



Daniel Herschlag

Professor of Biochemistry and, by courtesy, of Chemical Engineering and of Chemistry

CONTACT INFORMATION

• Administrative Contact

Morgan Williams - Administrative Associate

Email mwillia@stanford.edu

Tel 650-498-8009

Bio

BIO

The overarching goal of the Herschlag Lab is to understand the fundamental behavior of RNA and proteins and, in turn, how these behaviors determine and impact biology more broadly. We are particularly interested in questions of how enzymes work, how RNA folds, how proteins recognize RNA, and the roles of RNA/protein interactions in regulation and control, and the evolution of molecules and molecular interactions. The lab takes an interdisciplinary approach, spanning and integrating physics, chemistry and biology, and employing a wide range of techniques.

ACADEMIC APPOINTMENTS

- Professor, Biochemistry
- Professor (By courtesy), Chemical Engineering
- Member, Bio-X
- Member, Stanford Cancer Institute
- Faculty Fellow, Stanford ChEM-H

ADMINISTRATIVE APPOINTMENTS

- Senior Associate Dean of Graduate Education and Postdoctoral Affairs, School of Medicine, (2011-2015)

HONORS AND AWARDS

- Member, National Academy of Sciences (2018)
- Student Service Faculty Award, Biochemistry, Stanford School of Medicine (2012)
- William Rose Award, ASBMB (2010)
- Fellow, AAAS (2005)
- Merit Award, NIH (2002)
- Cope Scholar Award, ACS (2000)
- Established Investigator, AHA (1998-2002)
- Pfizer Award for Enzyme Chemistry, ACS (1997)

- Fellowship in Science and Engineering, David and Lucile Packard (1995-2000)
- Scholar, Searle (1993-1996)
- Scholar in Biomedical Science, Lucille P. Markey (1990-1997)
- Postdoctoral Fellowship, Helen Hay Whitney (1989-1990; Colorado)
- Fellowship, Gillette Foundation (1986-1987; Brandeis)
- Award in Biochemistry, American Institute of Chemists (1982; SUNY)
- Award for Excellence in Biochemistry, SUNY (1982)
- Phi Beta Kappa, Michigan (1979)
- Scholar, James B. Angell (1978, 1979; Michigan)

LINKS

- Herschlag lab website: <http://herschlaglab.stanford.edu>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

The overarching goal of the Herschlag Lab is to understand the fundamental behavior of RNA and proteins and, in turn, how these behaviors determine and impact biology more broadly. We are particularly interested in questions of how enzymes work, how RNA folds, how proteins recognize RNA, and the roles of RNA/protein interactions in regulation and control, and the evolution of molecules and molecular interactions. The lab takes an interdisciplinary approach, spanning and integrating physics, chemistry and biology, and employing a wide range of techniques.

Teaching

COURSES

2019-20

- Biochemistry Bootcamp: BIOC 202 (Aut)
- Chemistry for Biologists and Others: BIOS 294 (Aut)
- Developing an Original Research Proposal: BIOC 360 (Spr)

2018-19

- Developing an Original Research Proposal: BIOC 360 (Sum)

STANFORD ADVISEES

Med Scholar Project Advisor

Daniel Mokhtari

Doctoral Dissertation Reader (AC)

Arjun Aditham, Jacqueline Carozza, Noori Chai, David Hanifi

Postdoctoral Faculty Sponsor

Mason Appel

Doctoral Dissertation Advisor (AC)

Daniel Mokhtari, Margaux Pinney, Catherine Stark

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biochemistry (Phd Program)
- Biophysics (Phd Program)

Publications

PUBLICATIONS

- **A Quantitative and Predictive Model for RNA Binding by Human Pumilio Proteins** *MOLECULAR CELL*
Jarmoskaite, I., Denny, S. K., Vaidyanathan, P. P., Becker, W. R., Andreasson, J. L., Layton, C. J., Kappel, K., Shivashankar, V., Sreenivasan, R., Das, R., Greenleaf, W. J., Herschlag, D.
2019; 74 (5): 966–+
- **Demonstration of protein cooperativity mediated by RNA structure using the human protein PUM2 RNA**
Becker, W. R., Jarmoskaite, I., Vaidyanathan, P. P., Greenleaf, W. J., Herschlag, D.
2019; 25 (6): 702–12
- **Blind tests of RNA-protein binding affinity prediction.** *Proceedings of the National Academy of Sciences of the United States of America*
Kappel, K., Jarmoskaite, I., Vaidyanathan, P. P., Greenleaf, W. J., Herschlag, D., Das, R.
2019
- **A Microfluidics-Based Assay for Mapping Connectivity in Highly Proficient Enzymes Reveals Functional Modularity**
Markin, C. J., Mokhtari, D. A., Sunden, F., Herschlag, D., Fordyce, P. M.
CELL PRESS.2019: 66A
- **Bringing Enzymology into the Genomic Era: Developing and Deploying New Tools to Quantitatively Map Functional Connections Throughout an Enzyme**
Markin, C., Mokhtari, D., Sunden, F., Herschlag, D., Fordyce, P. M.
CELL PRESS.2019: 23A
- **A Quantitative and Predictive Model for RNA Binding by Human Pumilio Proteins.** *Molecular cell*
Jarmoskaite, I., Denny, S. K., Vaidyanathan, P. P., Becker, W. R., Andreasson, J. O., Layton, C. J., Kappel, K., Shivashankar, V., Sreenivasan, R., Das, R., Greenleaf, W. J., Herschlag, D.
2019
- **Quantitative Studies of an RNA Duplex Electrostatics by Ion Counting.** *Biophysical journal*
Gebala, M., Herschlag, D.
2019
- **Computational design of three-dimensional RNA structure and function.** *Nature nanotechnology*
Yesselman, J. D., Eiler, D., Carlson, E. D., Gotrik, M. R., d'Aquino, A. E., Ooms, A. N., Kladwang, W., Carlson, P. D., Shi, X., Costantino, D. A., Herschlag, D., Lucks, J. B., Jewett, et al
2019
- **Enhancement of RNA/Ligand Association Kinetics via an Electrostatic Anchor.** *Biochemistry*
Sengupta, R. N., Herschlag, D.
2019
- **The roles of structural dynamics in the cellular functions of RNAs.** *Nature reviews. Molecular cell biology*
Ganser, L. R., Kelly, M. L., Herschlag, D., Al-Hashimi, H. M.
2019
- **Ion counting demonstrates a high electrostatic field generated by the nucleosome.** *eLife*
Gebala, M., Johnson, S. L., Narlikar, G. J., Herschlag, D.
2019; 8
- **Serum electrolytes can promote hydroxyl radical-initiated biomolecular damage from inflammation.** *Free radical biology & medicine*
Komaki, Y., Simpson, A. M., Choe, J. K., Pinney, M. M., Herschlag, D., Chuang, Y. H., Mitch, W. A.
2019; 141: 475–82

- **Sequence-dependent RNA helix conformational preferences predictably impact tertiary structure formation.** *Proceedings of the National Academy of Sciences of the United States of America*
Yesselman, J. D., Denny, S. K., Bisaria, N., Herschlag, D., Greenleaf, W. J., Das, R.
2019
- **Increasing the length of poly-pyrimidine bulges broadens RNA conformational ensembles with minimal impact on stacking energetics** *RNA*
Merriman, D. K., Yuan, J., Shi, H., Majumdar, A., Herschlag, D., Al-Hashimi, H. M.
2018; 24 (10): 1363–76
- **The Story of RNA Folding, as Told in Epochs.** *Cold Spring Harbor perspectives in biology*
Herschlag, D., Bonilla, S., Bisaria, N.
2018; 10 (10)
- **Structural Coupling Throughout the Active Site Hydrogen Bond Networks of Ketosteroid Isomerase and Photoactive Yellow Protein** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
Pinney, M. M., Natarajan, A., Yabukarski, F., Sanchez, D. M., Liu, F., Liang, R., Doukov, T., Schwans, J. P., Martinez, T. J., Herschlag, D.
2018; 140 (31): 9827–43
- **High-Throughput Investigation of Diverse Junction Elements in RNA Tertiary Folding.** *Cell*
Denny, S. K., Bisaria, N., Yesselman, J. D., Das, R., Herschlag, D., Greenleaf, W. J.
2018
- **Hydrogen Bonds: Simple after All?** *BIOCHEMISTRY*
Herschlag, D., Pinney, M. M.
2018; 57 (24): 3338–52
- **Recording and Analyzing Nucleic Acid Distance Distributions with X-Ray Scattering Interferometry (XSI).** *Current protocols in nucleic acid chemistry*
Zettl, T., Das, R., Harbury, P. A., Herschlag, D., Lipfert, J., Mathew, R. S., Shi, X.
2018; 73 (1): e54
- **Gold nanocrystal labels provide a sequence-to-3D structure map in SAXS reconstructions** *SCIENCE ADVANCES*
Zettl, T., Mathew, R. S., Shi, X., Doniach, S., Herschlag, D., Harbury, P. B., Lipfert, J.
2018; 4 (5): eaar4418
- **Hidden Structural Modules in a Cooperative RNA Folding Transition** *CELL REPORTS*
Gracia, B., Al-Hashimi, H. M., Bisaria, N., Das, R., Herschlag, D., Russell, R.
2018; 22 (12): 3240–50
- **Dissecting the Electrostatics of Nucleic Acids**
Gebala, M., Allred, B. E., Herschlag, D.
CELL PRESS.2018: 441A–442A
- **Differential catalytic promiscuity of the alkaline phosphatase superfamily bimetallo core reveals mechanistic features underlying enzyme evolution** *JOURNAL OF BIOLOGICAL CHEMISTRY*
Sunden, F., AlSadhan, I., Lyubimov, A., Doukov, T., Swan, J., Herschlag, D.
2017; 292 (51): 20960–74
- **Slow molecular recognition by RNA** *RNA*
Gleitsman, K. R., Sengupta, R. N., Herschlag, D.
2017; 23 (12): 1745–53
- **Quantitative tests of a reconstitution model for RNA folding thermodynamics and kinetics** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Bisaria, N., Greenfeld, M., Limouse, C., Mabuchi, H., Herschlag, D.
2017; 114 (37): E7688–E7696
- **An Activator-Blocker Pair Provides a Controllable On-Off Switch for a Ketosteroid Isomerase Active Site Mutant** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
Lamba, V., Yabukarski, F., Herschlag, D.
2017; 139 (32): 11089–95

- **Kemp Eliminate Activity of Ketosteroid Isomerase** *BIOCHEMISTRY*
Lamba, V., Sanchez, E., Fanning, L. R., Howe, K., Alvarez, M. A., Herschlag, D., Forconi, M.
2017; 56 (4): 582-591
- **Pseudouridine and N-6 methyladenosine modifications weaken PUF protein/RNA interactions.** *RNA (New York, N.Y.)*
Vaidyanathan, P. P., AlSadhan, I., Merriman, D. K., Al-Hashimi, H., Herschlag, D.
2017
- **Lessons from Enzyme Kinetics Reveal Specificity Principles for RNA-Guided Nucleases in RNA Interference and CRISPR-Based Genome Editing.** *Cell systems*
Bisaria, N., Jarmoskaite, I., Herschlag, D.
2017; 4 (1): 21-29
- **Determination of the conformational ensemble of the TAR RNA by X-ray scattering interferometry.** *Nucleic acids research*
Shi, X., Walker, P., Harbury, P. B., Herschlag, D.
2017
- **Single-Molecule Fluorescence Reveals Commonalities and Distinctions among Natural and in Vitro-Selected RNA Tertiary Motifs in a Multistep Folding Pathway** *Journal of the American Chemical Society*
Bonilla, S., Limouse, C., Bisaria, N., Gebala, M., Mabuchi, H., Herschlag, D.
2017: 18576-18589
- **Single-Molecule Fluorescence Reveals Commonalities and Distinctions among Natural and in Vitro-Selected RNA Tertiary Motifs in a Multistep Folding Pathway.** *Journal of the American Chemical Society*
Bonilla, S., Limouse, C., Bisaria, N., Gebala, M., Mabuchi, H., Herschlag, D.
2017; 139 (51): 18576-89
- **Determination of Ion Atmosphere Effects on the Nucleic Acid Electrostatic Potential and Ligand Association Using AH+C Wobble Formation in Double-Stranded DNA** *J. Am. Chem. Soc.*
Allred, B. E., Gebala, M., Herschlag, D.
2017; 22 (139): 7540-7548
- **Mechanistic and Evolutionary Insights from Comparative Enzymology of Phosphomonoesterases and Phosphodiesterases across the Alkaline Phosphatase Superfamily.** *Journal of the American Chemical Society*
Sunden, F., AlSadhan, I., Lyubimov, A. Y., Ressler, S., Wiersma-Koch, H., Borland, J., Brown, C. L., Johnson, T. A., Singh, Z., Herschlag, D.
2016; 138 (43): 14273-14287
- **RNA Structural Modules Control the Rate and Pathway of RNA Folding and Assembly** *JOURNAL OF MOLECULAR BIOLOGY*
Gracia, B., Xue, Y., Bisaria, N., Herschlag, D., Al-Hashimi, H. M., Russell, R.
2016; 428 (20): 3972-3985
- **Does Cation Size Affect Occupancy and Electrostatic Screening of the Nucleic Acid Ion Atmosphere?** *Journal of the American Chemical Society*
Gebala, M., Bonilla, S., Bisaria, N., Herschlag, D.
2016; 138 (34): 10925-10934
- **Kinetic and thermodynamic framework for P4-P6 RNA reveals tertiary motif modularity and modulation of the folding preferred pathway.** *Proceedings of the National Academy of Sciences of the United States of America*
Bisaria, N., Greenfeld, M., Limouse, C., Pavlichin, D. S., Mabuchi, H., Herschlag, D.
2016; 113 (34): E4956-65
- **Evaluation of the Catalytic Contribution from a Positioned General Base in Ketosteroid Isomerase.** *Journal of the American Chemical Society*
Lamba, V., Yabukarski, F., Pinney, M., Herschlag, D.
2016; 138 (31): 9902-9909
- **Tungstate as a Transition State Analog for Catalysis by Alkaline Phosphatase** *JOURNAL OF MOLECULAR BIOLOGY*
Peck, A., Sunden, F., Andrews, L. D., Pande, V. S., Herschlag, D.
2016; 428 (13): 2758-2768
- **Correction to "Evaluating the Catalytic Contribution from the Oxyanion Hole in Ketosteroid Isomerase".** *Journal of the American Chemical Society*
Schwans, J. P., Sunden, F., Gonzalez, A., Tsai, Y., Herschlag, D.

2016; 138 (24): 7801-7802

- **Visualizing the formation of an RNA folding intermediate through a fast highly modular secondary structure switch** *NATURE COMMUNICATIONS*
Xue, Y., Gracia, B., Herschlag, D., Russell, R., Al-Hashimi, H. M.
2016; 7
- **The solution structural ensembles of RNA kink-turn motifs and their protein complexes.** *Nature chemical biology*
Shi, X., Huang, L., Lilley, D. M., Harbury, P. B., Herschlag, D.
2016; 12 (3): 146-152
- **High-throughput analysis and protein engineering using microcapillary arrays.** *Nature chemical biology*
Chen, B., Lim, S., Kannan, A., Alford, S. C., Sunden, F., Herschlag, D., Dimov, I. K., Baer, T. M., Cochran, J. R.
2016; 12 (2): 76-81
- **An active site rearrangement within the Tetrahymena group I ribozyme releases nonproductive interactions and allows formation of catalytic interactions.** *RNA*
Sengupta, R. N., Van Schie, S. N., Giambasu, G., Dai, Q., Yesselman, J. D., York, D., Piccirilli, J. A., Herschlag, D.
2016; 22 (1): 32-48
- **Differential Assembly of Catalytic Interactions within the Conserved Active Sites of Two Ribozymes.** *PLoS one*
Van Schie, S. N., Sengupta, R. N., Herschlag, D.
2016; 11 (8)
- **Cation-Anion Interactions within the Nucleic Acid Ion Atmosphere Revealed by Ion Counting.** *Journal of the American Chemical Society*
Gebala, M., Giambasu, G. M., Lipfert, J., Bisaria, N., Bonilla, S., Li, G., York, D. M., Herschlag, D.
2015; 137 (46): 14705-14715
- **Evolutionary Conservation and Diversification of Puf RNA Binding Proteins and Their mRNA Targets** *PLOS BIOLOGY*
Hogan, G. J., Brown, P. O., Herschlag, D.
2015; 13 (11)
- **Comment on "Extreme electric fields power catalysis in the active site of ketosteroid isomerase"** *SCIENCE*
Natarajan, A., Yabukarski, F., Lamba, V., Schwans, J. P., Sunden, F., Herschlag, D.
2015; 349 (6251)
- **BIOPHYSICS. Comment on "Extreme electric fields power catalysis in the active site of ketosteroid isomerase".** *Science*
Natarajan, A., Yabukarski, F., Lamba, V., Schwans, J. P., Sunden, F., Herschlag, D.
2015; 349 (6251): 936-?
- **Determination of Hydrogen Bond Structure in Water versus Aprotic Environments To Test the Relationship Between Length and Stability** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
Sigala, P. A., Ruben, E. A., Liu, C. W., Piccoli, P. M., Hohenstein, E. G., Martinez, T. J., Schultz, A. J., Herschlag, D.
2015; 137 (17): 5730-5740
- **Extensive site-directed mutagenesis reveals interconnected functional units in the alkaline phosphatase active site** *ELIFE*
Sunden, F., Peck, A., Salzman, J., Ressler, S., Herschlag, D.
2015; 4
- **Learning from ribozymes** *RNA-A PUBLICATION OF THE RNA SOCIETY*
Herschlag, D.
2015; 21 (4): 527-528
- **Probing the kinetic and thermodynamic consequences of the tetraloop/tetraloop receptor monovalent ion-binding site in P4-P6 RNA by smFRET** *BIOCHEMICAL SOCIETY TRANSACTIONS*
Bisaria, N., Herschlag, D.
2015; 43: 172-178
- **From static to dynamic: the need for structural ensembles and a predictive model of RNA folding and function** *CURRENT OPINION IN STRUCTURAL BIOLOGY*
Herschlag, D., Allred, B. E., Gowrishankar, S.
2015; 30: 125-133

- **Three aSNAP and 10 ATP Molecules Are Used in SNARE Complex Disassembly by N-ethylmaleimide-sensitive Factor (NSF).** *Journal of biological chemistry*
Shah, N., Colbert, K. N., Enos, M. D., Herschlag, D., Weis, W. I.
2015; 290 (4): 2175-2188
- **Extensive site-directed mutagenesis reveals interconnected functional units in the alkaline phosphatase active site.** *eLife*
Sunden, F., Peck, A., Salzman, J., Ressler, S., Herschlag, D.
2015; 4
- **Single-molecule dataset (SMD): a generalized storage format for raw and processed single-molecule data.** *BMC bioinformatics*
Greenfeld, M., van de Meent, J., Pavlichin, D. S., Mabuchi, H., Wiggins, C. H., Gonzalez, R. L., Herschlag, D.
2015; 16: 3-?
- **Quantifying Nucleic Acid Ensembles with X-ray Scattering Interferometry.** *Methods in enzymology*
Shi, X., Bonilla, S., Herschlag, D., Harbury, P.
2015; 558: 75-97
- **Probing the Origins of Catalytic Discrimination between Phosphate and Sulfate Monoester Hydrolysis: Comparative Analysis of Alkaline Phosphatase and Protein Tyrosine Phosphatases** *BIOCHEMISTRY*
Andrews, L. D., Zalatan, J. G., Herschlag, D.
2014; 53 (43): 6811-6819
- **A kinetic and thermodynamic framework for the Azoarcus group I ribozyme reaction** *RNA-A PUBLICATION OF THE RNA SOCIETY*
Gleitsman, K. R., Herschlag, D. H.
2014; 20 (11): 1732-1746
- **Understanding nucleic Acid-ion interactions.** *Annual review of biochemistry*
Lipfert, J., Doniach, S., Das, R., Herschlag, D.
2014; 83: 813-841
- **Using unnatural amino acids to probe the energetics of oxanion hole hydrogen bonds in the ketosteroid isomerase active site.** *Journal of the American Chemical Society*
Natarajan, A., Schwans, J. P., Herschlag, D.
2014; 136 (21): 7643-7654
- **Assembly line polyketide synthases: mechanistic insights and unsolved problems.** *Biochemistry*
Khosla, C., Herschlag, D., Cane, D. E., Walsh, C. T.
2014; 53 (18): 2875-2883
- **Roles of Long-Range Tertiary Interactions in Limiting Dynamics of the Tetrahymena Group I Ribozyme** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
Shi, X., Bisaria, N., Benz-Moy, T. L., Bonilla, S., Pavlichin, D. S., Herschlag, D.
2014; 136 (18): 6643-6648
- **Experimental and Computational Mutagenesis To Investigate the Positioning of a General Base within an Enzyme Active Site** *BIOCHEMISTRY*
Schwans, J. P., Hanoian, P., Lengerich, B. J., Sunden, F., Gonzalez, A., Tsai, Y., Hammes-Schiffer, S., Herschlag, D.
2014; 53 (15): 2541-2555
- **From a structural average to the conformational ensemble of a DNA bulge.** *Proceedings of the National Academy of Sciences of the United States of America*
Shi, X., Beauchamp, K. A., Harbury, P. B., Herschlag, D.
2014; 111 (15): E1473-80
- **From a structural average to the conformational ensemble of a DNA bulge.** *Proceedings of the National Academy of Sciences of the United States of America*
Shi, X., Beauchamp, K. A., Harbury, P. B., Herschlag, D.
2014; 111 (15): E1473-80
- **Ion Counting from Explicit-Solvent Simulations and 3D-RISM** *BIOPHYSICAL JOURNAL*
Giambasu, G. M., Luchko, T., Herschlag, D., York, D. M., Case, D. A.
2014; 106 (4): 883-894

- **Site-Directed Mutagenesis Maps Interactions That Enhance Cognate and Limit Promiscuous Catalysis by an Alkaline Phosphatase Superfamily Phosphodiesterase** *BIOCHEMISTRY*
Wiersma-Koch, H., Sunden, F., Herschlag, D.
2013; 52 (51): 9167-9176
- **Uncovering the Determinants of a Highly Perturbed Tyrosine pKa in the Active Site of Ketosteroid Isomerase.** *Biochemistry*
Schwans, J. P., Sunden, F., Gonzalez, A., Tsai, Y., Herschlag, D.
2013; 52 (44): 7840-7855
- **The stanford institute for chemical biology.** *ACS chemical biology*
Chen, J. K., Du Bois, J., Glenn, J., Herschlag, D., Khosla, C.
2013; 8 (9): 1860-1861
- **Quantitative dissection of hydrogen bond-mediated proton transfer in the ketosteroid isomerase active site.** *Proceedings of the National Academy of Sciences of the United States of America*
Sigala, P. A., Fafarman, A. T., Schwans, J. P., Fried, S. D., Fenn, T. D., Caaveiro, J. M., Pybus, B., Ringe, D., Petsko, G. A., Boxer, S. G., Herschlag, D.
2013; 110 (28): E2552-61
- **Quantitative dissection of hydrogen bond-mediated proton transfer in the ketosteroid isomerase active site** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Sigala, P. A., Fafarman, A. T., Schwans, J. P., Fried, S. D., Fenn, T. D., Caaveiro, J. M., Pybus, B., Ringe, D., Petsko, G. A., Boxer, S. G., Herschlag, D.
2013; 110 (28): E2552-E2561
- **Use of anion-aromatic interactions to position the general base in the ketosteroid isomerase active site** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Schwans, J. P., Sunden, F., Lassila, J. K., Gonzalez, A., Tsai, Y., Herschlag, D.
2013; 110 (28): 11308-11313
- **Ground State Destabilization by Anionic Nucleophiles Contributes to the Activity of Phosphoryl Transfer Enzymes** *PLOS BIOLOGY*
Andrews, L. D., Fenn, T. D., Herschlag, D.
2013; 11 (7)
- **Structural ensemble and microscopic elasticity of freely diffusing DNA by direct measurement of fluctuations.** *Proceedings of the National Academy of Sciences of the United States of America*
Shi, X., Herschlag, D., Harbury, P. A.
2013; 110 (16): E1444-51
- **Structural ensemble and microscopic elasticity of freely diffusing DNA by direct measurement of fluctuations.** *Proceedings of the National Academy of Sciences of the United States of America*
Shi, X., Herschlag, D., Harbury, P. A.
2013; 110 (16): E1444-51
- **Fundamental challenges in mechanistic enzymology: progress toward understanding the rate enhancements of enzymes.** *Biochemistry*
Herschlag, D., Natarajan, A.
2013; 52 (12): 2050-2067
- **Fundamental Challenges in Mechanistic Enzymology: Progress toward Understanding the Rate Enhancements of Enzymes** *BIOCHEMISTRY*
Herschlag, D., Natarajan, A.
2013; 52 (12): 2050-2067
- **Ground State Destabilization from a Positioned General Base in the Ketosteroid Isomerase Active Site** *BIOCHEMISTRY*
Ruben, E. A., Schwans, J. P., Sonnett, M., Natarajan, A., Gonzalez, A., Tsai, Y., Herschlag, D.
2013; 52 (6): 1074-1081
- **Nucleic Acid Conformation Ensembles Revealed by Au-SAXS Interferometry** *57th Annual Meeting of the Biophysical-Society*
Shi, X., Harbury, P., Herschlag, D.
CELL PRESS.2013: 502A-502A
- **RNA radiolabeling.** *Methods in enzymology*
Porecha, R., Herschlag, D.

2013; 530: 255-279

- **Fluorescently Labeling Synthetic RNAs.** *Methods in enzymology*
Greenfeld, M., Herschlag, D.
2013; 530: 281-297
- **Salt dependence of the radius of gyration and flexibility of single-stranded DNA in solution probed by small-angle x-ray scattering** *PHYSICAL REVIEW E*
Sim, A. Y., Lipfert, J., Herschlag, D., Doniach, S.
2012; 86 (2)
- **Metal-ion rescue revisited: Biochemical detection of site-bound metal ions important for RNA folding** *RNA-A PUBLICATION OF THE RNA SOCIETY*
Frederiksen, J. K., Li, N., Das, R., Herschlag, D., Piccirilli, J. A.
2012; 18 (6): 1123-1141
- **Exploring purine N7 interactions via atomic mutagenesis: The group I ribozyme as a case study** *RNA-A PUBLICATION OF THE RNA SOCIETY*
Forconi, M., Benz-Moy, T., Gleitsman, K. R., Ruben, E., Metz, C., Herschlag, D.
2012; 18 (6): 1222-1229
- **Robust design and optimization of retroaldol enzymes** *PROTEIN SCIENCE*
Althoff, E. A., Wang, L., Jiang, L., Giger, L., Lassila, J. K., Wang, Z., Smith, M., Hari, S., Kast, P., Herschlag, D., Hilvert, D., Baker, D.
2012; 21 (5): 717-726
- **Electrostatics of Nucleic Acid Folding under Conformational Constraint** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
Anthony, P. C., Sim, A. Y., Chu, V. B., Doniach, S., Block, S. M., Herschlag, D.
2012; 134 (10): 4607-4614
- **Single Molecule Analysis Research Tool (SMART): An Integrated Approach for Analyzing Single Molecule Data** *PLOS ONE*
Greenfeld, M., Pavlichin, D. S., Mabuchi, H., Herschlag, D.
2012; 7 (2)
- **Thermodynamic evidence for negative charge stabilization by a catalytic metal ion within an RNA active site.** *ACS chemical biology*
Sengupta, R. N., Herschlag, D., Piccirilli, J. A.
2012; 7 (2): 294-299
- **Quantitative, directional measurement of electric field heterogeneity in the active site of ketosteroid isomerase** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Fafarman, A. T., Sigala, P. A., Schwans, J. P., Fenn, T. D., Herschlag, D., Boxer, S. G.
2012; 109 (6): E299-E308
- **A Role for a Single-Stranded Junction in RNA Binding and Specificity by the Tetrahymena Group I Ribozyme** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*
Shi, X., Solomatin, S. V., Herschlag, D.
2012; 134 (4): 1910-1913
- **Thermodynamic Evidence for Negative Charge Stabilization by a Catalytic Metal Ion within an RNA Active Site** *ACS CHEMICAL BIOLOGY*
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