane Domain is Required for the Insertion of AtTic40 into the Inner Envelope Membrane of Chloroplasts. *Plant J.* 52: 824-838*.* (**†**Corresponding Author)

22. Hiroshi Shimada , Mariko Mochizuki , Kan Ogura , **John E. Froehlich** , Katherine W. Osteryoung , Yumiko Shirano , Daisuke Shibata , Shinji Masuda , Kazuki Mori , and Ken-ichiro Takamiya (2007) *Arabidopsis* Cotyledon-Specific Chloroplast Biogenesis Factor CYO1 Is a Protein Disulfide Isomerase. *Plant Cell* 19:3157-3169*.*

23. Carl Andre, **John E. Froehlich**, Matthew R. Moll, Christoph Benning (2007) A Heteromeric Plastidic Pyruvate Kinase Complex Involved in Seed Oil Biosynthesis in Arabidopsis. *Plant Cell* 19:2006-2022*.*

24. Shin-ya Miyagishimaa, **John E. Froehlich**, Katherine W. Osteryoung (2006) The Outer Envelope Protein PDV1, Together with its Paralogue PDV2, Mediates Recruitment of the Dynamin-Related Protein ARC5 to the Plastid Division Site in *Arabidopsis*. *Plant Cell* 18:2517-2530.

25. Changcheng Xu, Bin Yu, Adam J. Cornish, **John E. Froehlich**, Christoph Benning (2006) Phosphatidylglycerol biosynthesis in chloroplasts of Arabidopsis mutants deficient in acyl-ACP glycerol 3-phosphate acyltransferase. *Plant J*. 47:296-309.

26. Changcheng Xu, Jilian Fan, **John E. Froehlich** , Awai K, Christoph Benning (2005) Mutation of the TGD1 chloroplast envelope protein affects phosphatidate metabolism in Arabidopsis. *Plant Cell* 17:3094-3110

27. Eyal Fridman, Jihong Wang, Yoko Iijima, **John E. Froehlich,** David R. Gang, John Ohlrogge, Eran Pickersky (2005) Metabolic, Genomic and Biochemical Analysis of Grandular Trichomes from the Wild Tomato Species *Lycopersicon hirsutum* Identifies a Key Enzyme in the Biosynthesis of Methylketones. *Plant Cell* 17:1252-1267.

28. Diane Constan, **John E Froehlich,** Sowkya Rangarajan, Kenneth Keegstra (2004) A Stromal Hsp100 Protein Is Required for Normal Chloroplast Development and Function in Arabidopsis. *Plant* *Physiology* 136: 3605-3615.

29. Amelie A. Kelly, **John E. Froehlich** and Peter Dörmann (2003) Disruption of the Two Digalactosyldiacylglycerol (DGDG) Synthase Genes DGD1 and DGD2 in Arabidopsis Demonstrates a Critical Role for DGDG Synthesis for Photosynthesis and during Phosphate Deprivation and Reveals the Existence of an Additional, Independent Enzyme of Galactolipid Synthesis. *Plant Cell* 15: 2694-706.

30. **John E. Froehlich**, Brett Phinney,Rosemary McAndrew, Curtis Wilkerson, Douglas Gage, Katherine Osteryoung (2003) Mass Spectrometry Based Proteomic Study of *Arabidopsis thaliana* Chloroplastic Envelope Membranes Utilizing Alternatives to Traditional Two-Dimensional Electrophoresis. *J of Proteome Research* 2:413-425.

31. Stanislav Vitha, **John E. Froehlich,** Olga Koksharova, Harrie van Erp, Katherine W. Osteryoung (2003) Arabidopsis ARC6 Is a J-Domain Plastid Division Protein Whose Prokaryotic Ancestors Are Unique to Cyanobacteria. *Plant Cell* 15:1918-1933.

32. Changcheng Xu, Jilian Fan, Wayne Riekhof, **John E. Froehlich**, Christoph Benning (2003) A permease-like protein involved in ER-to-Thylakoid lipid transfer in Arabidopsis. *EMBO J.* 22:2370-2379.

33. Hongbo Gao, Denna Kadirjan-Kalbach, **John E. Froehlich,** Katherine W. Osteryoung (2003) ARC5, a Cytosolic Dynamin-like Protein from Plants, is Part of the Chloroplast Division Machinery. *PNAS* 100: 4328-48333.

34. Dongsun Cao, **John E. Froehlich**, Hui Zhang and Chi-Lien Cheng (2003) The Chlorate-Resistant and Photomorphogenesis-Defective Mutant *cr88* Encodes a Chloroplast-Targeted HsP90. *Plant J.*  33: 107-118.

35. Dörte Klaus, Heiko Härtel, Lynda Fitzpatrick, **John E. Froehlich,** Jamie Hubert, Christoph Benning, and Peter Dörmann (2002) Digalactosyldiacylglycerol Synthesis in Chloroplasts of the *Arabidopsis* *dgd1*  Mutant.  *Plant* *Physiology* 128: 885-895.

36. Rosemary S. McAndrew **,John E. Froehlich**, Kevin D. Stoke, Stanislav Vitha and Katherine W. Osteryoung (2001) The Co-localization of Plastid Division Proteins in the Chloroplast Stromal Compartment Establishes a New Functional Relationship Between FtsZ1 and FtsZ2 in Higher Plants. *Plant Physiology* 127: 1656-1666.

37. **John E. Froehlich,** Christoph Benning, and Peter Dörmann (2001) The Digalactosyldiacylglycerol Synthase DGD1 is Inserted into the Outer Envelope Membrane of Chloroplasts in a Manner Independent of the General Import Pathway and does not Depend on MGDG Synthase for DGDG Biosynthesis. *J. Biol. Chem.* 276:31806-31812.

38. Christy Watson, **, John E. Froehlich** , Caroline Josefsson, Clint Chapple, Francis Durst, Irene Benveniste and Ronald Coolbaugh (2001) Localization of CYP86B1 in the Outer Envelope of Chloroplasts. *Plant Cell Physiol*. 42: 873-878.

39. **John E. Froehlich,**  Aya Itoh and Gregg Howe (2001) Tomato Allene Oxide Synthase and Fatty Acid Hydroperoxide Lyase, Two Cytochrome P450s Involved in Oxylipin Metabolism, are Targeted to Different Membranes of Chloroplast Envelope*. Plant Physiology* 125:306-317.

40. Amy DeRocher, Christopher Hagen, **John E. Froehlich**, Jean E. Feagin, and Marilyn Parsons (2000) Analysis of Targeting Sequences Demonstrates that Trafficking to the *Toxoplasma gondii* Plastid Branches off the Secretory Pathway. *Journal of Cell Science* 113:3969-3977

41. K.S. Colletti, E.A. Tattersall, K.A. Pyke, **John E. Froehlich**, K.D. Stokes, K.W.Osteryoung (2000) Placement of the Chloroplast Division Apparatus is Mediated by a Homologue of the Bacterial Cell Division Site-determining Factor MinD. *Current Biology* 10: 507-516.

42. Glen Turner, Jonathan Gershenzon, Erik Nielsen, **John E. Froehlich**, and Rodney Croteau (1999) Limonene Synthase Responsible for Monoterpene Biosynthesis in Peppermint is Localized to Leucoplasts of Oil Gland Secretory Cells. *Plant Physiology* 120:879-886.

43. Michael Young, Ken Keegstra, and **John E. Froehlich†** (1999) GTP Promotes Precursor Binding but is Not Required During the Translocation Step of Protein Import into Chloroplasts. *Plant Physiology* 121:237-243. (**†**Corresponding Author)

44. Michael Weaver, **John E. Froehlich** and Rick Amassino (1998) The Chloroplastic-targeted ERD1 Protein Declines During Senescence, While Its mRNA Increases. *Plant Physiology* 119:1209-1216.

45. Diane Jackson, **John E. Froehlich** and Ken Keegstra (1998) The Topology of Tic 110 a Component of the Chloroplastic Protein Import Apparatus. *J. Biol. Chem.* 273:16583-16588.

46. **John E. Froehlich** and Ken Keegstra (1997) Identification of a Translocation Intermediate Occupying Functional Protein Import Sites in the Chloroplastic Envelope Membrane; *J. Biol. Chem*. 272:8077-8082.

47. Pat Tranel, **John E. Froehlich** Arun Goyal, and Ken Keegstra (1995) A Component of the Chloroplastic Protein Import Apparatus is Targeted to the Outer Envelope Membrane via a Novel Pathway. *EMBO J.* 14: 2436-2446.

48. **John Froehlich**, Roger Poorman, Eileen Reardon, Susan R. Barnum. and Jan G. Jaworski (1990) Purification and Characterization of Acyl Carrier Protein from Two Different Cyanobacteria. *European Journal of Biochemistry*. 193: 817-825.

(Manuscripts in preparation derived from student projects)

49. **John E. Froehlich,** Eric Vanderpool, and Katayoon Dehesh (2016) Identification of a Thioesterase/Fatty acid transporter complex located at the inner envelope of chloroplasts. (Manuscript in preparation).

50. **John E. Froehlich** and John Stein (2016) Multiple Chloroplasts Division 1 (MCD1) is targeted to the inner envelope of chloroplasts by the post-import pathway. (Manuscript in preparation)

## BOOKS AND REVIEWS

1. Studying *Arabidopsis* envelope protein localization and topology using thermolysin and trypsin proteases; **John E. Froehlich** (2011) *In*  Methods in Molecular Biology: Chloroplast Research in *Arabidopsis*: Methods and Protocols, Ed. Paul Jarvis, Humana Press, New York, New York (USA), pp. 351-367.

2. Protein Import into Chloroplasts: Kenneth Keegstra and **John E. Froehlich** (1999) Curr. Opinion in Plant Biol. 2:471-476.

3. Transport of Cytoplasmically Synthesized Proteins into Chloroplasts; Kenneth Keegstra, M. Akita, J. Davila-Aponte, **John E. Froehlich**, E. Neilsen, and S. Reumann (1998) *In* Cellular Integration of Signaling Pathways in Plant Development, Eds. F. Lo.Schiavo, R.L. Last, G. Morelli, N.V. Raikhel, Vol H 104, pp. 23-33, NATO ASI Series, Springer-Verlag (Berlin)

4. In vitro Import of Proteins into Chloroplasts; Barry D. Bruce, Sharyn Perry, **John E. Froehlich** and Ken Keegstra (1994) In Plant Mol. Biol. Manual, Eds.S. B. Gelvin and R. A. Schilperoot; pp. **J1**, 1-15, Kluwer Academic Publishers (London)

5. Purification and Characterization of Acyl Carrier Protein from Two

Different Cyanobacteria; **John Froehlich**, Jan G. Jaworski, and Susan R. Barnum. In the 9th International Symposium on the Biochemistry, Structure and Utilization of Plant Lipids, Eds. P. J. Quinn and J. L. Harwood; pp. 105-107, Portland Press LTD (London).

# PRESENTATIONS

Stop and Go Traffic: The Targeting of Chloroplastic Membrane Proteins to either the Inner Envelope or Thylakoid membrane; John E. Froehlich,  and  Kenneth Keegstra , At the Annual Meeting of The American Society of Plant Biologist, Minneapolis, Minnesota (2011)

Stop and Go Traffic: The Targeting of Chloroplastic Membrane Proteins to either the Inner Envelope or Thylakoid membrane; Eric Vanderpool\* and John E. Froehlich, , At University Undergraduate Research and Arts Forum, Michigan State University, (2011) (\* Received an Award for Poster)

Protein Targeting to the Thylakoid Membrane; John E. Froehlich, and Kenneth Keegstra, At Gordon Research Conference: Protein Transport across Cell Membranes, Galveston, Texas (2010)

Protein Targeting to the Thylakoid Membrane; John E. Froehlich,  and  Kenneth Keegstra , At the Annual Meeting of The American Society of Plant Biologist, Honolulu, Hawaii (2009)

The Road Less Travelled: Investigating the Multi-step Targeting Pathway of Tic40 to the Chloroplastic Inner Envelope Membrane; Joanna Tripp, John E. Froehlich,  and  Kenneth Keegstra , At the Annual Meeting of The American Society of Plant Biologist, Boston, MA (2006)

A Novel Cross-linking Strategy aimed at Investigating Precursor Interaction with the Chloroplastic TIC Complex and with Stromal Molecular Chaperones; John E. Froehlich,  and  Kenneth Keegstra , At the Annual Meeting of The American Society of Plant Biologist, Seattle, WA (2005)

Mapping the Topology of the Pea Chloroplastic Protein Import Channel Toc75; John E. Froehlich,  Sigrun Reumann, Jason Kuchar, Brett S. Phinney, Curtis G. Wilkerson, Kenneth Keegstra , At the Annual Meeting of The American Society of Plant Biologist, Honolulu, Hawaii (2003)

Mass Spectrometry Based Proteomic Study of Pea and Arabidopsis thaliana Chloroplast Membranes Utilizing Alternatives to Traditional Two-Dimensional Electrophoresis; John E. Froehlich, Brett Phinney,Rosemary McAndrew, Curtis Wilkerson, Douglas Gage, Katherine Osteryoung, At the Annual Meeting of The American Society of Plant Biologist, Denver, CO (2002)

FtsZ1 and FtsZ2 Proteins are Localized in the Chloroplasts; Kevin Stokes, John E. Froehlich, Rosemary S. McAndrew, Stanislav Vitha, and Katherine Osteryoung, At the Annual Meeting of The American Society of Plant Biologist, Providence, RI (2001)

# Genes Involved in Digalactosyl Diacylglycerol Biosynthesis in Arabidopsis; Amelie Kelly, Peter Dormann, and John E. Froehlich, At the Annual Meeting of The American Society of Plant Physiologists, San Diego, CA (2000)

# Tomato Allene Oxide Synthase and Fatty Acid Hydroperoxide Lyase are Targeted to the Chloroplasts Envelope Membrane by Different Pathways; John E. Froehlich, Itoh Ayah, and Gregg Howe, At the Annual Meeting of The American Society of Plant Physiologists, San Diego, CA (2000)

Allene Oxide Synthase is Imported into and Targeted to the Inner Envelope membrane of Pea and Tomato Chloroplasts; John E. Froehlich, Amy De Rocher, and Gregg A. Howe, At the Annual Meeting of The American Society of Plant Physiologists, Baltimore, MD (1999)

The Topology of Tic 110 a Component of the Chloroplastic Protein Import Apparatus; Diane Jackson, John E. Froehlich and Ken Keegstra, At the Annual Meeting of The American Society of Plant Physiologists, Madison, WI (1998)

The Effect of GTP Analogs on Binding and Import of Precursor Protein into Pea Chloroplasts; Michael Young, John E. Froehlich and Ken Keegstra At the Annual Meeting of The American Society of Plant Physiologists, Madison, WI (1998).

Blocking Protein Import into Pea Chloroplast using Avidin/Precursor Complexes John E. Froehlich and Ken Keegstra At the 36th Annual Meeting of The American Society for Cell Biology, San Francisco, CA. (1996).

Subunits of the Chloroplastic Protein Import Machinery in Maize and Arabidopsis J. A. Davila-Aponte, J. E. Froehlich, P. J. Tranel and Ken Keegstra At the 36th Annual Meeting of The American Society for Cell Biology, San Francisco, CA. (1996).

Identification and Analysis of Components of the Chloroplastic Protein Import Apparatus: Novel Targeting and Insertion of One of the Components. P. J. Tranel, M. Akita, J. Davila-Aponte, A. Goyal, J. E. Froehlich, E. Nielsen, and Ken Keegstra At the LX Cold Springs Harbor Symposium on Quantitative Biology, Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1995)

A Component of the Chloroplastic Protein Import Apparatus is Targeted to the Outer Envelope Membrane via a Novel Pathway; Pat Tranel, John E. Froehlich\*, Arun Goyal, and Ken Keegstra. At the 1995 Midwest Section American Society of Plant Physiologists (Talk)

Preliminary Identification of a Peroxisomal Protein Receptor by Cross-linking; John E. Froehlich, Martin Weidmann, and Paul B. Lazarow. At the 31st Annual Meeting of The American Society for Cell Biology, Boston, Mass. (1991)

Purification and Characterization of Acyl Carrier Protein from Two

Different Cyanobacteria; John E. Froehlich, Jan G. Jaworski, and Susan R. Barnum. At the 9th International Symposium on the Biochemistry, Structure and Utilization of Plant Lipids, Kent, UK (1990)

Purification and Characterization of Acyl Carrier Protein from Two

Different Cyanobacteria; John E. Froehlich, Jan G. Jaworski, and Susan R. Barnum. At the joint meeting of American and Canadian Societies of Plant Physiologist, Toronto, Canada (1989)

**SEMINAR PRESENTATIONS**

Title: **“Stop OR Go Traffic : Targeting of Chloroplastic Integral Membrane Proteins to either the Inner Envelope or Thylakoid Membrane” .**

Western Michigan University Department of Biological Sciences Colloquium

(invited Speaker)

Western Michigan University (Kalamazoo, MI )

March 29, 2013

Host: Dr. Kathryn M Docherty

Title: **“Stop OR Go Traffic : Targeting of Chloroplastic Integral Membrane Proteins to either the Inner Envelope or Thylakoid Membrane” .**

EMU Biology Seminar Series (Invited Speaker)

Eastern Michigan University (Ypsilanti, MI )

March 31, 2011

Host: Dr. Aaron Liepman

Title: **A Little Pushing and Pulling: Protein Translocation Across the Chloroplastic Envelope Membrane**

Recent Advances in Biology Seminar (Invited Speaker)

Lawrence University (Appleton WI)

October 20, 2006

Host: Dr. Nicholas C. Maravolo

Title: **A Little Pushing and Pulling: Protein Translocation Across the Chloroplastic Envelope Membrane**

Canadian Society of Plant Physiologist Eastern Regional Meeting

(Invited Speaker)

Wilfrid Laurier University

December 16-17, 2005

Host: Dr. Matthew Smith

Title: **Proteomic Study of the *Arabidopsis thaliana* Chloroplastic Envelope Membrane Utilizing Alternatives to Traditional Two-Dimensional Electrophoresis**

University of Tennessee, Memphis

October 23, 2003

Host: Dr. Steven Schwartzbach

## Thesis Defense

Student: Kyle Westen

Title: **Toward a functional characterization of the Acidic domain of the chloroplast protein import receptor Toc159**

Mentor: Dr. Matthew Smith, Wilfrid Laurier University, Waterloo, Ontario (Canada)

Invited Outside Reviewer: Dr. John E. Froehlich, Michigan State University, East Lansing, Michigan, (USA)

Date: January 23, 2012

**PAPER REVIEWS**

Have reviewed numerous papers for the following journals:

Journal of Natural Resources, Life Sciences Education,

Plant Physiology, Journal of Biological Chemistry, The Plant Journal, Proteomics, PNAS, The Plant Cell, Genetics, PloS,

**USDA**

National Research Initiative (NRI) Proposal Reviewer: 2004, 2005, 2006

Ad-hoc Reviewer for National Science Foundation: 2012

### COLLABORATORS AND OTHER AFFILIATIONS

Collaborators: Katherine Osteryoung (Michigan State University), Peter Dörmann (Max-Planck-Institute, Golm, Germany), Gregg Howe (Michigan State University), Clint Chapple (U of Purdue), Ronald Coolbaugh (U of Purdue), Marilyn Parsons (U of Washington, Seattle ), Amy DeRocher (U of Washington, Seattle ), Rodney Croteau (Washington State University), Jonathan Gershenzon (Max-Planck-Institute, Jena, Germany), Christoph Benning (Michigan State University), Douglas Gage (Michigan State University), Eran Pichersky (U of Michigan), Andreas P.M. Weber, (Heinrich-Heine-Universität, Düsseldorf, Germany), Stefan Walter (U of Michigan), Rob Larkin (Michigan State University), Robert Last (Michigan State University), Matthew Smith (Wilfrid Laurier University), Dean DellaPenna (Michigan State University), Sheng Yang He (MSU-DOE Plant Research Lab), James Alfano (U of Nebraska-Lincoln), David Kramer (MSU-DOE Plant Research Lab), Mike Garivito (Michigan State University), Katherine Dehesh (UC Davis), Federica Brandizzi (MSU-DOE Plant Research Lab), Donna Fernandez (U Wisconsin-Madison), Jochen Zimmer (U of Virginia), Kentaro Inuoe (UC Davis).

**Advisor**

**Advisor for undergraduate research projects**:

Michael Young ( Washington University, St. Louis,MO),1995-1998

Brandon Blinkenberg (Michigan State University pursuing MS in computer science), 1999-2001

Richard Kollewehr (Michigan State University), 2002-2003

Bryan Kovas (Wayne State Medical School), 2002-2004

Christian Rosar (Fulbright Scholar) Fall 2005

Sowkya Rangarajan (Hershey Medical School, Hershey, PA), 2003-2005

Emily Olenzek (Michigan State University Medical School), 2005- 2007

Rob Orler (Michigan State University, **Lab Technician**), 2006- 2008

Eric Vanderpool (Indiana University), 2010- 2011

John Stein (Michigan State University School of Osteopathic Med. ) 2010-2012

Andrew Ostosh (Michigan State University Medical School) 2011-2014

Josh Temple (Michigan State University, **Lab Technician**) 2011-2013

David Salvatori (Michigan State University, undergraduate) 2014-present

Aaron Walkowski (Michigan State University, undergraduate) 2014-present

David Kasperski III (Michigan State University, undergraduate) 2016-present

Anthony Rotondo (Michigan State University, undergraduate) 2016-present

**Biochemistry Research and Trainee Program (BRTP) student**:

Dan Giles (Lawrence University) 5/17/04-5/17/05

**Postdocs**:

Dr. Hyder Ali Koja (National Institute of Polytechnics (INP-ENSAT, France) 4/8/04-9/30/06; obtained post-doctoral position

Dr. Joanna Tripp (University Frankfurt am Main, Germany) 3/1/05-8/30/07

**2007 Secondary Teacher Summer Research Experiences in Plant Genomics Program**: Jim Dawe (High School Science teacher from Mio, Michigan).

**Funding**

National Science Foundation (NSF) grant (MCB 0316262) 2003-2006 (**Accepted**)

Department of Energy-Plant Research Laboratory Appointment

**UNIVERSITY ACTIVITIES**

# UURAF Participation: As described from the MSU Undergraduate Research Website: “*The annual University Undergraduate Research and Arts Forum (UURAF) provides Michigan State undergraduate students with an opportunity to showcase their scholarship and creative activity. Held each spring in the MSU Union, UURAF brings together an intellectual community of highly motivated students to share their work with faculty, peers, and external audiences. UURAF provides a unique educational opportunity for aspiring researchers. MSU undergraduates gain experience in presenting their research, answer questions about their work from audience members and guests, and receive constructive feedback from judges*”.

**UURAF 2004**

Presenter: Eric Vanderpool

Poster Title: “Stop and Go Traffic: The targeting of chloroplast membrane proteins to either the Inner Envelope Membrane or Thylakoid Membrane”

(*Winner Best Poster*)

Presenter: John Stein

Poster Title: “Like Threading a Needle: The Targeting of Membrane Proteins with Multiple Transmembrane Domains to the Thylakoid Membrane”

Presenter: Rob Orler

Poster Title: “Investigating the Multiple Targeting Pathways that Direct Proteins to Various Membranes within Chloroplasts”

Presenter: Sowkya Rangarajan

Oral Presentation (Gold Room A), Session I

Molecular Biology

Talk Title: “Genetic Investigation of Molecular Chaperones Involved in Protein Import into Chloroplasts ”

**UURAF 2005**

Presenter: Sowkya Rangarajan

Oral Presentation (Gold Room A), Session II

Biochemistry and Molecular Biology

Talk Title: “Examining the Role and Function of Various Domains of Tic40 during Protein Import into Chloroplasts”

**UURAF 2015**

Presenters: David Salvatori and Aaron Walkowski

Poster Title: “Shedding Light on Photosynthesis”

**MSU-DOE Plant Research Student Presentation (DOE Review 2014)**

Presenter: Andrew Ostosh

Poster Title: “Characterization of a FtsH Protease Complex Located at the Inner Envelope of Chloroplasts”

**MSU-DOE Plant Research Coordinator for:**

**1) PRL-ASC: PRL Arabidopsis Service Center**

**Supervisor:** John E Froehlich

**Staff:** Linda Danhof**,** Susan Myers, Tessa Clark, Katie Ivan

**Mission:** The PRL Arabidopsis Service Center (ASC) is offering two services to assist PRL researchers: 1) Arabidopsis T87 cell culture transformation service and 2) Arabidopsis Plant transformation service (For more information see: PRL ASC webpage : http:prlasc.bch.msu.edu ). The goal of this center is to help free up the time and space for PRL researchers. The center is being supervised by John Froehlich. For further information visit the website or contact Linda Danhof at danhof@msu.edu or Susan Myers at [myerssus@msu.edu](mailto:myerssus@msu.edu).

**2) Protein Simple Wes® Facility (Plant Biology, Room S248)**

**Supervisor:** John E Froehlich

**Staff:** Brendon Johnson (Technician; MSU Graduate)

**Purpose:** Coordinate usage of the Protein Simple Wes® machine by members of the PRL faculty members involved in Project A, B or C as designated by the MSU-DOE PRL proposal.

**Mission Statement:** One common method to characterize newly found proteins involved in photosynthesis is western blotting. Unfortunately, western blotting is both time-consuming, difficult to standardize between experimental runs, and not amenable to high throughput approaches.

To overcome these shortcomings, the MSU-DOE PRL has purchased an automated western blot system, termed Wes™, (See Protein Simple Webpage), to accelerate the analysis of photosynthetic mutants. This instrument automates the entire western blotting procedure and has several significant advantages over conventional western blotting such as:

* All the manual steps are removed accelerating the assays, and fully analyzed results are ready in just 3-5 hours
* Automating the process removes variability, so results are more reproducible run to run, between users and over time.
* Since Wes doesn't do a blotting step, protein transfer inconsistencies are eliminated, giving you more quantitative data.
* Automated, standardized protocols will allow us to better compare results on experiments taken at different times

Enhances Experimental Aims

Integration of the Wes™ in our workflow should allow us to rapidly 1) classify the genes of emergent function according to their effects on the levels of photosynthetic complexes; 2) identify protein interacting partners that can suggest function; determine the effects of mutations and environmental conditions on the turnover rates of photosynthetic complexes.

The results of these studies will provide essential clues for determining the functions of newly-identified photosynthetic genes. The Wes™ is located in Plant Biology Building, Room S248 (Contact Dr. John Froehlich, [froehli5@msu.edu](mailto:froehli5@msu.edu) , for initial training and usage time.)