

# STEPHEN D. FRIED

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## APPOINTMENTS & POSITIONS

*2014–to date* [King's College](#), Cambridge, UK  
Junior Research Fellow

*2014–to date* [MRC Laboratory of Molecular Biology](#), Cambridge, UK  
Visiting Researcher

*2016–to date* [European Bioinformatics Institute](#), Hinxton, UK  
Visiting Researcher

## EDUCATION

***Ph.D.*** *2009–2014* Stanford University, Stanford, CA, USA  
Dissertation: *On the Origins of Catalysis by Ketosteroid Isomerase*  
Advisor: Prof. S. G. BOXER

***Bachelor's*** *2005–2009* Massachusetts Institute of Technology, Cambridge, MA, USA  
**S.B.s** in Chemistry and Physics. Minor in History  
Thesis: *Oxygen-Oxygen Bonds: Catalytic Redox Pathways in Energy Storage*  
Advisors: Prof. A. TOKMAKOFF & Prof. D. G. NOCERA

## TEACHING EXPERIENCE

*2016–2018* Part 1B, Biochemistry and Molecular Biology (supervisor)  
Modules covered topics in structure and function of proteins and nucleic acids, regulation of gene expression, metabolism, and signaling.

*2015–2016* Part 1A, Chemistry (supervisor)  
Modules covered topics in organic, inorganic, and physical chemistry.

*2014–2105* Part 1B, Biochemistry and Molecular Biology (supervisor)

*2014* CHEM 185: Advanced Biophysical Chemistry (head TA)  
Coordinated discussions; mentored students; assigned and marked final papers.

*2013* CHEM 135: Physical Chemistry Principles (head TA)  
Designed the curriculum; wrote and managed assignments, exams, and course materials.

*2011* CHEM 221: Physical Organic Chemistry (TA)

*2010* CHEM 173: Quantum Mechanics (TA)

*2009* CHEM 131: Organic Chemistry III (TA)

## PUBLICATIONS

H-index = 11 ([Google scholar profile](#)).

- (20) [DOI-link](#) **Fried, S. D.**; Boxer, S. G.  
“Electric Fields and Enzyme Catalysis.”  
*Annu. Rev. Biochem.* **2017**, 86, 387–415.
- (19) [DOI-link](#) Wang, L.; **Fried, S. D.**; Markland, T. E.  
“Proton Network Flexibility Enables Robustness and Large Electric Fields in the Ketosteroid Isomerase Active Site.”  
*J. Phys. Chem. B* **2017**, DOI: 10.1021/acs.jpcc.7b06985
- (18) Boxer, S. G.; **Fried, S. D.**; Schneider, S. H.; Wu, Y.  
“Electric Fields and Enzyme Catalysis.”  
Proceedings of the 24<sup>th</sup> International Solvay Conference on Chemistry, World Scientific Publishing Co. **2017**.
- (17) [DOI-link](#) Elliott, T. S.; Bianco, A.; Townsley, F. M.; **Fried, S. D.**; Chin, J. W.  
“Tagging and Enriching Proteins Enables Cell-Specific Proteomics.”  
*Cell Chem. Biol.* **2016**, 23, 805–815.
- (16) [DOI-link](#) Wu, Y.; **Fried, S. D.**; Boxer, S. G.  
“Dissecting Proton Delocalization in an Enzyme’s Hydrogen Bond Network with Unnatural Amino Acids.”  
*Biochemistry* **2015**, 54, 7110–7119.
- (15) [DOI-link](#) **Fried, S. D.**; Schmied, W. H.; Uttamapinant, C.; Chin, J. W.  
“Ribosome Subunit Stapling for Orthogonal Translation in *E. coli*.”  
*Angew. Chem. Int. Ed.* **2015**, 54, 12791–12794.
- (14) [DOI-link](#) **Fried, S. D.**; Boxer, S. G.  
“Response to Comments on “Extreme electric fields power catalysis in the active site of ketosteroid isomerase.””  
*Science* **2015**, 349, 936.
- (13) [DOI-link](#) **Fried, S. D.**; Boxer, S. G.  
“Measuring Electric Fields and Noncovalent Interactions Using the Vibrational Stark Effect.”  
*Accounts of Chemical Research* **2015**, 48, 998–1006.
- (12) [DOI-link](#) Wang, L.; **Fried, S. D.**; Boxer, S. G.; Markland, T. E.  
“Quantum Delocalization of Protons in the Hydrogen Bond Network of an Enzyme Active Site.”  
*Proc. Natl. Acad. Sci. USA* **2014**, 111, 18454–18459.
- (11) [DOI-link](#) **Fried, S. D.**; Bagchi, S.; Boxer, S. G.  
“Extreme Electric Fields Drive Catalysis in an Enzyme Active Site.”  
*Science* **2014**, 346, 1510–1514.
- (10) [DOI-link](#) Mu, X.; Wang, Q.; Wang, L.-P.; **Fried, S. D.**; Piquemal, J.-P.; Dalby, K. N.; Ren, P.  
“Modeling Organochlorine Compounds and the  $\sigma$ -hole Effect Using a Polarizable Multipole Force Field.”  
*J. Phys. Chem. B* **2014**, 118, 6456–6465.
- (9) [DOI-link](#) **Fried, S. D.**; Wang, L.-P.; Boxer, S. G.; Ren, P.; Pande, V. S.  
“Calculations of the Electric Fields in Liquid Solutions.”  
*J. Phys. Chem. B* **2013**, 117, 16236–16248.
- (8) [DOI-link](#) **Fried, S. D.**; Boxer, S. G.

- “Thermodynamic Framework for Identifying Free Energy Inventories of Enzyme Catalytic Cycles.”  
*Proc. Natl. Acad. Sci. USA* **2013**, 110, 12271–12276.
- (7)  
[DOI-link](#) **Fried, S. D.**; Bagchi, S.; Boxer, S. G.  
“Measuring Electrostatic Fields in Both Hydrogen Bonding and non-Hydrogen Bonding Environments Using Carbonyl Vibrational Probes.”  
*J. Am. Chem. Soc.* **2013**, 135, 11181–11192.
- (6)  
[DOI-link](#) Sigala, P. A.; Fafarman, A. T.; Schwans, J.P.; **Fried, S. D.**; Fenn, T. D.; Caaveiro, J. M. M.; Pybus, B.; Ringe, D.; Petsko, G. A.; Boxer, S. G.; Herschlag, D.  
“Quantitative Dissection of Hydrogen Bond-Mediated Proton Transfer in the Ketosteroid Isomerase Active Site.”  
*Proc. Natl. Acad. Sci. USA* **2013**, 110, E2552–E2561.
- (5)  
[DOI-link](#) Bagchi, S.; **Fried, S. D.**; Boxer, S. G.  
“A Solvatochromic Model Calibrates Nitriles’ Vibrational Frequencies to Electrostatic Field.”  
*J. Am. Chem. Soc.* **2012**, 134, 10373–10376.
- (4)  
[DOI-link](#) Levinson, N. M.; **Fried, S. D.**; Boxer, S. G.  
“Solvent-induced Infrared Frequency Shifts in Aromatic Nitriles are Quantitatively Described by the Vibrational Stark Effect.”  
*J. Phys. Chem. B* **2012**, 116, 10470–10476.
- (3)  
[DOI-link](#) **Fried, S. D.**; Boxer, S. G.  
“Evaluation of the Energetics of the Concerted Acid-Base Mechanism in Enzymatic Catalysis: The Case of Ketosteroid Isomerase.”  
*J. Phys. Chem. B* **2012**, 116, 690–697.
- (2) **Fried, S. D.**; Kanan, M. W.; Nocera, D. G.  
“Bridged Bisindole Carboxylates as a Model for Oxidative O-O Homocoupling.”  
*The Nucleus* **2008**, 86, 9, 14–20.
- (1)  
[DOI-link](#) Rosenthal, J.; Chng, L. L.; **Fried, S. D.**; Nocera, D. G.  
“Stereochemical Control of H<sub>2</sub>O<sub>2</sub> Dismutation by Hangman Porphyrins.”  
*Chem. Commun.* **2007**, 25, 2642–2644.

## CONFERENCES

### Oral Presentations

- (3)  
October 2016 Boxer, S. G.; **Fried, S. D.**; Wu, Y.; Schneider S.  
“Electric Fields and Enzyme Catalysis.”  
24<sup>th</sup> International Solvay Conference on Chemistry, Brussels, Belgium.
- (2)  
September 2015 **Fried, S. D.**; Schmied, W. H.; Uttamapinant, C.; Chin J. W.  
“Ribosome Subunit Fusion Liberates the Large Subunit for Neofunctionalization.”  
Engineering Life 2015 Symposium, Dresden, Germany.
- (1)  
February 2013 **Fried, S. D.**; Bagchi, S.; Boxer, S. G.  
“Vibrational Stark Effects in the Active Site of Ketosteroid Isomerase Point to Large Electric Fields Driving Chemical Catalysis.”  
57<sup>th</sup> Biophysical Society Annual Meeting, Philadelphia, PA, USA.

### Poster Presentations

- (6)  
June 2016 **Fried, S. D.**; Wu, Y.; Schneider, S. H.; Boxer, S. G.  
“Extreme Electric Fields and Electrostatic Preorganization in Enzyme Catalysis.”  
EMBO Conferences: Chemistry of Biocatalysis: From Understanding to Design, Oulu, Finland

- (5) *February 2014* **Fried, S. D.;** Wang, L.-P.; Boxer, S. G.; Ren, P.; Pande, V. S.  
 "Calculations of the Electric Fields in Solutions and Proteins."  
 58<sup>th</sup> Biophysical Society Annual Meeting, San Francisco, CA.
- (4) *October 2013* **Fried, S. D.;** Wang, L.-P.; Boxer, S. G.; Ren, P.; Pande, V. S.  
 "Calculations of the Electric Fields in the Solution Phase."  
 Johnson Symposium, Stanford, CA.
- (3) *February 2012* **Fried, S. D.;** Boxer, S. G.  
 "An Amendment to Pauling's Paradigm of Transition State Binding."  
 56<sup>th</sup> Biophysical Society Annual Meeting, San Diego, CA.
- (2) *July 2011* **Fried, S. D.;** Boxer, S. G.  
 "A Modification to Pauling's Paradigm of Transition State Binding."  
 RSC Challenges in Chemical Biology, Manchester, UK.
- (1) *October 2010* **Fried, S. D.;** Boxer, S. G.  
 "How to Catalyze an Enolization Reaction: Getting some tips from the expert,  
 Ketosteroid Isomerase."  
 Johnson Symposium, Stanford, CA.

#### HONORS

- 2014 Annual Reviews Prize for Best Dissertation in Physical Chemistry
- 2013 Invited to the 63<sup>rd</sup> Meeting of Nobel Laureates in Lindau
- 2013 Enzymes section co-chair at the 57<sup>th</sup> Biophysical Society Annual Meeting
- 2012 Stanford Interdisciplinary Graduate Fellow
- 2012 Stanford Bio-X Fellow
- 2009 MIT Department of Chemistry Alpha Chi Sigma Award
- 2009 Sigma Pi Sigma – Physics Honor Society
- 2009 Hertz Fellowship Finalist
- 2009 NSF Graduate Research Fellow
- 2009 Phi Beta Kappa
- 2007 ACS Norris Richards Scholar for Undergraduate Research
- 2007 MIT Department of Chemistry Sophomore Achievement Award

#### LANGUAGES

- Human* ENGLISH – Mother tongue  
 FRENCH – Intermediate  
 HEBREW – Intermediate
- Computer* PYTHON  
 MatLab  
 FORTRAN  
 L<sup>A</sup>T<sub>E</sub>X  
 Bash

## COLLABORATIONS

- 2016– Prof. Reudi Aebersold (ETH Zurich) – cross-linking mass spectrometry for proteomics
- 2016– Prof. Janet Thornton (EMBL-EBI) – enzyme informatics
- 2016– Prof. Daniel Khananshili (Tel Aviv University) – functional electrostatics in sodium-calcium exchangers
- 2015– Dr. Lucy Colwell (University of Cambridge) – computational biology of tRNAs and synthetases

## SERVICE & LEADERSHIP

- 2015–2016 King's College Wine Committee
- 2014–2015 King's College Computing Committee
- 2012–2013 Organized the Physical Chemistry Tutorial Series – Stanford Chemistry Department
- 2011–2013 Safety Coordinator – Boxer Laboratory
- 2011 TA Trainer – Stanford Department of Chemistry
- 2010-2012 Board of Directors and Financial Committee – Hillel at Stanford

October 19, 2017