



## Sebastian Doniach

Professor of Applied Physics and of Physics, Emeritus

### Bio

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#### BIO

How is the function of biomolecules in living systems related to their atomic structure?

Professor Doniach's research group uses scattering of synchrotron X-rays from electron storage rings at SLAC and at the Argonne National Laboratory to study changes in the conformation of molecules as their solvent environments are changed. The research also involves computer simulations of the dynamics and energetic of the resulting changes.

Recent advances in the biology of DNA have shown that a very large part of the genome in eukaryotes codes for small RNA molecules that appear to be central to the way the genes (coding for proteins) are put together. Doniach's group is currently studying structural changes that occur when some small functional RNA's turn on and off gene expression (riboswitches) without needing to involve protein transcription factors. Understanding RNA control mechanisms is central to our ability to intervene in biological functions such as generation of biofuels by bacteria or of intervention when cells start to go cancerous.

The Doniach group's bio-simulation work involves new ways to represent changes in molecular structure, in which the entire trajectory for a change of conformation is represented in a large number of CPU's where each time slice of the trajectory is managed by one of the CPU's. In this way, a representation of changes involving thousands of degrees of freedom may be obtained at atomic resolution. This method has recently been applied to look at protein misfolding. Another project involves using a highly simplified normal mode representation to represent large scale conformational changes in molecular motor molecules and DNS polymerase.

The group is also working on ways to improve the methods of computing the statistical mechanics of counter-ion shielding of the very large Coulomb forces endangered by the phosphate backbones of DNA and RNA. Software has been developed that modifies the solving of the Poisson Boltzmann equation to include the effects of finite ion size. Further modifications are being worked in to include effects of ion-ion correlations.

Current Area of Focus:

- Membrane Proteins

#### ACADEMIC APPOINTMENTS

- Emeritus Faculty, Acad Council, Applied Physics
- Member, Bio-X
- Member, Wu Tsai Neurosciences Institute

## ADMINISTRATIVE APPOINTMENTS

- Visiting Fellow, Los Alamos National Laboratory, (1987-1991)
- Professor, of Physics and Applied Physics, Stanford University, (1979- present)
- JSPS Visiting Professor, University of Tokyo, (1978- present)
- Professor Associe; 1975-76, 1978, 1982, University of Paris, France, (1975-1982)
- Director, Stanford Synchrotron Radiation Laboratory, (1973-1978)
- Lecturer, Imperial College, (1967-1969)
- Reader in Physics, Imperial College, (1967-1969)
- Lecturer, Queen Mary College, (1960-1964)
- ICI Fellow, University of Liverpool, (1958-1960)

## PROFESSIONAL EDUCATION

- Ph.D., University of Liverpool, England , Physics (1958)
- B.A., Cambridge University, England , Physics (1954)

## Research & Scholarship

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### CURRENT RESEARCH AND SCHOLARLY INTERESTS

Study of changes in conformation of proteins and RNA using x-ray scattering

## Teaching

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### COURSES

#### 2019-20

- Topics in Molecular Biophysics: Biophysics of Functional RNA (BIOPHYS 392): APPPHYS 392, BIOPHYS 392 (Aut)

#### 2018-19

- Advanced Numerical Methods for Data Analysis and Simulation: APPPHYS 345 (Aut)
- Methods in Computational Biology: APPPHYS 315, BIOPHYS 315 (Spr)

### STANFORD ADVISEES

#### Doctoral Dissertation Co-Advisor (AC)

Abhimanyu Banerjee

#### Doctoral (Program)

Nathan Lee, Alana Papula, Yihui Quek

### GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biophysics (Phd Program)

## Publications

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### PUBLICATIONS

- **The linac coherent light source single particle imaging road map** *STRUCTURAL DYNAMICS*  
Aquila, A., Barty, A., Bostedt, C., Boutet, S., Carini, G., Deponte, D., DRELL, P., Doniach, S., Downing, K. H., Earnest, T., Elmlund, H., Elser, V., Guehr, et al  
2015; 2 (4)

- **Tuning Micelle Dimensions and Properties with Binary Surfactant Mixtures** *LANGMUIR*  
Oliver, R. C., Lipfert, J., Fox, D. A., Lo, R. H., Kim, J. J., Doniach, S., Columbus, L.  
2014; 30 (44): 13353-13361
- **Observation of correlated X-ray scattering at atomic resolution.** *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*  
Mendez, D., Lane, T. J., Sung, J., Sellberg, J., Levard, C., Watkins, H., Cohen, A. E., Soltis, M., Sutton, S., Spudich, J., Pande, V., Ratner, D., Doniach, et al  
2014; 369 (1647)
- **Understanding nucleic Acid-ion interactions.** *Annual review of biochemistry*  
Lipfert, J., Doniach, S., Das, R., Herschlag, D.  
2014; 83: 813-841
- **Dependence of Micelle Size and Shape on Detergent Alkyl Chain Length and Head Group** *PLOS ONE*  
Oliver, R. C., Lipfert, J., Fox, D. A., Lo, R. H., Doniach, S., Columbus, L.  
2013; 8 (5)
- **'Hidden' states are pervasive in RNA folding: detection and dissection through mutate-and-map experiments** *Joint Annual Meeting of the ASPET/BPS at Experimental Biology (EB)*  
Das, R., Doniach, S., Ali, M., Cordero, P., VanLang, C.  
FEDERATION AMER SOC EXP BIOL.2013
- **Caulobacter chromosome in vivo configuration matches model predictions for a supercoiled polymer in a cell-like confinement** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Hong, S., Toro, E., Mortensen, K. I., de la Rosa, M. A., Doniach, S., Shapiro, L., Spakowitz, A. J., McAdams, H. H.  
2013; 110 (5): 1674-1679
- **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)
- **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
- **AquaSAXS: a web server for computation and fitting of SAXS profiles with non-uniformly hydrated atomic models** *NUCLEIC ACIDS RESEARCH*  
Poitevin, F., Orland, H., Doniach, S., Koehl, P., Delarue, M.  
2011; 39: W184-W189
- **RNA Structure, Function, and (Thermo-) Dynamics: A SAXS and Single-Molecule Perspective** *55th Annual Meeting of the Biophysical-Society*  
Lipfert, J., Herschlag, D., Doniach, S., Dekker, N. H.  
CELL PRESS.2011: 1-2
- **ATP-independent reversal of a membrane protein aggregate by a chloroplast SRP subunit** *NATURE STRUCTURAL & MOLECULAR BIOLOGY*  
Jaru-Ampornpan, P., Shen, K., Lam, V. Q., Ali, M., Doniach, S., Jia, T. Z., Shan, S.  
2010; 17 (6): 696-U64
- **Dissecting electrostatic screening, specific ion binding, and ligand binding in an energetic model for glycine riboswitch folding** *RNA-A PUBLICATION OF THE RNA SOCIETY*  
Lipfert, J., Sim, A. Y., Herschlag, D., Doniach, S.  
2010; 16 (4): 708-719
- **The Ligand-Free State of the TPP Riboswitch: A Partially Folded RNA Structure** *JOURNAL OF MOLECULAR BIOLOGY*  
Ali, M., Lipfert, J., Seifert, S., Herschlag, D., Doniach, S.  
2010; 396 (1): 153-165
- **Combining Single-Molecule Optical Trapping and Small-Angle X-Ray Scattering Measurements to Compute the Persistence Length of a Protein ER/K alpha-Helix** *BIOPHYSICAL JOURNAL*  
Sivaramakrishnan, S., Sung, J., Ali, M., Doniach, S., Flyvbjerg, H., Spudich, J. A.  
2009; 97 (11): 2993-2999

- **Do conformational biases of simple helical junctions influence RNA folding stability and specificity?** *RNA-A PUBLICATION OF THE RNA SOCIETY*  
Chu, V. B., Lipfert, J., Bai, Y., Pande, V. S., Doniach, S., Herschlag, D.  
2009; 15 (12): 2195-2205
- **Mixing and Matching Detergents for Membrane Protein NMR Structure Determination** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*  
Columbus, L., Lipfert, J., Jambunathan, K., Fox, D. A., Sim, A. Y., Doniach, S., Lesley, S. A.  
2009; 131 (21): 7320-7326
- **Riboswitch conformations revealed by small-angle X-ray scattering.** *Methods in molecular biology (Clifton, N.J.)*  
Lipfert, J., Herschlag, D., Doniach, S.  
2009; 540: 141-159
- **USE OF SMALL ANGLE X-RAY SCATTERING (SAXS) TO CHARACTERIZE CONFORMATIONAL STATES OF FUNCTIONAL RNAs** *METHODS IN ENZYMOLOGY, VOL 469: BIOPHYSICAL, CHEMICAL, AND FUNCTIONAL PROBES OF RNA STRUCTURE, INTERACTIONS AND FOLDING, PT B*  
Doniach, S., Lipfert, J.  
2009; 469: 237-251
- **A repulsive field: advances in the electrostatics of the ion atmosphere** *CURRENT OPINION IN CHEMICAL BIOLOGY*  
Chu, V. B., Bai, Y., Lipfert, J., Herschlag, D., Doniach, S.  
2008; 12 (6): 619-625
- **Critical assessment of nucleic acid electrostatics via experimental and computational investigation of an unfolded state ensemble** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*  
Bai, Y., Chu, V. B., Lipfert, J., Pande, V. S., Herschlag, D., Doniach, S.  
2008; 130 (37): 12334-12341
- **The complete VS ribozyme in solution studied by small-angle X-ray scattering** *STRUCTURE*  
Lipfert, J., Ouellet, J., Norman, D. G., Doniach, S., Lilley, D. M.  
2008; 16 (9): 1357-1367
- **Dynamic charge interactions create surprising rigidity in the ER/K alpha-helical protein motif** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Sivaramakrishnan, S., Spink, B. J., Sim, A. Y., Doniach, S., Spudich, J. A.  
2008; 105 (36): 13356-13361
- **Long single alpha-helical tail domains bridge the gap between structure and function of myosin VI** *NATURE STRUCTURAL & MOLECULAR BIOLOGY*  
Spink, B. J., Sivaramakrishnan, S., Lipfert, J., Doniach, S., Spudich, J. A.  
2008; 15 (6): 591-597
- **Quantitative and comprehensive decomposition of the ion atmosphere around nucleic acids** *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY*  
Bai, Y., Greenfeld, M., Travers, K. J., Chu, V. B., Lipfert, J., Doniach, S., Herschlag, D.  
2007; 129 (48): 14981-14988
- **Evaluation of ion binding to DNA duplexes using a size-modified Poisson-Boltzmann theory** *BIOPHYSICAL JOURNAL*  
Chu, V. B., Bai, Y., Lipfert, J., Herschlag, D., Doniach, S.  
2007; 93 (9): 3202-3209
- **Size and shape of detergent micelles determined by small-angle x-ray scattering** *JOURNAL OF PHYSICAL CHEMISTRY B*  
Lipfert, J., Columbus, L., Chu, V. B., Lesley, S. A., Doniach, S.  
2007; 111 (43): 12427-12438
- **MinActionPath: maximum likelihood trajectory for large-scale structural transitions in a coarse-grained locally harmonic energy landscape** *NUCLEIC ACIDS RESEARCH*  
Franklin, J., Koehl, P., Doniach, S., Delarue, M.  
2007; 35: W477-W482
- **Toward the mechanism of dynamical couplings and translocation in hepatitis C virus NS3 helicase using elastic network model** *PROTEINS-STRUCTURE FUNCTION AND BIOINFORMATICS*  
Zheng, W., Liao, J., Brooks, B. R., Doniach, S.  
2007; 67 (4): 886-896

- **Low-resolution models for nucleic acids from small-angle X-ray scattering with applications to electrostatic modeling** *13th International Conference on Small-Angle Scattering*  
Lipfert, J., Chu, V. B., Bai, Y., Herschlag, D., Doniach, S.  
WILEY-BLACKWELL.2007: S229–S234
- **Analysis of small-angle X-ray scattering data of protein-detergent complexes by singular value decomposition** *13th International Conference on Small-Angle Scattering*  
Lipfert, J., Columbus, L., Chu, V. B., Doniach, S.  
WILEY-BLACKWELL.2007: S235–S239
- **Structural transitions and thermodynamics of a glycine-dependent riboswitch from *Vibrio cholerae*** *JOURNAL OF MOLECULAR BIOLOGY*  
Lipfert, J., Das, R., Chu, V. B., Kudaravalli, M., Boyd, N., Herschlag, D., Doniach, S.  
2007; 365 (5): 1393-1406
- **Small-angle X-ray scattering from RNA, proteins, and protein complexes** *ANNUAL REVIEW OF BIOPHYSICS AND BIOMOLECULAR STRUCTURE*  
Lipfert, J., Doniach, S.  
2007; 36: 307-327
- **Towards the mechanism of dynamic couplings and translocation in Hepatitis C virus NS3 helicase using elastic network model** *51st Annual Meeting of the Biophysical-Society*  
Zheng, W., Liao, J., Brooks, B. R., Doniach, S.  
CELL PRESS.2007: 177A–178A
- **Modeling RNA low resolution structure and thermodynamics from small-angle X-ray scattering** *51st Annual Meeting of the Biophysical-Society*  
Lipfert, J., Chu, V. B., Bai, Y., Ouellet, J., Lilley, D. M., Herschlag, D., Doniach, S.  
CELL PRESS.2007: 417A–417A
- **Quantitative and comprehensive decomposition of the ion atmosphere around nucleic acids** *51st Annual Meeting of the Biophysical-Society*  
Bai, Y., Travers, K., Chu, V. B., Lipfert, J., Doniach, S., Herschlag, D.  
CELL PRESS.2007: 46A–46A
- **Expression, purification, and characterization of *Thermotoga maritima* membrane proteins for structure determination** *PROTEIN SCIENCE*  
Columbus, L., Lipfert, J., Klock, H., Millett, I., Doniach, S., Lesley, S. A.  
2006; 15 (5): 961-975
- **Dynamic bond constraints in protein Langevin dynamics** *JOURNAL OF CHEMICAL PHYSICS*  
Franklin, J., Doniach, S.  
2006; 124 (15)
- **Sample holder for small-angle x-ray scattering static and flow cell measurements** *REVIEW OF SCIENTIFIC INSTRUMENTS*  
Lipfert, J., Millett, I. S., Seifert, S., Doniach, S.  
2006; 77 (4)
- **How large is an alpha-helix? Studies of the radii of gyration of helical peptides by small-angle X-ray scattering and molecular dynamics** *JOURNAL OF MOLECULAR BIOLOGY*  
Zagrovic, B., Jayachandran, G., Millett, I. S., Doniach, S., Pande, V. S.  
2005; 353 (2): 232-241
- **Adaptive time stepping in biomolecular dynamics** *JOURNAL OF CHEMICAL PHYSICS*  
Franklin, J., Doniach, S.  
2005; 123 (12)
- **Unusual compactness of a polyproline type II structure** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Zagrovic, B., Lipfert, J., Sorin, E. J., Millett, I. S., van Gunsteren, W. F., Doniach, S., Pande, V. S.  
2005; 102 (33): 11698-11703
- **Protein misfolding and amyloid formation for the peptide GNNQQNY from yeast prion protein Sup35: Simulation by reaction path annealing** *JOURNAL OF MOLECULAR BIOLOGY*  
Lipfert, J., Franklin, J., Wu, F., Doniach, S.

2005; 349 (3): 648-658

- **Fold recognition aided by constraints from small angle X-ray scattering data** *PROTEIN ENGINEERING DESIGN & SELECTION*  
Zheng, W. J., Doniach, S.  
2005; 18 (5): 209-219
- **Network of dynamically important residues in the open/closed transition in polymerases is strongly conserved** *STRUCTURE*  
Zheng, W. J., Brooks, B. R., Doniach, S., Thirumalai, D.  
2005; 13 (4): 565-577
- **Effects of nitration on the structure and aggregation of alpha-synuclein** *MOLECULAR BRAIN RESEARCH*  
Uversky, V. N., Yamin, G., Munishkina, L. A., Karymov, M. A., Millett, I. S., Doniach, S., Lyubchenko, Y. L., Fink, A. L.  
2005; 134 (1): 84-102
- **Probing counterion modulated repulsion and attraction between nucleic acid duplexes in solution** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Bai, Y., Das, R., Millett, I. S., Herschlag, D., Doniach, S.  
2005; 102 (4): 1035-1040
- **Principles of RNA compaction: Insights from the equilibrium folding pathway of the P4-P6 RNA domain in monovalent cations** *JOURNAL OF MOLECULAR BIOLOGY*  
Takamoto, K., Das, R., He, Q., Doniach, S., Brenowitz, M., Herschlag, D., Chance, M. R.  
2004; 343 (5): 1195-1206
- **Random-coil behavior and the dimensions of chemically unfolded proteins** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Kohn, J. E., Millett, I. S., JACOB, J., Zagrovic, B., Dillon, T. M., Cingel, N., Dothager, R. S., Seifert, S., Thiyagarajan, P., Sosnick, T. R., Hasan, M. Z., Pande, V. S., Ruczinski, et al  
2004; 101 (34): 12491-12496
- **Stimulation of insulin fibrillation by urea-induced intermediates** *JOURNAL OF BIOLOGICAL CHEMISTRY*  
Ahmad, A., Millett, I. S., Doniach, S., Uversky, V. N., Fink, A. L.  
2004; 279 (15): 14999-15013
- **Protein misfolding and aggregation in a 7 residue peptide from the yeast prion protein Sup35 - Simulation by reaction path annealing** *48th Annual Meeting of the Biophysical-Society*  
Lipfert, J., Wu, F., Franklin, J., Doniach, S.  
CELL PRESS.2004: 416A-416A
- **Natively unfolded C-terminal domain of caldesmon remains substantially unstructured after the effective binding to calmodulin** *PROTEINS-STRUCTURE FUNCTION AND BIOINFORMATICS*  
Permyakov, S. E., Millett, I. S., Doniach, S., Permyakov, E. A., Uversky, V. N.  
2003; 53 (4): 855-862
- **A comparative study of motor-protein motions by using a simple elastic-network model** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Zheng, W. J., Doniach, S.  
2003; 100 (23): 13253-13258
- **Partially folded intermediates in insulin fibrillation** *BIOCHEMISTRY*  
Ahmad, A., Millett, I. S., Doniach, S., Uversky, V. N., Fink, A. L.  
2003; 42 (39): 11404-11416
- **The fastest global events in RNA folding: Electrostatic relaxation and tertiary collapse of the tetrahymena ribozyme** *JOURNAL OF MOLECULAR BIOLOGY*  
Das, R., Kwok, L. W., Millett, I. S., Bai, Y., Mills, T. T., JACOB, J., Maskel, G. S., Seifert, S., Mochrie, S. G., Thiyagarajan, P., Doniach, S., Pollack, L., Herschlag, et al  
2003; 332 (2): 311-319
- **Nuclear localization of alpha-synuclein and its interaction with histones** *BIOCHEMISTRY*  
Goers, J., Manning-Bog, A. B., McCormack, A. L., Millett, I. S., Doniach, S., Di Monte, D. A., Uversky, V. N., Fink, A. L.

2003; 42 (28): 8465-8471

- **Counterion distribution around DNA probed by solution X-ray scattering** *PHYSICAL REVIEW LETTERS*  
Das, R., Mills, T. T., Kwok, L. W., Maskel, G. S., Millett, I. S., Doniach, S., Finkelstein, K. D., Herschlag, D., Pollack, L.  
2003; 90 (18)
- **Closing the folding chamber of the eukaryotic chaperonin requires the transition state of ATP hydrolysis** *CELL*  
Meyer, A. S., Gillespie, J. R., Walther, D., Millet, I. S., Doniach, S., Frydman, J.  
2003; 113 (3): 369-381
- **Three-dimensional flux states as a model for the pseudogap phase of transition metal oxides** *PHYSICAL REVIEW B*  
Schroeter, D. F., Doniach, S.  
2002; 66 (7)
- **Elucidation of the molecular mechanism during the early events in immunoglobulin light chain amyloid fibrillation - Evidence for an off-pathway oligomer at acidic pH** *JOURNAL OF BIOLOGICAL CHEMISTRY*  
Souillac, P. O., Uversky, V. N., Millett, I. S., Khurana, R., Doniach, S., Fink, A. L.  
2002; 277 (15): 12666-12679
- **Effect of association state and conformational stability on the kinetics of immunoglobulin light chain amyloid fibril formation at physiological pH** *JOURNAL OF BIOLOGICAL CHEMISTRY*  
Souillac, P. O., Uversky, V. N., Millett, I. S., Khurana, R., Doniach, S., Fink, A. L.  
2002; 277 (15): 12657-12665
- **Biophysical properties of the synucleins and their propensities to fibrillate - Inhibition of alpha-synuclein assembly by beta- and gamma-synucleins** *JOURNAL OF BIOLOGICAL CHEMISTRY*  
Uversky, V. N., Li, J., Souillac, P., Millett, I. S., Doniach, S., Jakes, R., Goedert, M., Fink, A. L.  
2002; 277 (14): 11970-11978
- **Rapid compaction during RNA folding** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Russell, R., Millett, I. S., Tate, M. W., Kwok, L. W., Nakatani, B., Gruner, S. M., Mochrie, S. G., Pande, V., Doniach, S., Herschlag, D., Pollack, L.  
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- **Protein structure prediction constrained by solution X-ray scattering data and structural homology identification** *JOURNAL OF MOLECULAR BIOLOGY*  
Zheng, W. J., Doniach, S.  
2002; 316 (1): 173-187
- **Distribution of molecular size within an unfolded state ensemble using small-angle X-ray scattering and pulse field gradient NMR techniques** *JOURNAL OF MOLECULAR BIOLOGY*  
Choy, W. Y., Mulder, F. A., Crowhurst, K. A., Muhandiram, D. R., Millett, I. S., Doniach, S., Forman-Kay, J. D., Kay, L. E.  
2002; 316 (1): 101-112
- **Equilibrium collapse and the kinetic 'foldability' of proteins** *BIOCHEMISTRY*  
Millet, I. S., Townsley, L. E., Chiti, F., Doniach, S., Plaxco, K. W.  
2002; 41 (1): 321-325
- **Exploring the folding landscape of a structured RNA** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Russell, R., Zhuang, X. W., Babcock, H. P., Millett, I. S., Doniach, S., Chu, S., Herschlag, D.  
2002; 99 (1): 155-160
- **Toward a taxonomy of the denatured state: Small angle scattering studies of unfolded proteins** *UNFOLDED PROTEINS*  
Millet, I. S., Doniach, S., Plaxco, K. W.  
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- **Changes in biomolecular conformation seen by small angle X-ray scattering** *CHEMICAL REVIEWS*  
Doniach, S.  
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- **Simulation of protein folding by reaction path annealing** *JOURNAL OF CHEMICAL PHYSICS*  
Eastman, P., Gronbech-Jensen, N., Doniach, S.

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- **Exploring the RNA folding landscape, one molecule at a time.**  
Herschlag, D., Russell, R., Zhuang, X. W., Bartley, L., Babcock, H. P., Miller, I. S., Doniach, S., Chu, S.  
AMER CHEMICAL SOC.2000: U82-U82
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Bada, M., Walther, D., Arcangioli, B., Doniach, S., Delarue, M.  
2000; 300 (3): 563-574
- **Small angle X-ray scattering reveals a compact intermediate in RNA folding** *NATURE STRUCTURAL BIOLOGY*  
Russell, R., Millett, I. S., Doniach, S., Herschlag, D.  
2000; 7 (5): 367-370
- **Fourth-generation X-ray sources: some possible applications to biology** *Synchrotron Radiation Satellite Meeting of the XVIII IUCr Congress*  
Doniach, S.  
WILEY-BLACKWELL PUBLISHING, INC.2000: 116-120
- **Reconstruction of low-resolution three-dimensional density maps from one-dimensional small-angle X-ray solution scattering data for biomolecules** *JOURNAL OF APPLIED CRYSTALLOGRAPHY*  
Walther, D., Cohen, F. E., Doniach, S.  
2000; 33: 350-363
- **Zn<sup>2+</sup>-mediated structure formation and compaction of the "Natively unfolded" human prothymosin alpha** *BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS*  
Uversky, V. N., Gillespie, J. R., Millett, I. S., Khodyakova, A. V., Vasilenko, R. N., Vasiliev, A. M., Rodionov, I. L., Kozlovskaya, G. D., Dolgikh, D. A., Fink, A. L., Doniach, S., Permyakov, E. A., Abramov, et al  
2000; 267 (2): 663-668
- **Transient dimer in the refolding kinetics of cytochrome c characterized by small-angle X-ray scattering** *BIOCHEMISTRY*  
Segel, D. J., ELIEZER, D., Uversky, V., Fink, A. L., Hodgson, K. O., Doniach, S.  
1999; 38 (46): 15352-15359
- **Natively unfolded human prothymosin alpha adopts partially folded collapsed conformation at acidic pH** *BIOCHEMISTRY*  
Uversky, V. N., Gillespie, J. R., Millett, I. S., Khodyakova, A. V., Vasiliev, A. M., Chernovskaya, T. V., Vasilenko, R. N., Kozovskaya, G. D., Dolgikh, D. A., Fink, A. L., Doniach, S., Abramov, V. M.  
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- **Characterization of transient intermediates in lysozyme folding with time-resolved small-angle X-ray scattering** *JOURNAL OF MOLECULAR BIOLOGY*  
Segel, D. J., Bachmann, A., Hofrichter, J., Hodgson, K. O., Doniach, S., Kiefhaber, T.  
1999; 288 (3): 489-499
- **Protein dynamics simulations from nanoseconds to microseconds** *CURRENT OPINION IN STRUCTURAL BIOLOGY*  
Doniach, S., Eastman, P.  
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- **Association of partially-folded intermediates of staphylococcal nuclease induces structure and stability** *PROTEIN SCIENCE*  
Uversky, V. N., Karnoup, A. S., Khurana, R., Segel, D. J., Doniach, S., Fink, A. L.  
1999; 8 (1): 161-173
- **Protein denaturation: A small-angle X-ray scattering study of the ensemble of unfolded states of cytochrome c** *BIOCHEMISTRY*  
Segel, D. J., Fink, A. L., Hodgson, K. O., Doniach, S.  
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