

# DOROTHY A. ERIE

*Curriculum Vitae 9/00*

**Research Interests:** Elucidating the kinetic mechanism of transcription elongation.  
Using scanning force microscopy and nanomanipulation to investigate the conformational and physical properties of protein-protein and protein-nucleic acid interactions.  
Thermodynamics of proteins and nucleic acids.

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**Present position:** Assistant Professor in the Chemistry Department at the University of North Carolina-Chapel Hill.

## Degrees:

Ph.D.	Physical Chemistry	Rutgers-The State University of New Jersey New Brunswick, NJ 08903	January, 1989
MS	Physical Chemistry	University of Wisconsin Madison, WI 53706	August, 1985
BS	Chemistry	Louisiana State University Baton Rouge, LA 70803	May, 1982

## Education/ Employment:

11/94 - 7/95	<b>Research Associate</b> Professor Michael Chamberlin Division of Biochemistry and Molecular Biology University of California - Berkeley. Berkeley, CA
5/92 - 10/94	<b>Research Associate</b> Professor Carlos Bustamante Institute of Molecular Biology University of Oregon Eugene, OR
11/88 - 5/92	<b>NIH Postdoctoral Fellow/Research Associate</b> Professor Peter von Hippel Institute of Molecular Biology University of Oregon Eugene, OR

- 9/85 - 10/88      **Graduate student.**  
Professors Kenneth Breslauer and Wilma Olson  
Department of Chemistry  
Rutgers University  
Piscataway, NJ  
**Dissertation:** Constrained Nucleic Acid Structures: An Experimental and Theoretical Investigation
- 8/82 - 8/85      **Masters student**  
Professor M. Thomas Record, Jr.  
Department of Chemistry  
University of Wisconsin  
Madison, WI

## **Teaching Activities:**

### **Past Graduate Students**

Ms. Xioafan Tang, M.S.  
Ms. Valerie Bullock, M.S., Law School  
Dr. J. Estelle Foster, Eli Lilly

### **Current Graduate Students**

Suzie Purinton (second year)  
Brian Hogan (second year)  
Shannon Forbes (third year)  
Hong Wong (third year; Materials Science)  
Sarah Holtschlag (fourth year)  
Yu Xue (fifth year)  
Glenn Ratcliff (sixth year)

### **Past Postdocs**

Michael Batalia (Office of Information and Technology Transfer, North Carolina State University)

### **Current Postdocs**

Martin Guthold (11/97)

### **Past Undergraduate Students**

Susanna Matsen (Med. School), David Gealt (Med. School), Preeti Chugha (Grad. School, Biochem.),  
Jeff Knight (Grad. School, Pharmacology), Galaxy Li (Med. School)

### **Current Undergraduate Students**

Ben Herrick (senior), Susan Chung (junior), Claudine Warfel (junior)

### **Courses**

I teach two courses a year.

Chem 136L: Biochemistry Laboratory (Fall 1995, Spring 1997, Spring 1998, Spring 1999)  
Chem 131: Nucleic Acid Chemistry (Spring 1997, Spring 1998, Spring 1999)  
Chem 180: Biophysical Chemistry (Fall 1999, Fall 2000)  
Chem 11: First Semester General Chemistry (Fall 2000)

## Service (Past and Present)

### Departmental Service

Committee assignments  
Ph.D. committees (>20)  
Networking committee  
Undergraduate Honors committees  
Lectureship committee  
Faculty Search committee (Waters)

### University Service

Admissions Committee, Program in Molecular and Cellular Biophysics  
Faculty Search Committees:  
Materials Science  
School of Pharmacy, Division of Medicinal Chemistry and Natural Products  
Graduate Student Committees  
Biochemistry and Biophysics  
Minority Graduate Education Committee  
Preceptor for the Mentorship program at the North Carolina School of Science and Mathematics (High School seniors)  
Preceptor for Project Uplift: Research training for minority high school students  
Preceptor for Research Apprentice Program (Summer research program for underprivileged high school students)

### National Service

#### Committees:

Biophysical Society Education Committee

#### Manuscript referee

*Biochemistry*

*Biophysical Journal*

*Biopolymers*

*Journal of Molecular Biology*

*Nucleic Acids Research*

*Proceedings of the National Academy of Sciences*

*Journal of Physical Chemistry*

*Protein Science*

*Science*

#### Proposal review

PRF, NIH (*ad hoc*)

#### Scientific meetings organized:

4/19-21/96 Water on the Water: A Discussion of the Role of Water in Biological Macromolecules, Oak Island, North Carolina.

### Awards and Honors:

Co-chair of the 2002 Biopolymers Gordon Conference  
Chair of the Transcription Elongation session at the 2000 Post-Initiation Transcription Meeting, Mountain Lake, VA (10/27-29/00)  
Chair of a Symposium at the 1998 Biophysical Society Meeting titled "The Devil is in the Details: Structural and Mechanistic Aspects of Transcription," Kansas City, MO (2/98)  
Junior Faculty Development Award, University of North Carolina (1995)

## Grants:

- National Institutes of Health R29 grant (GM54136) for transient-state kinetics of transcription elongation. \$493,038 for 5/96-4/01.
- Co-PI of National Institutes of Health NCRR grant (3-P41-RR02170-15S1); Interactive graphics for Molecular Studies and Microscopy; ~\$120,000 4/98-3/01 (PI: Fred Brooks, UNC Computer Science).
- National Institutes of Health R01 grant (ES09895) for biophysical and scanning force microscopy studies of human base excision repair. \$627,591 for 5/99-4/02.
- University Faculty Research Grant for imaging of biological processes in real time using scanning force microscopy \$3,000.

## Patent Pending:

- Erie, D.A., Ratcliff, G., and Superfine, R “Photothermal Modulation for Oscillating Mode Atomic Force Microscopy in Solution” **Patent application serial # 09/506,617**, February 18, 2000

## Society Memberships:

- Biophysical Society  
American Chemical Society  
RNA Society of North Carolina

## Meetings Attended:

- 1996, 1998, and 2000 Biopolymers Gordon Conferences  
1998 Mutagenesis Gordon Conference  
2000 Carcinogenesis and Mutagenesis Gordon Conference  
1996, 1998 Biophysical Society Meeting  
1998 Southeast Regional Meeting of the American Chemical Society  
1998 FASEB Prokaryotic Transcription Initiation Meeting  
1998, 2000 Post-initiation Transcription Meeting, Mountain Lake, VA  
1999 Microscopy and Microanalysis Meeting  
1999 Volumetric Properties of Biological Objects: An International Symposium”, Toronto, CA.

## Invited Seminars since Joining UNC:

- 6/21/00 Rockefeller University, New York, NY “*Allosteric Binding of Nucleoside Triphosphates Regulates Transcription Elongation*”.
- 3/2/00 Institute of Molecular Biology, University of Oregon, Eugene, OR “*Allosteric Binding of Nucleoside Triphosphates Regulates Transcription Elongation*”.
- 3/1/00 Structural Biology, University of California-Berkeley, Berkeley, CA “*Allosteric Binding of Nucleoside Triphosphates Regulates Transcription Elongation*”.
- 1/27/00 Department of Bacteriology, University of Wisconsin, Madison, WI “*Allosteric Binding of Nucleoside Triphosphates Regulates Transcription Elongation*”.
- 1/26/00 Department of Chemistry, Northwestern University, Evanston IL “*Allosteric Binding of Nucleoside Triphosphates Regulates Transcription Elongation*”.
- 10/25/99 Department of Biochemistry, Michigan State University, Lansing, MI “*Transcription Elongation: The Devil is in the Details*”.
- 9/17/99 Department of Chemistry, Davidson University, Davidson, NC “*Scanning Force Microscopy: Technological Advances and Biological Applications*”.

- 8/4/99 Symposium speaker at the 1999 Microscopy and Microanalysis Meeting in the symposium titled "Biological Applications of Scanning Probe Microscopies," Portland, OR. "Scanning Force Microscopy and Nanomanipulation: Studies of DNA and Proteins Involved in DNA Repair"
- 8/9/99 Speaker at "Volumetric Properties of Biological Objects: An International Symposium", Toronto, CA. "*Osmolyte-Induced Changes in Protein Conformational Equilibria: Excluded Volume Effects versus Water and Solute Binding*".
- 1/22/99 Institute of Structural Biology, Virginia Commonwealth University, Richmond, VA "*Transcription Elongation: The Devil is in the Details*".
- 11/23/98 Department of Biological Sciences, University of Pittsburgh, Pittsburgh, PA "*Scanning Force Microscopy: Technological Advances and Biological Applications*".
- 11/6/98 Symposium speaker at the 1998 Southeast Regional Meeting of the American Chemical Society in the symposium titled "Hydrophobic effects in protein folding and ligand binding". "*Osmolyte-Induced Changes in Protein Conformational Equilibria: Binding and Crowding*".
- 7/27/98 Institute of Biotechnology, University of Texas Health Sciences Center, San Antonio, TX
- 2/26/98 Symposium speaker at the 1998 Biophysical Society Meeting in the symposium titled "The Devil is in the Details: Structural and Mechanistic Aspects of Transcription," Kansas City, MO
- 10/24/97 Department of Chemistry, Appalachian State University
- 9/19/96 Department of Biochemistry, North Carolina State University, Raleigh, NC "*Osmolyte-Induced Changes in Protein Conformational Equilibria: Binding and Crowding*".
- 10/8/95 National Institute of Environmental Health Sciences, Research Triangle Park, North Carolina, "*Scanning Force Microscopy of Protein-Nucleic Acid Complexes*"

### Complete Bibliography:

- Hogan, B. and Erie, D.A. "Identification, Purification and Characterization of GreA Homologs from *T. aquaticus* and *T. thermophilus*," in preparation.
- Holmes, S.F. and Erie, D.A. "A Single Downstream Base Modulates Nucleotide Addition catalyzed by RNA polymerase," in preparation.
- Erie, D.A. and Foster, J.E.: "Transcript cleavage and Arrest-State Formation," in preparation.
- Bullock, V. and Erie, D.A., "Association States of Human ? DNA polymerase and DNA ligase I, in preparation.
- Erie, D.A. and Foster, J.E. "Repair Paths of *E. coli* RNA polymerase," in preparation.
- Erie, D.A. "Dynamics of Transcription Elongation," in preparation. Invited review for *Microbiology and Molecular Biology Reviews*.
- Holtschlag, S.R., Foster, J.E., and Erie D.A. "Oxidation of *E. coli* RNA polymerase Enhances Misincorporation," in preparation.
- Hall, M.C., Wang, H., Erie, D.A., and Kunkel, T.A. "High Affinity Cooperative DNA Binding by the Yeast Mlh1-Pms1 Heterodimer," in preparation.

- Wong, O.K., Guthold, M., Erie, D.A., and Gelles, J. "Multiple Conformations of Lactose Repressor-DNA Looped Complexes Revealed by Single Molecule Techniques," in preparation.
- Davis-Searles, P.R., Saunders, A.J., Erie, D.A., Winzor, D.J., and Pielak, G.J. "Interpreting the Effects of Small Uncharged Solutes on Protein-Folding Equilibria," *Annu. Rev. Biophys. Biomol. Struct.*, **30**, 271-306 (2001).
- Ratcliff, G. and Erie, D.A. "Determination of Protein Stoichiometries and Binding constants using Volumetric Analysis of AFM Images," submitted.
- Batalia, M., Protozanova, E., Macgregor, R.B., and Erie, D. A. "Self-Assembly of Frayed Wires and Frayed-Wire Networks: Nanoconstruction with Tetraplex DNA," submitted.
- Foster, J.E., Holmes, S.F., and Erie D.A. "Allosteric Binding of Nucleoside Triphosphates Regulates Transcription Elongation," submitted.
- Guthold, M. and Erie, D.A., Single molecule study reveals a complex *E. coli* RNA polymerase," *ChemBioChem*, **2**, 167-170..
- Guthold, M., Falvo, M. R., Matthews, W. G., Paulson, S., Washburn, S., Erie, D., Superfine, R., Brooks, F. P. & Taylor, R. M. "Controlled Manipulation of Molecular Samples with the nanoManipulator," *IEEE/ASME Transactions on Mechatronics* **5**, 189-198 (2000).
- Xue, Y., Hogan, B., and Erie, D.A. "Purification and Characterization of *Thermus thermophilus* RNA polymerase," *Biochemistry*, **39**, 14356-14362 (2000).
- Guthold, M., Falvo, M., Matthews, W. G., Paulson, S., Mullin, J., Lord, S., Erie, D., Washburn, S., Superfine, R., Brooks, F. P. & Taylor, R. M. "Investigation and Modification of Molecular Structures Using the NanoManipulator," *J Mol. Graphics Mod.* **17**, 187-197 (1999).
- Saunders, A. J., Davis-Searles, P.R., Allen, D.L., Pielak, G. J., and Erie, D. A. "Osmolyte-Induced Changes in Protein Conformational Equilibria," *Biopolymers*, **53**, 293-307 (2000).
- Guthold, M., Matthews, G., Negishi, A., Taylor, R., Erie, D., Brooks, F., and Superfine, R., "Quantitative Manipulation of DNA and Viruses in Liquid with the NanoManipulator Scanning Force Microscope," *Surface and Interface Analysis*, **27**, 437-443 (1999).
- Davis-Searles PR. Morar AS. Saunders AJ. Erie DA. Pielak GJ. "Sugar-induced molten-globule model," *Biochemistry*. **37**, 17048-53 (1998).
- Ratcliff, G., Superfine, R., and Erie, D.A. "Photothermal Modulation for Oscillating Mode Atomic Force Microscopy in Solution," *Applied Physics Letters*, **72**, 1911-1913 (1998).
- Wolberg, A. S., Stafford, D. W., and Erie, D. A. "Human Factor IX Binds to Specific Sites in the Collagenous Domain of Collagen IV," *Journal of Biological Chemistry*, **272**, 16717-16720 (1997).
- Bustamante, C., Erie, D. A., and Yang, G. "Scanning Force Microscopy of Biological Macromolecules: A Perspective," in *Nanofabrication and Biosystems: integrating materials science, engineering, and biology*, Eds. Hoch, Jelinski, and Craighead, Cambridge University Press, New York, pp. 159-179 (1996).

- Erie, D. A. and Bustamante, C. "Nonspecific DNA Bending and the Specificity of Protein-DNA Interactions," *Science*, **269**, 989-990 (1995).
- Erie, D. A., Yang, G., Schultz, H. C., and Bustamante, C. "DNA Bending by Cro Protein in Specific and Nonspecific Complexes: Implications for Protein Site Recognition and Specificity," *Science*, **266**, 1562-1566 (1994).
- Gulthold, M., Bezanilla, M., Erie, D. A., Jenkens, B., Hansma, H. G., and Bustamante, C. "Following the Assembly of RNA Polymerase-DNA Complexes in Aqueous Solution with the Scanning Force Microscope," *Proceedings of the National Academy of Sciences*, **91**, 12,927-12,931 (1994).
- Bustamante, C., Erie, D. A., and Keller, D. "Biochemical and Structural Applications of Scanning Force Microscopy," *Current Opinions in Structural Biology*, **4**, 750-760 (1994).
- Erie, D. A., Hajiseyedjavadi, O., Young, M. C. and von Hippel, P. H. "Multiple RNA Polymerase Conformations and GreA: Control of the Fidelity of Transcription," *Science*, **262**, 867-873 (1993).
- Erie, D. A., Suri, A., Breslauer, K. J. Jones R. A., and Olson, W. K. "Theoretical Models of DNA Hairpin Loop Conformations: Correlations with Thermodynamic and Spectroscopic Data," *Biochemistry*, **32**, 436-454 (1993).
- Erie, D. A., Breslauer, K. J. and Olson, W. K. "A Monte Carlo Method for Generating Structures of Short Single-Stranded DNA Sequences," *Biopolymers*, **33**, 75-105 (1993).
- Erie, D. A., Yager, T. D., and von Hippel, P. H. "The Single Nucleotide Addition Cycle in Transcription: A Biophysical and Biochemical Perspective," *Annual Reviews of Biophysics and Biomolecular Structure*, **21**, 379-415 (1992).
- Erie, D. A., "Constrained Nucleic Acid Structures: An Experimental and Theoretical Investigation," Ph.D. Thesis, Rutgers University, New Brunswick, NJ, 294 pages (1990).
- Erie, D. A., Olson, W. K., Jones, R. A., Sinha, N., and Breslauer, K. J. "The Melting Behavior of a Covalently-Closed, Single-Stranded Circular DNA," *Biochemistry* **28**, 268-273 (1989).
- Erie, D. A., Sinha, N., Olson, W. K., Jones, R. A., and Breslauer, K. J. "A Dumbbell-Shaped, Double-Hairpin Structure of DNA: A Thermodynamic investigation," *Biochemistry* **26**, 7150-7159 (1987).
- Overgaard, T., Erie, D. A., Darsey, J. A., and Mattice, W. L. "Helix Formation by Hydroxyamyl-L-Glutaminyl Residues in Water and Aqueous Sodium Dodecyl Sulfate," *Biopolymers* **23**, 1595-1603 (1984).
- Erie, D. A., Darsey, J. A., and Mattice, W. L. "Representative Configurations of Unperturbed Poly(L-alanine) Chains," *Macromolecules* **16**, 910-914 (1983).