Curriculum Vitae: Peter D. Dahlberg

Contact

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Education

Stanford University, Stanford, California USA: Postdoc in Chemistry

University of Chicago, Chicago, Illinois USA: Ph.D. in Biophysics **December 2016**
Dissertation: Energy Transfer Events In Photosynthesis Observed *in vivo* Using Nonlinear Ultrafast Spectroscopies

McGill University, Montreal, QC, Canada: B.S., First Class Honours Physics **May 2011**

Employment

SLAC National Accelerator Laboratory, Menlo Park, California USA
Staff scientist **2023-Present**
Panofsky fellow **2021-2023**

Stanford University, Stanford, California USA
Postdoctoral fellow, Supervisor: Professor W.E. Moerner **2016-2021**

University of Chicago, Chicago, Illinois USA
PhD Candidate, Supervisors: Professor Greg Engel and Dr. David M. Tiede **2011-2016**

University of California, Berkeley, Berkeley, California USA
Research Internship, Supervisor: Professor Ashok Gadgil **Summer 2010**

McGill University, Montreal, Quebec Canada
Research Assistant, Supervisor: Professor Paul Wiseman **Academic year 2010**
Research Assistant, Supervisor: Professor Matthew Dobbs **Academic Years 2007-2010**

University of Minnesota, Minneapolis, Minnesota USA
Research Assistant, Supervisor: Professor Shaul Hannany **Summer 2008**
Research Assistant, Supervisor: Professor Gary Balas **Summer 2007**

Honors And Awards

SLAC Panofsky Fellowship , 2021
NSF Graduate Research Fellowship (GRFP), 2012
University of Chicago Graduate Program in Biophysical Sciences distinguished scholar, 2012
US Department of Energy Science Undergraduate Laboratory Internship, 2010
Sigma Xi Excellence in Undergraduate Research Award, 2011
Graduated First Class Honours in Physics, 2011
Golden Key International Honors Society, 2007, 2008, 2009

Research Experience and Scientific Interests

Freeman Dyson, the famed theoretical physicist, said "new directions in science are launched by new tools much more often than by new concepts." Indeed, the unifying theme of my research is to develop new tools; specifically, optical instrumentation to enable new biological discoveries. During my PhD I focused on methods to suppress noise from scattered light in ultrafast two-dimensional electronic spectroscopy measurements. This allowed us to study ultrafast energy transfer events in living photosynthetic cells rather than just in vitro, as had always been done previously. More recently, beginning with my postdoctoral work, I have focused on the combination of fluorescence microscopy and cryogenic electron

tomography. Performing fluorescence microscopy in a manner compatible with cryogenic electron tomography presents numerous technical and fundamental challenges, but the potential biological insight that these complementary approaches provide makes these challenges worthy of attention. Currently I am pursuing several different combinations of these two microscopy methods that differ in the type of fluorescence microscopy performed and in the manner that the sample is prepared. Each approach provides context to interpret the structural information from cryogenic electron tomography. This context allows us to go beyond cataloging the observed structures and instead get directly at their biological function.

Publications

Total publications: 39 H-index: 23 i10-Index: 27

J Yoniles, JA Summers, KA Zielinski, C Antolini, M Panjalingam, S Lisova, FR Moss, MA Di Perna, C Kupitz, MS Hunter, L Pollack, S Wakatsuki PD Dahlberg. "Time-resolved cryogenic electron tomography for the study of transient cellular processes." *Molecular Biology of the Cell*, 2024 - *Just Accepted*

D Perez, DP Dowlatshahi, CA Azaldegui, PD Dahlberg, WE Moerner."Exploring transient states of PAmKate to enable improved cryogenic single-molecule imaging." *Under Review JACS*

EA Koning, M Panjalingam, J Tran, MR Eckhart, PD Dahlberg, Lucy Shapiro."The Biogenesis of Bacterial PHB Granules." *bioRxiv*, 2023

AM Sartor, PD Dahlberg, D Perez, WE Moerner "Characterization of mApple as a Red Fluorescent Protein for Cryogenic Single-Molecule Imaging with Turn-Off and Turn-On Active Control Mechanisms." *The Journal of Physical Chemistry B*, 127(12), 2690-2700, 2023

PD Dahlberg, D Perez, CW Hecksel, W Chiu, WE Moerner, "Metallic Support Films Reduce Optical Heating in Cryogenic Correlative Light and Electron Tomography." *Journal of Structural Biology*, 214(4), 107901-107908, 2022

L Segev-Zarko, PD. Dahlberg, SY Sun, DM Pelt, CY Kim, ES Egan, JA Sethian, W Chiu, JC Boothroyd, "Cryo-electron tomography with mixed-scale dense neural networks reveals key steps in deployment of Toxoplasma invasion machinery." *PNAS Nexus*, 1(4), pgac183, 2022

D Perez, PD Dahlberg, J Wang, AM Sartor, JS Borden, LS Shapiro, WE Moerner, "Identification and demonstration of roGFP2 as an environmental sensor for cryogenic correlative light and electron microscopy." *Journal of Structural Biology*, 214(3), 107881-107886, 2022

WB Carpenter, A Lavania, JS Borden, LM Oltrogge, D Perez, PD Dahlberg, DF Savage, WE Moerner, "Ratiometric Sensing of Redox Environments Inside Individual Carboxysomes Trapped in Solution." *The Journal of Physical Chemistry Letters*, 13(20), 4455-4462, 2022

S Saurabh, TN Chong, C Bayas, PD Dahlberg, HN Cartwright, WE Moerner, LS Shapiro, "ATP-responsive biomolecular condensates tune bacterial kinase signaling." *Science Advances*, 8(7), eabm6570, 2022

AH Squires, Q Wang, PD Dahlberg, WE Moerner, "A bottom-up perspective on photodynamics and photoprotection in light-harvesting complexes using anti-Brownian trapping." *The Journal of Chemical Physics*, 156(7), 070901, 2022

PD Dahlberg, WE Moerner, "Cryogenic Super-Resolution Fluorescence and Electron Microscopy Correlated at the Nanoscale." *Annual Review of Physical Chemistry*, 72, 253-278, 2021

PD Dahlberg, D Perez, Z Su, W Chiu, WE Moerner, "Cryogenic Correlative Singel-Particle Photoluminescence Spectroscopy and Electron Tomography for Investigation of Nanomaterials." *Angewandte Chemie International Edition*, 59(36), 15642-15648, 2020

PD Dahlberg, S Saurabh, AM Sartor, J Wang, P Mitchell, W Chiu, LS Shapiro, WE Moerner, "Cryogenic Single-Molecule Fluorescence Annotations for Electron Tomography Reveals *In Stiu* Organization of Key Proteins in *Caulobacter*." *Proceedings of the National Academy of Sciences*, 117(25), 13937-13944, 2020

AH Squires, A Lavania, PD Dahlberg, WE Moerner, "Interferometric Scattering Enables Fluorescence-Free Electrokinetic Trapping of Single Nanoparticles in Free Solution" *Nano Letters* 19(6), 4112-4117, 2019

AH Squires, PD Dahlberg, H Liu, NC Magdaong, RE Blankenship, WE Moerner "Single-Molecule Trapping and Spectroscopy Reveals Photophysical Heterogeneity of Phycobilisomes Quenched by Orange Carotenoid Protein" *Nature Communications* 10(1), 1172, 2019

SC Massey, PC Ting, SH Yeh, PD Dahlberg, SH Sohail, MA Allodi, EC Martin, S Kais, CN Hunter, GS Engel, "Orientational Dynamics of Transition Dipoles and Exciton Relaxation in LH2 from Ultrafast Two-Dimensional Anisotropy" *Journal Of Physical Chemistry Letters* 10(2), 270-277, 2019

PD Dahlberg, AM Sartor, J Wang, S Saurabh, LS Shapiro, WE Moerner, "Identification of PAmKate as a Red Photoactivatable Fluorescent Protein for Cryogenic Super-Resolution Imaging." *Journal of American Chemical Society*, 140(39), 12310-12313, 2018

L Wang, NP Brawand, M Voros, PD Dahlberg, JP Otto, NE Williams, DM Tiede, G Galli, GS. Engel, "Excitations Partition Into Two Distinct Populations in Bulk Perovskites" *Advanced Optical Materials*, 6(5), 1700975, 2018

SH Sohail, PD Dahlberg, MA Allodi, SC Massey, PC Ting, EC Martin, CN Hunter, GS. Engel, "Communication: Broad Manifold of Excitonic States in Light-Harvesting Complex 1 Promotes Efficient Unidirectional Energy Transfer *in vivo*" *The Journal of Chemical Physics*, 147(13), 131101, 2017

PD Dahlberg, PC Ting, SC Massey, EC Martin, CN Hunter, GS. Engel, "Mapping The Ultrafast Flow Of Harvested Solar Energy In Living Photosynthetic Cells" *Nature Communications*, 8(1), 988, 2017

SR Soltau, J Niklas, PD Dahlberg, KL Mulfort, OG Poluektov, LM Utschig "Charge Separation Related To Photocatalytic H_2 Production From A Ru-Apoflavodoxin-Ni Biohybrid" *ACS Energy Letters*, 2(1), 230-238, 2016

MA Allodi,PD Dahlberg, RJ Mazuski, HC Davis, GS. Engel, "Optical Resonance Imaging: An Optical Analog To MRI With Subdiffraction-Limited Capabilities" *ACS Photonics*, 3(12), 2445-2452, 2016

PD Dahlberg, CT Boughter, NF Faruk, L Hong, YH Koh, MA Reyer, A Shaiber, A Sherani, J Zhang, JE Jureller, AT Hammond "A Simple Approach To Spectrally Resolved Fluorescence And Bright Field Microscopy Over Select Regions Of Interest," *Review Of Scientific Instruments*, 87(11), 113704, 2016

D Hayes, RG Hadt, JD Emery, AA Cordones, ABF Martinson, ML Shelby, KA Fransted, PD Dahlberg, J Hong, X Zhang, Q Kong, RW Schoenlein, L Chen "Electronic And Nuclear Contributions To Time-Resolved Optical And X-Ray Absorption Spectra Of Hematite And Insights Into Photoelectrochemical Performance" *Energy And Environmental Science*, 9(12), 3754-3769, 2016

SR Soltau, PD Dahlberg, J Niklas, OG Poluektov, KL Mulfort, LM Utschig "Ru-Protein-Co Biohybrids Designed For Solar Hydrogen Production: Understanding Electron Transfer Pathways Related To Photocatalytic Function," *Chemical Science*, 7(12), 7068-7078, 2016

PD Dahlberg, PC Ting, SC Massey, DM Tiede, GS. Engel, "Electronic Structure and Dynamics Of Higher-Lying Excited States In Light Harvesting Complex 1 From *Rhodobacter sphaeroides*" *journal of physical chemistry A*, 120(24), 4124-4130, 2016

A Gopal, B Rappaz, V Rouger, I Martyn, PD Dahlberg, R Meland, I Beamish, T Kennedy, and P Wiseman "Netrin-1 regulated distribution of UNC5B and DCC in live cells revealed by TICCS" *Biophysical Journal*, 110(3), 623-634, 2016

PD Dahlberg, GJ Norris, C Wang, S Viswanathan, VP Singh, and GS Engel, "Coherences Observed *in vivo* in Photosynthetic Bacteria Using Two-Dimensional Electronic Spectroscopy," *The Journal Of Chemical Physics*, 143(10), 101101, 2015

ML Flanagan, PD Long, PD Dahlberg, BS Rolczynski, SC. Massey, GS Engel, "Mutations to R. Sphaeroides Reaction Center Perturb Energy Levels and Vibronic Coupling but Not Observed Energy Transfer Rates," *The Journal of Physical Chemistry A*, 120(9), 1479-1487, 2015

C She, I Fedin, DS Dolzhnikov, PD Dahlberg, GS Engel, RD Schaller, and DV Talapin, "Red, Yellow, Green, and Blue Amplified Spontaneous Emission and Lasing Using Colloidal Nanoplatelets," *ACS Nano*, 9(10), 9475-9485, 2015

SR Soltau, J Niklas, PD Dahlberg, OG Poluektov, DM Tiede, KL Mulfort and LM Utschig, "Aqueous light driven hydrogen production by a Ru-ferredoxin-Co biohybrid," *Chemical Communications*, 51(53), 10628-10631, 2015

VP Singh, M Westberg, C Wang, PD Dahlberg, T Gellen, AT Gardiner, RJ Cogdell and GS Engel, "Towards quantification of vibronic coupling in photosynthetic antenna complexes." *The Journal Of Chemical Physics*, 142(21), 212446, 2015

JR Caram, H Zheng, PD Dahlberg, BS Rolczynski, GB Griffin, DS Dolzhnikov, DV Talapin and GS Engel, "Exploring size and state dynamics in CdSe quantum dots using two-dimensional electronic spectroscopy." *The Journal Of Chemical Physics*, 140(8), 084701, 2014

H Zheng, JR Caram, PD Dahlberg, BS Rolczynski, S Viswanathan, DS Dolzhnikov, A Khadivi, DV Talapin, and GS Engel, "Dispersion-Free Continuum Two-Dimensional Electronic Spectrometer." *Applied Optics* 53(9), 1909-1917, 2014

AF Fidler, VP Singh, PD Long, PD Dahlberg, GS Engel, "Dynamic Localization of Electronic Excitation in Photosynthetic Complexes Revealed With Chiral Two-Dimensional Spectroscopy," *Nature Communications*, 5(1), 3286, 2014

JR Caram, H Zheng, PD Dahlberg, BS. Rolcyznski, GB Griffin, AF Fidler, DS Dolzhnikov, DV Talapin, GS Engel, "Persistent Inter-Excitionic Quantum Coherence in CdSe Quantum Dots," *The Journal of Physical Chemistry Letters*, 5(1), 196-204, 2013

PD Dahlberg, AF Fidler, JR Caram, PD Long, GS Engel, "Energy Transfer Observed in Live Cells Using Two-Dimensional Electronic Spectroscopy," *The Journal of Physical Chemistry Letters*, 4(21), 3636-3640, 2013

AF Fidler, VP Singh, PD Long, PD Dahlberg, GS Engel, "Probing Energy Transfer Events in the Light Harvesting Complex 2 of *Rhodobacter sphaeroides* With Two-Dimensional Spectroscopy," *The Journal of Chemical Physics*, 139(15), 155101, 2013

AF Fidler, VP Singh, PD Long, PD Dahlberg, GS Engel, "Time Scales of Coherent Dynamics in the Light-Harvesting Complex 2 (LH2) of *Rhodobacter sphaeroides*" *The Journal of Physical Chemistry Letters*, 4(9), 1404-1409, 2013

Presentations

Invited Talks

PD Dahlberg, "Super-resolved cryogenic correlative light and electron microscopy: Specific labelling

with cellular context," *ONI Super-Resolution Summit*, San Francisco, California, April 2024

PD Dahlberg, "Brief introduction to cryogenic correlative light and electron microscopy," *EMBO Practical Course on In Situ Structural Biology by Cryo-FIB and Cryo-ET*, Martinsried, Germany, April 2024

PD Dahlberg, "Advanced methods in cryogenic correlative light and electron microscopy: from super-resolution to fluorescent biosensors," *University of Minnesota Biophysics Seminar*, Minneapolis, Minnesota, October 2023

PD Dahlberg, "Advanced methods in cryogenic correlative light and electron microscopy: specific labelling with cellular context ," *SSRL Monthly Seminar*, Menlo Park, California, August 2023

PD Dahlberg, "Super-resolved cryogenic correlative light and electron microscopy: Specific labelling with cellular context," *CZII Hardware Frontiers for CryoET Workshop*, Redwood City, California, May 2023

PD Dahlberg, "Super-resolved cryogenic correlative light and electron microscopy: Specific labelling with cellular context," *EMBO Workshop: In situ structural biology*, Heidelberg, Germany, February 2023

PD Dahlberg, "What in the Cell is Going on?!," *SLAC Public Lecture*, Menlo Park, CA, USA, January 2023

PD Dahlberg, "Advanced methods in cryogenic CLEM: from super-resolution to fluorescent biosensors," *Symposium on recent developments in cellular electron microscopy*, Paris, France, March 2022

PD Dahlberg, "Cryogenic super-resolution fluorescence correlated with cryogenic electron tomography: combining specific labelling and high resolution context," *SPIE Photonics West*, San Francisco, California, January 2022

PD Dahlberg, "Cryogenic Single-Molecule Localizations Correlated with Electron Tomography," *Center for Integrated Nanotechnologies Annual Meeting*, *(virtual)* Sandia National Laboratories, Albuquerque, New Mexico, September 2021

PD Dahlberg, "Combining cryogenic single-molecule fluorescence measurements and CryoEM," *Purdue Physical Chemistry Seminar*, West Lafayette, Indiana, September 2021

PD Dahlberg, "Seeing is believing: a new imaging method that significantly enhances observation of subcellular organization," *SLAC Panofsky Fellowship candidacy seminar*, *(virtual)* Menlo Park, California, March 2021

PD Dahlberg, "Combining cryogenic single-molecule fluorescence measurements and CryoEM: New methods with applications from biology to physical chemistry," *SMU Chemistry Seminar*, *(virtual)* Dallas, Texas, March 2021

PD Dahlberg, "Combining cryogenic single-molecule fluorescence measurements and CryoEM: New methods with applications from biology to physical chemistry," *UCLA Physical Chemistry Seminar*, *(virtual)* Los Angeles, California, March 2021

PD Dahlberg, "Cryogenic Super-Resolution Fluorescence Correlated with Cryogenic Electron Tomography: Combining Specific Labelling and High Resolution," *UCSD*, San Diego, California, February 2020

PD Dahlberg, "Cryogenic Super-Resolution Fluorescence Correlated with Cryogenic Electron Tomography: Combining Specific Labelling and High Resolution," *Scripps Research*, La Jolla, California, February 2020

PD Dahlberg, P Ting, SC Massey, GJ Norris, CN Hunter, DM Tiede, GS Engel, "2D Electronic Spectroscopy and Its Application to Photosynthetic Energy Transfer, *St. Olaf joint Chemistry-Physics Seminar*, Northfield, Minnesota, Scheduled September 30, 2015

PD Dahlberg, P Ting, SC Massey, GJ Norris, CN Hunter, DM Tiede, GS Engel, "2DES Constrains Electronic Structure Calculations and Energy Transfer Simulation, *UIUC Chemistry Seminar*, Champaign, Illinois, scheduled August 19, 2015

PD Dahlberg, P Ting, SC Massey, GJ Norris, CN Hunter, DM Tiede, GS Engel, "2D Electronic Spectroscopy Reveals Energy Transfer *in vivo*, *MIT Chemistry Seminar*, Boston, Massachusetts, May 2015

Professional Society Membership

American Chemical Society 2019 - Present
Biophysical Society 2012 - Present

Teaching Experience

Guest Lecturer, Stanford University, BioE 301 Biological Cryogenic Electron Microscopy and Tomography, Spring 2022

Guest Lecturer, Stanford University, Chem 275 Advanced Physical Chemistry - Single-Molecule and Light Spring 2021 and 2020

Teaching Assistant, University of Chicago. Sept.-Dec. 2015 BPHS 35001 Synthesis and Modification

Teaching Assistant, University of Chicago. Jan.-Mar. 2016 BPHS 35002 Synthesis and Modification

"Synthesis and Modification" is a required lab class for all biophysics graduate students at the University of Chicago. The year I was the teaching assistant has been the only year that the lab project resulted in publication, *Review Of Scientific Instruments*,87 (11),113704, 2016

Professional Service

Journal Article and Grant Reviewer: Reviews for Langmuir, Journal of Physical Chemistry Letters, PNAS, BBA-Bioenergetics, Department of Energy, and the Swiss National Science Foundation in the last year

Community Service

Founding member, board member, volunteer coordinator, and chief technical officer of the non-profit *Artifice*. *Artifice* focuses on science and technology education in south Chicago both as a weekly after school program at three different schools and as a hacker space in the community. To date we have reached over 100 students. **2013-Present**
Article from University of Chicago and Article from APS newsletter

Director of demonstration alley during the University of Chicago Physical Sciences Division open house, *Physics With A Bang*. Responsibilities included preparing 20 different demonstrations, teaching 25 graduate student volunteers to perform the demonstrations, and directing the 500+ community members that attended the open house through demonstration alley. **2015**

Volunteer and team leader with the Science and Technology Outreach Mentorship Program, STOMP. STOMP ran weekly after school science clubs at various University of Chicago charter schools for grades K-8. **2011-2014**

Skills

Super-resolution cryogenic correlative light and electron microscopy

Super-resolution microscopy
Cryogenic electron tomography
Cryogenic FIB-SEM with integrated light microscope
Optical instrumentation design and construction
Matlab, LabVIEW, machining, and basic electronic circuit design
Photosynthetic bacteria cell culture
Protein expression and purification
Femtosecond two-dimensional electronic spectroscopy
Femtosecond-millisecond transient absorption