Steve Meisburger

Curriculum Vitae

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Education

Aug. 2014 **Doctor of Philosophy**, *Applied Physics, Cornell University*, Ithaca, New York.
Ion interactions with single- and double-stranded DNA measured using solution X-ray scattering.
Advisor - Lois Pollack

May 2007 **Bachelor of Arts**, *Physics, Carleton College*, Northfield, Minnesota.
Summa cum laude

Grants and Awards

2016-2018 **NIH NRSA Postdoctoral Fellowship: "Allosteric motions of B_{12} enzymes"**, *Princeton University*, Princeton, New Jersey.
Advisor - Nozomi Ando (Chemistry). F32-GM117757.

May 2017 **Best Poster: Technical Achievement**, *CHESS Users' Meeting*.
For "Unmixing Enzyme Allostery".

May 2017 **Travel Award**, *American Crystallographic Association*.
To attend annual meeting in New Orleans, LA.

Apr. 2017 **Travel and Professional Development Award**, *American Society for Biochemistry and Molecular Biology*.
To attend annual meeting in Chicago, IL.

2008-2011 **NIH Predoctoral Training Grant in Molecular Biophysics**, *Cornell University*, Ithaca, New York.
Advisor - Lois Pollack (Applied & Engineering Physics). T32-GM008267.

May 2007 **Distinction awarded for Senior Integrative Exercise (Thesis)**, *Carleton College*, Northfield, Minnesota.

Research Experience

2018-present **Postdoctoral Research Associate**, *Cornell University*, Ithaca, New York.
Advisor - Nozomi Ando (Chemistry and Chemical Biology).

2016-2018 **Postdoctoral Research Fellow**, *Princeton University*, Princeton, New Jersey.
Advisor - Nozomi Ando (Chemistry).

- Investigated the dynamics of highly flexible multi-dommain metalloenzymes using solution small-angle X-ray scattering (SAXS) and X-ray diffuse scattering from crystals.
- Trained in biophysical chemistry of metalloproteins, including anaerobic technique, expression, purification, and crystallization.

2014-2016 **Postdoctoral Research Associate**, *Princeton University*, Princeton, New Jersey.
Advisor - Nozomi Ando (Chemistry).

- Established equilibrium model for allosteric regulation of liver Phenylalanine Hydroxylase by combining chromatography-coupled SAXS with mathematical deconvolution.

2008-2014 **Graduate Research Assistant**, *Cornell University*, Ithaca, New York.
Advisor - Lois Pollack (Applied & Engineering Physics)

- Microfabricated rapid mixers at the Cornell NanoScale Science & Technology Facility.
- Performed time-resolved and anomalous SAXS experiments at Cornell High Energy Synchrotron Source (CHESS) and the Advanced Photon Source (APS).

- Transcribed, purified, and characterized RNA using biophysical techniques including fluorescence, UV melting, and atomic emission spectroscopy.
- Thesis combined theory and experiment to understand the interplay of electrostatics and flexibility in the processes of RNA folding and DNA compaction.

Summer 2006 **Undergraduate Researcher**, *REU at the Santa Fe Institute*, Santa Fe, New Mexico.
Advisor - Alfred Hubler

Summer 2005 **Undergraduate Researcher**, *NNIN REU at Stanford University*, Palo Alto, California.
Advisor - Fabian Pease

Publications

[23] **Meisburger SP**, Case DA, Ando N. *Diffuse X-ray Scattering from Correlated Motions in a Protein Crystal.* Preprint on **bioRχiv** doi:10.1101/805424 (2019). *Submitted.*

[22] Khan CA, **Meisburger SP**, Ando N, Fitzpatrick PF. *The phenylketonuria-associated substitution R68S converts phenylalanine hydroxylase to a constitutively active enzyme but reduces its stability.* **J. Biol. Chem.** 294(12): 4359-67 (2019).

[21] Parker MJ, Maggiolo AO, Thomas WC, Kim A, **Meisburger SP**, Ando N, Boal AK, Stubbe J. *An endogenous dAMP ligand in Bacillus subtilis class Ib RNR promotes assembly of a noncanonical dimer for regulation by dATP.* **PNAS** 115: E4594–E4603 (2018).

[20] **Meisburger SP***, Thomas WC*, Watkins MB*, and Ando N. *X-ray scattering studies of protein structural dynamics.* **Chem. Rev.** 117(12): 7615–72 (2017).

*equal contribution

[19] **Meisburger SP** & Ando N. *Correlated motions from crystallography beyond diffraction.* **Acc. Chem. Res** 50: 580–583 (2017).

[18] Plumridge A, **Meisburger SP**, Andresen K, and Pollack L. *The impact of base stacking on the conformations and electrostatics of single-stranded DNA.* **Nucl. Acids Res.** 45: 3932-3943 (2017).

[17] Plumridge A*, **Meisburger SP***, Pollack L. *Visualizing single-stranded nucleic acids in solution.* **Nucl. Acids Res.** gkw1297 (2017).

*equal contribution

[16] **Meisburger SP,** Taylor AB, Khan CA, Zhang S, Fitzpatrick PF, Ando N. *Domain movements upon activation of phenylalanine hydroxylase characterized by crystallography and chromatography-coupled small-angle X-ray scattering.* **JACS** 138(20): 6506–16 (2016).

[15] Chen Y, Tokuda JM, Topping T, **Meisburger SP**, Pabit SA, Gloss LM, Pollack L. *Asymmetric unwrapping of nucleosomal DNA propagates asymmetric opening and dissociation of the histone core.* **PNAS** 114: 334-339 (2016).

[14] Rustiguel JK, Soares ROS, **Meisburger SP**, Davis KM, Malzbender KL, Ando N, Dias-Baruffi M, Nonato MC. *Full-length model of the human galectin-4 and insights into dynamics of inter-domain communication.* **Sci. Rep.** 6: 33633 (2016).

[13] **Meisburger SP**, Pabit SA, Pollack L. *Determining the locations of ions and water around DNA from X-ray scattering measurements.* **Biophys. J.** 108: 2886-95 (2015).

[12] Hopkins JB, Katz AM, **Meisburger SP**, Warkentin MA, Thorne RE, Pollack L. *A microfabricated fixed path length silicon sample holder enables robust background subtraction for cryoSAXS.* **J. Appl. Cryst.** 48: 227-37 (2015).

[11] Chen Y, Tokuda JM, Topping T, Sutton JL, **Meisburger SP**, Pabit SA, Gloss LM, Pollack L. *Revealing transient structures of nucleosomes as DNA unwinds.* **Nucl. Acids Res.** 42: 8767-76 (2014).

[10] Nguyen HT, Pabit SA, **Meisburger SP**, Pollack L, Case DA. *Accurate small and wide angle x-ray scattering profiles from atomic models of proteins and nucleic acids.* **J. Chem. Phys.** 141: 22D508 (2014).

[9] **Meisburger SP**, Sutton JL, Chen H, Pabit SA, Kirmizialtin S, Elber R, Pollack L. *Polyelectrolyte properties of single stranded DNA measured using SAXS and single-molecule FRET: beyond the wormlike chain model.* **Biopolymers** 99: 1032-45 (2013).

[8] **Meisburger SP**, Warkentin M, Chen H, Hopkins JB, Gillilan RE, Pollack L, Thorne RE. *Breaking the radiation damage limit with Cryo-SAXS.* **Biophys. J.** 104(1): 227-36 (2013).

[7] Chen H*, **Meisburger SP***, Pabit SA, Sutton JL, Webb WW, Pollack L. *Ionic strength-dependent persistence lengths of single-stranded RNA and DNA.* **PNAS** 109(3): 799-804 (2012).

*equal contribution

[6] Yoo TY*, **Meisburger SP***, Hinshaw J*, Pollack L, Haran G, Sosnick TR, Plaxco K. *Small-angle X-ray scattering and single-molecule FRET spectroscopy produce highly divergent views of the low-denaturant unfolded state.* **J. Mol. Biol.** 418(3-4): 226-36 (2012).

*equal contribution

[5] Kirmizialtin S, Pabit SA, **Meisburger SP**, Pollack L, Elber R. *RNA and its ionic cloud: solution scattering experiments and atomically detailed simulations.* **Biophys. J.** 102(4): 819-28 (2012).

[4] Blose JM, Pabit SA, **Meisburger SP**, Li L, Jones CD, Pollack L. *Effects of a protecting osmolyte on the ion atmosphere surrounding DNA duplexes.* **Biochemistry** 50(40): 8540-7 (2011).

[3] Li L, Pabit SA, **Meisburger SP**, Pollack L. *Double-stranded RNA resists condensation.* **Phys. Rev. Lett.** 106: 108101 (2011).

[2] Pabit SA, **Meisburger SP**, Li L, Blose JM, Jones CD, Pollack L. *Counting ions around DNA with anomalous small-angle X-ray scattering.* **JACS** 132(46): 16334-6 (2010).

[1] Pabit SA, Qiu X, Lamb JS, Li L, **Meisburger SP**, Pollack L. *Both helix topology and counterion distribution contribute to the more effective charge screening in dsRNA compared with dsDNA.* **Nucl. Acids Res.** 37: 3887-96 (2009).

Patents

Meisburger SP, Warkentin MA, Hopkins JB, Katz AM, Pollack L, and Thorne RE. (2018). *Apparatus and methods for low temperature small angle x-ray scattering.* US 9,927,336 (June 4, 2012).

Presentations

Talks

On the origin of diffuse X-ray scattering from protein crystals. Meisburger SP, Ando N. **ACS Northeast Regional Meeting**. June 25, 2019. *Invited.*

Correlated Motions from Protein Crystallography. Meisburger SP, Case DA, Ando N. **Seminar at the Center for Nonlinear Studies, Los Alamos National Lab**. October 16, 2018. *Invited.*

Correlated Motions from Protein Crystallography. Meisburger SP, Case DA, Ando N. **ACA Annual Meeting**: Session 1.1.1 Closing the R-Factor Gap in Protein Crystallography. July 21, 2018.

A new method for computational purification of complex mixtures by chromatography-coupled SAXS. Meisburger SP, Taylor AB, Khan CA, Zhang S, Fitzpatrick PF, Ando N. **ACA Annual Meeting**: Hybrid Methods - BioSAXS Session. May 27, 2017.

Unmixing Enzyme Allostery. Meisburger SP, Taylor AB, Khan CA, Zhang S, Fitzpatrick PF, Ando N. **ASBMB Annual Meeting**: Structural Dynamics of Enzymes Spotlight Session. April 24, 2017. *Invited.*

X-ray imaging of enzymes in motion. Meisburger SP. **CHESS-U Workshops: Biomolecules in Motion.** June 8, 2016. *Invited.*

Sorting out the structure of single-stranded DNA. Meisburger SP, Sutton JL, Chen H, Andresen K, Pollack L. **58th Annual Biophysical Society Meeting.** Feb. 2014.

Introducing Cryo-SAXS: Solution structures from nanoliter volumes. Meisburger SP, Warkentin M, Chen H, Hopkins JB, Katz AM, Gillilan RE, Pollack L. **CHESS Users' Meeting.** June 2013. *Invited.*

Time-Resolved SAXS Reconstructions Reveal a Kinetic Intermediate in RNA Folding. Meisburger SP, Pabit SA, Li L, Blose JM, Brooks K, Hampel K, Pollack L. **RNA-UNY Conference**. Oct. 2010.

Posters (selected)

*Unmixing Enzyme Allostery.** Meisburger SP**,** Taylor AB, Khan CA, Zhang S, Fitzpatrick PF, Ando N. **CHESS Users' Meeting**. June 2017.

*Awarded best poster: technical achievement

Introducing Cryo-SAXS for measuring low resolution macromolecular structure without radiation damage. Meisburger SP, Warkentin M, Chen H, Hopkins JB, Katz AM, Gillilan RE, Thorne RE, Pollack L. **57th Annual Biophysical Society Meeting.** Feb. 2013.

A semi-transparent beamstop for accurate normalization of millisecond time-resolved SAXS profiles. Meisburger SP, Gillilan RE, Woll A, Pollack L. **Chess Users' Meeting**. June 2012.

Solution structures of flexible RNA molecules in mono- and divalent salt. Meisburger SP, Chen H, Pabit SA, Sutton JL, Webb WW, Pollack L. **56th Annual Biophysical Society Meeting.** Feb 2012.

Measuring the dimensions of a compact kinetic intermediate in the folding pathway of the GlmS Ribozyme. Meisburger SP, Pabit SA, Li L, Blose JM, Brooks K, Hampel K, Pollack L. **55th Annual Biophysical Society Meeting.** Feb 2011.

Visualizing the structure of the glmS riboswitch as it folds using time-resolved SAXS. Meisburger SP, Pabit SA, Li L, Blose JM, Hampel K, Pollack L. **54th Annual Biophysical Society Meeting.** Feb 2010.

Teaching & Mentoring

Workshops

October 2018 **Lecturer**, *Advanced Light Source*, Berkeley, California.
9th annual SIBYLS BioSAXS workshop

April 2018 **Lecturer**, *Cornell High Energy Synchrotron Source*, Ithaca, New York.
BioSAXS Essentials 8: Getting Started in Biological Small-Angle X-ray Solution Scattering

May 2017 **Lecturer**, *Cornell High Energy Synchrotron Source*, Ithaca, New York.
BioSAXS Essentials 7: Getting Started in Biological Small-Angle X-ray Solution Scattering

May 2016 **Lecturer**, *Cornell High Energy Synchrotron Source*, Ithaca, New York.
BioSAXS Essentials 6: Getting Started in Biological Small-Angle X-ray Solution Scattering

Nov. 2014 **Lecturer**, *Cornell High Energy Synchrotron Source*, Ithaca, New York.
BioSAXS Essentials 5: Getting Started in Biological Small-Angle X-ray Solution Scattering

Mentoring

2016 **Mentor**, *Princeton University*, Princeton, New Jersey.
Supervised an undergraduate thesis project in Chemistry on simulation of diffuse scattering from crystals (Brian Chang '16)

2012-2013 **Mentor**, *Cornell University*, Ithaca, New York.
Supervised an undergraduate honors thesis project in Applied Physics on ion counting with ICP-AES (Peter Gu '13)

2012-2013 **Mentor**, *Cornell University*, Ithaca, New York.
Supervised undergraduate honors thesis project in Applied Physics on measuring distances in DNA with gold nanoparticle labels (Mark Landy '13)

University Teaching

Fall 2018 **Guest Lecturer**, *Cornell University*, Ithaca, New York.
CHEM 2870: *Introductory Physical Chemistry*

Fall 2015 **Teaching Assistant**, *Princeton University*, Princeton, New Jersey.
CHM 515: *Biophysical Chemistry I*

Spring 2014 **Guest Lecturer**, *Princeton University*, Princeton, New Jersey.
CHM 516: *Biophysical Chemistry II*

Fall 2013 **Guest Lecturer**, *Cornell University*, Ithaca, New York.
ENGRD 2520: *Physics of Life*

2012-2013 **Teaching Assistant**, *Cornell University*, Ithaca, New York.
AEP 3630: *Electronic Circuits*

Professional Societies

2017-present **American Crystallographic Association**.

- Active member of Small-Angle Scattering Special Interest Group
- Speaker at 2018 Annual Meeting: *Correlated Motions from Protein Crystallography*
- Organized *Diffuse Scattering for Biological Structure and Dynamics* session for the 2019 national meeting.

2009-2015 **Biophysical Society**.

- Co-chair of *Platform AR: DNA Structure & Dynamics* at the 58th Annual Meeting (Feb 2014), San Francisco, CA
- Platform speaker at the 58th Annual Meeting (Feb 2014): *Sorting out the structure of single-stranded DNA*
- Poster presenter at the 2010, 2011, 2012, and 2013 Annual Meetings

Committees and Service

2016-2019 **Elected member of the User Executive Committee**, *Cornell High Energy Synchrotron Source*, Ithaca, New York.

2015-present **Reviewer**, *JACS*.

2017-present **Reviewer**, *IUCR*.