

## CURRICULUM VITAE

### ABRAHAM M. LENHOFF

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- Education:** B.Sc. (Eng.) in Chemical Engineering (with first-class honors), University of Cape Town, 1976.
- M.S. in Chemical Engineering, University of Wisconsin-Madison, 1979.  
Thesis (under Prof. M. Morari): The Design of Integrated Processing Systems with Consideration of Dynamic Behaviour.
- Ph.D. in Chemical Engineering, University of Wisconsin-Madison, 1984.  
Thesis (under Prof. E. N. Lightfoot): Convective Dispersion and Interphase Mass Transfer.

**Research interests:**

Applied protein biophysics and bioengineering, thermodynamics and transport phenomena, separations processes, colloid and interface science.

**Professional experience:**

- 2005- Director, NIH Center of Biomedical Research Excellence on Membrane Protein Production and Characterization, University of Delaware
- 2002- Gore Professor of Chemical Engineering, University of Delaware, Newark, DE
- 2000-2005 Director, NIH Center of Biomedical Research Excellence in Structural and Functional Genomics, University of Delaware
- 1996- Professor, Department of Chemical Engineering, University of Delaware, Newark, DE
- 1990-1996 Associate Professor, Department of Chemical Engineering, University of Delaware, Newark, DE
- 12/1994-5/1995 Visiting Research Fellow, Departments of Chemistry and Chemical Engineering, University of Melbourne, Australia
- 7-8/1990 Visiting Professor, Department of Chemical Engineering, University of Cape Town, South Africa

1984-1990	Assistant Professor, Department of Chemical Engineering, University of Delaware, Newark, DE
6-8/1985	Research Fellow, Institut für Anorganische Chemie and Analytische Chemie, Johannes-Gutenberg Universität, Mainz, Federal Republic of Germany
1980	Junior Lecturer, Department of Chemical Engineering, University of Cape Town, South Africa

**Honors:**

1974-1976	D. N. Malan Medals in Chemical Engineering
1975-1976	Cape Town Corporation Medals in Engineering
1976	S. A. Institution of Chemical Engineers Medal
1985	Research Fellowship, Alexander von Humboldt-Stiftung
1987	NSF Presidential Young Investigator Award
1991	College of Engineering Special Faculty Award
2000	Weissberger-Williams Lecturer, Eastman Kodak Co.
2002	Gore Professorship in Chemical Engineering
2003	Fellow, American Institute for Medical and Biological Engineering
2003	Fellow, American Association for the Advancement of Science
2009	American Chemical Society Award in Separations Science and Technology
2009	Alan S. Michaels Award for the Recovery of Biological Products
2009	College of Engineering Excellence in Teaching Award

**Professional activities:**

American Institute of Chemical Engineers  
 American Association for the Advancement of Science  
 American Chemical Society  
 American Crystallographic Association  
 Biophysical Society  
 Protein Society  
 South African Institution of Chemical Engineers  
 Associate Editor, *AIChE Journal* (2005-)  
 Editorial Board, *Journal of Pharmaceutical Sciences* (1994-1996)  
 Editorial Board, *Journal of Colloid and Interface Science* (2001-2004)  
 Editorial Board, *Biotechnology and Bioengineering* (2003-)  
 Member-at-Large of Council, Gordon Research Conferences (2006-2008)  
 Member, BRT-B Study Section, NIH-NIGMS (2007-2011)

## Publications in refereed journals

1. Lenhoff, A. M., and M. Morari, "Design of Resilient Processing Plants. I. Process Design Under Consideration of Dynamic Aspects", *Chem. Eng. Sci.* **37**, 245-258 (1982).
2. Lightfoot, E. N., A. M. Lenhoff and R. L. Rodriguez, "Use of Moments to Characterize Mass Transport in Steady Flows of Arbitrary Complexity", *Chem. Eng. Sci.* **37**, 954-956 (1982).
3. Lenhoff, A. M., and E. N. Lightfoot, "The Effects of Axial Diffusion and Permeability Barriers on the Transient Response of Tissue Cylinders. I. Solution in Transform Space", *J. Theor. Biol.* **97**, 663-677 (1982).
4. Lenhoff, A. M., and E. N. Lightfoot, "The Effects of Axial Diffusion and Permeability Barriers on the Transient Response of Tissue Cylinders. II. Solution in Time Domain", *J. Theor. Biol.* **106**, 207-238 (1984).
5. Lenhoff, A. M., "Computation of the Eigenvalues of a Class of Non-Self-Adjoint Operators", *SIAM J. on Appl. Math.* **45**, 360-368 (1985).
6. Lightfoot, E. N., R. F. Rudolph, A. M. Lenhoff, E. H. Lanphier, C. E. Lehner and L. A. Whiteside, "Hydrogen Washout in Bone Cortex and Periosteum", *Undersea Biomed. Res.* **13**, 425-441 (1985).
7. Lenhoff, A. M., and E. N. Lightfoot, "Convective Dispersion and Interphase Mass Transfer", *Chem. Eng. Sci.* **41**, 2795-2810 (1986).
8. Lenhoff, A. M., "Significance and Estimation of Chromatographic Parameters", *J. Chrom.* **384**, 285-299 (1987).
9. Daskopoulos, P., and A. M. Lenhoff, "Dispersion Coefficient for Laminar Flow in Curved Tubes", *AIChE J.*, **34**, 2052-2058 (1988).
10. Daskopoulos, P., and A. M. Lenhoff, "Flow in Curved Ducts: Bifurcation Structure for Stationary Ducts", *J. Fluid Mech.*, **203**, 125-148 (1989).
11. Boedeker, A. R., and A. M. Lenhoff, "Affinity Separations using Liquid Perfluorocarbon Supports: Rate Effects", *Biotech. Prog.*, **5**, 132-135 (1989).
12. Shankar, A., and A. M. Lenhoff, "Dispersion in Laminar Flow in Short Tubes", *AIChE J.*, **35**, 2048-2052 (1989).
13. LaMarca, C., A. M. Lenhoff and P. Dhurjati, "Partitioning of Host and Recombinant Cells in Aqueous Two-Phase Polymer Systems", *Biotech. Bioeng.*, **36**, 484-492 (1990).
14. Daskopoulos, P., and A. M. Lenhoff, "Flow in Curved Ducts. Part 2. Rotating Ducts", *J. Fluid Mech.*, **217**, 575-593 (1990).
15. Yoon, B. J., and A. M. Lenhoff, "A Boundary Element Method for Molecular Electrostatics with Electrolyte Effects", *J. Comput. Chem.*, **11**, 1080-1086 (1990).
16. Haggerty, L., and A. M. Lenhoff, "Relation of Protein Electrostatics Computations to Ion Exchange and Electrophoretic Behavior", *J. Phys. Chem.*, **95**, 1472-1477 (1991).

17. Haggerty, L., B. A. Watson, M. A. Barteau and A. M. Lenhoff, "Ordered Arrays of Proteins on Graphite Observed by Scanning Tunneling Microscopy", *J. Vac. Sci. Tech. B*, **9**, 1219-1222 (1991).
18. Shankar, A., and A. M. Lenhoff, "Dispersion and Partitioning in Short Coated Tubes", *Ind. Eng. Chem. Res.*, **30**, 828-835 (1991).
19. Daskopoulos, P., and A. M. Lenhoff, "Modelling of Particle Separations in Complex Flows", *Sep. Sci. Tech.*, **26**, 1013-1050 (1991).
20. Shankar, A., and A. M. Lenhoff, "Dispersion in Round Tubes and Its Implications for Extra-Column Dispersion", *J. Chrom.*, **556**, 235-248 (1991).
21. Shibata, C. T., and A. M. Lenhoff, "TIRF of Salt and Surface Effects on Protein Adsorption: I. Equilibrium", *J. Coll. Interf. Sci.*, **148**, 469-484 (1992).
22. Shibata, C. T., and A. M. Lenhoff, "TIRF of Salt and Surface Effects on Protein Adsorption: II. Kinetics", *J. Coll. Interf. Sci.*, **148**, 485-507 (1992).
23. Yoon, B. J., and A. M. Lenhoff, "Computation of the Electrostatic Interaction Energy between a Protein and a Charged Surface", *J. Phys. Chem.*, **96**, 3130-3134 (1992).
24. Watson, B. A., M. A. Barteau, L. Haggerty, A. M. Lenhoff and R. S. Weber, "Scanning Tunneling Microscopy and Tunneling Spectroscopy of Ordered Hetero- and Isopolyanion Arrays on Graphite", *Langmuir*, **8**, 1145-1148 (1992).
25. Haggerty, L., and A. M. Lenhoff, "STM and AFM in Biotechnology", *Biotech. Prog.*, **9**, 1-11 (1993).
26. Haggerty, L., and A. M. Lenhoff, "Analysis of Ordered Arrays of Adsorbed Lysozyme by Scanning Tunneling Microscopy", *Biophys. J.*, **64**, 886-895 (1993).
27. Roth, C. M., and A. M. Lenhoff, "Electrostatic and van der Waals Contributions to Protein Adsorption: Computation of Equilibrium Constants", *Langmuir*, **9**, 962-972 (1993).
28. Richards, J. R., A. N. Beris and A. M. Lenhoff, "Steady Laminar Flow of Liquid-Liquid Jets at High Reynolds Numbers", *Phys. Fluids A*, **5**, 1703-1717 (1993).
29. Schure, M. R., and A. M. Lenhoff, "Consequences of Wall Adsorption in Capillary Electrophoresis: Theory and Simulation", *Anal. Chem.*, **65**, 3024-3037 (1993).
30. Palkar, S. A., and A. M. Lenhoff, "Energetic and Entropic Contributions to the Interaction of Unequal Spherical Double Layers", *J. Coll. Interf. Sci.*, **165**, 177-194 (1994).
31. Lenhoff, A. M., "Contributions of Surface Features to the Electrostatic Properties of Rough Colloidal Particles", *Colloids Surf. A*, **87**, 49-59 (1994).
32. Johnson, C. A., P. Wu and A. M. Lenhoff, "Electrostatic and van der Waals Contributions to Protein Adsorption: 2. Modelling of Ordered Arrays", *Langmuir*, **10**, 3705-3713 (1994).
33. Richards, J. R., A. M. Lenhoff and A. N. Beris, "Dynamic Breakup of Liquid-Liquid Jets", *Phys. Fluids*, **6**, 2640-2655 (1994).

34. Chae, K. S., and A. M. Lenhoff, "Computation of the Electrophoretic Mobility of Proteins", *Biophys. J.*, **68**, 1120-1127 (1995).
35. Pjura, P. E., M. E. Paulaitis and A. M. Lenhoff, "Molecular Thermodynamic Properties of Protein Solutions from Partial Specific Volumes", *AIChE J.*, **41**, 1005-1009 (1995).
36. Neal, B. L., and A. M. Lenhoff, "Excluded Volume Contribution to the Osmotic Second Virial Coefficient for Proteins", *AIChE J.*, **41**, 1010-1014 (1995).
37. Richards, J. R., A. N. Beris and A. M. Lenhoff, "Drop Formation in Liquid-Liquid Systems Before and After Jetting", *Phys. Fluids*, **7**, 2617-2630 (1995).
38. Roth, C. M., and A. M. Lenhoff, "Electrostatic and van der Waals Contributions to Protein Adsorption: Comparison of Theory and Experiment", *Langmuir*, **11**, 3500-3509 (1995).
39. Palkar, S. A., and A. M. Lenhoff, "Effect of Taper on Diffusion and Adsorption in a Cylindrical Pore", *Ind. Eng. Chem. Res.*, **34**, 3551-3555 (1995).
40. Roth, C. M., B. L. Neal and A. M. Lenhoff, "Van der Waals Interactions Involving Proteins", *Biophys. J.*, **70**, 977-987 (1996).
41. Roth, C. M., K. K. Unger and A. M. Lenhoff, "A Mechanistic Model of Retention in Protein Ion-Exchange Chromatography", *J. Chrom. A*, **726**, 45-56 (1996).
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43. Johnson, C. A., and A. M. Lenhoff, "Adsorption of Charged Latex Particles on Mica Studied by Atomic Force Microscopy", *J. Coll. Interf. Sci.*, **179**, 587-599 (1996).
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47. Velev, O. D., T. A. Jede, R. F. Lobo and A. M. Lenhoff, "Porous Silica via Colloidal Crystallization", *Nature*, **389**, 447-448 (1997).
48. Asthagiri, D., and A. M. Lenhoff, "Influence of Structural Details in Modeling Electrostatically Driven Protein Adsorption", *Langmuir*, **13**, 6761-6768 (1997).
49. Oberholzer, M. R., N. J. Wagner and A. M. Lenhoff, "Grand Canonical Brownian Dynamics Simulation of Colloidal Adsorption", *J. Chem. Phys.*, **107**, 9157-9167 (1997).
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51. Roth, C. M., J. E. Sader and A. M. Lenhoff, "Electrostatic Contribution to the Energy and Entropy of Protein Adsorption", *J. Coll. Interf. Sci.*, **203**, 218-221 (1998).
52. Velev, O. D., E. W. Kaler and A. M. Lenhoff, "Protein Interactions in Solution Characterized by Light and Neutron Scattering: Comparison of Lysozyme and Chymotrypsinogen", *Biophys. J.*, **75**, 2682-2697 (1998).
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55. Chang, C., and A. M. Lenhoff, "Comparison of Protein Adsorption Isotherms and Uptake Rates in Preparative Cation-Exchange Materials", *J. Chrom. A*, **827**, 281-293 (1998).
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61. Velev, O. D., P. M. Tessier, A. M. Lenhoff and E. W. Kaler, "Nanostructured Photonic Metal Synthesized via Colloidal Crystal Templates", *Nature*, **401**, 548 (1999).
62. Velev, O. D., E. W. Kaler and A. M. Lenhoff, "Photochemical Micromachining of Lysozyme Crystals", *Adv. Matls.*, **11**, 1345-1349 (1999).
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64. DePhillips, P., and A. M. Lenhoff, "Pore Size Distributions of Cation Exchange Adsorbents Determined by Inverse Size-Exclusion Chromatography", *J. Chrom. A*, **883**, 39-54 (2000).
65. Asthagiri, D., A. M. Lenhoff and D. T. Gallagher, "Role of Competitive Interactions in Growth Rate Trends of Subtilisin s88 Crystals", *J. Cryst. Growth*, **212**, 543-554 (2000).
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70. Velev, O. D., A. M. Lenhoff and E. W. Kaler, "A Class of Microstructured Particles via Colloidal Crystallization", *Science*, **287**, 2240-2243 (2000).
71. Velev, O. D., E. W. Kaler and A. M. Lenhoff, "Surfactant Diffusion into Lysozyme Crystal Matrices Investigated by Quantitative Fluorescence Microscopy", *J. Phys. Chem. B*, **104**, 9267-9275 (2000).
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74. Velev, O. D., and A. M. Lenhoff, "Colloidal Crystals as Templates for Porous Materials", *Curr. Opinion Coll. Interf. Sci.*, **5**, 56-63 (2000).
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76. Tessier, P. M., O. D. Velev, A. T. Kalambur, J. F. Rabolt, A. M. Lenhoff and E. W. Kaler, "Assembly of Gold Nanostructured Films Templated by Colloidal Crystals and Use in Surface-Enhanced Raman Spectroscopy", *J. Amer. Chem. Soc.*, **122**, 9554-9555 (2000).
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79. Tessier, P. M., A. M. Lenhoff and S. I. Sandler, "Rapid Measurement of Protein Osmotic Second Virial Coefficients by Self-Interaction Chromatography", *Biophys. J.*, **82**, 1620-1631 (2002).
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81. Tessier, P. M., S. D. Vandrey, B. W. Berger, R. Pazhianur, S. I. Sandler and A. M. Lenhoff, "Self-Interaction Chromatography: A Novel Screening Method for Rapid Protein Crystallization", *Acta Cryst. D*, **58**, 1531-1535 (2002).

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89. Tessier, P. M., V. J. Verruto, S. I. Sandler and A. M. Lenhoff, "Correlation of Diafiltration Sieving Behavior of Lysozyme-BSA Mixtures with Osmotic Second Virial Cross Coefficients", *Biotech. Bioeng.*, **87**, 303-310 (2004).
90. Tessier, P. M., and A. M. Lenhoff, "Measurements of Protein Self-Association as a Rational Guide to Crystallization", *Curr. Opin. Biotech.*, **14**, 512-516 (2003).
91. DePhillips, P., and A. M. Lenhoff, "Relative Retention of FGF-1 and FGF-2 on Strong Cation Exchange Adsorbents", *J. Chrom. A*, **1036**, 51-60 (2004).
92. Tessier, P. M., S. I. Sandler and A. M. Lenhoff, "Direct Measurement of Protein Osmotic Second Virial Cross Coefficients by Cross-Interaction Chromatography", *Prot. Sci.*, **13**, 1379-1390 (2004).
93. Chang, J., A. M. Lenhoff and S. I. Sandler, "Determination of Fluid-Solid Transitions in Model Protein Solutions Using the Histogram Reweighting Method and Expanded Ensemble Simulations", *J. Chem. Phys.*, **120**, 3003-3014 (2004).
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95. Yao, Y., and A. M. Lenhoff, "Determination of Pore Size Distributions of Porous Chromatographic Adsorbents by Inverse Size Exclusion Chromatography", *J. Chrom. A*, **1037**, 273-282 (2004). Erratum: *J. Chrom. A*, **1113**, 259 (2006).



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100. Berger, B. W., C. M. Gendron, C. R. Robinson, E. W. Kaler and A. M. Lenhoff, "The Role of Protein and Surfactant Interactions in Membrane Protein Crystallization", *Acta Cryst. D*, **61**, 724-730 (2005).
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102. Yao, Y., and A. M. Lenhoff, "Electrostatic Contributions to Protein Retention in Ion-Exchange Chromatography. II. Proteins with Various Degrees of Structural Differences", *Anal. Chem.*, **77**, 2157-2165 (2005).
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