

CURRICULUM VITAE
ABRAHAM M. LENHOFF

Department of Chemical and Biomolecular Engineering
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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:

2012-2017	Chair, Department of Chemical and Biomolecular Engineering, University of Delaware
9-12/2010	Olaf A. Hougen Visiting Professor, Department of Chemical and Biological Engineering, University of Wisconsin
2010-	Allan P. Colburn Professor of Chemical Engineering, University of Delaware
2005-2015	Director, NIH Center of Biomedical Research Excellence on Membrane Protein Production and Characterization, University of Delaware
2002-2010	Gore Professor of Chemical Engineering, University of Delaware
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
1990-1996	Associate Professor, Department of Chemical Engineering, University of Delaware
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

6-8/1985 Research Fellow, Institut für Anorganische Chemie and Analytische Chemie, Johannes-Gutenberg Universität, Mainz, 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 in the Recovery of Biological Products

2009 College of Engineering Excellence in Teaching Award

2010 Allan P. Colburn Professorship in Chemical Engineering

2010 Olaf A. Hougen Visiting Professorship, University of Wisconsin

2011 Marvin J. Johnson Award in Microbial and Biochemical Technology

2014 Francis Alison Award, University of Delaware

2017 Hess Lecturer, University of Virginia

Professional activities:

American Institute of Chemical Engineers

American Association for the Advancement of Science

American Chemical Society

American Crystallographic Association

Biophysical Society

Protein Society

Associate Editor, *AICHE Journal* (2005-2012)

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)

Member, Advisory Board, *Chemical & Engineering News* (2012-2015)

Member, Governing Board, Council for Chemical Research (2012-2015)

Conference Co-Chair, Biopartitioning and Purification (BPP) (2013)
Member, Visiting Committee, Department of Chemical and Biological
Engineering, University of Wisconsin (2011-2017)

Patent

Lee, K., A. Lenhoff, K. Valente, N. Levy and Y. Gokarn, "Reduction of Lipase Activity in Product Formulations", US Patent 9,932,591 (2018).

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).
44. Roth, C. M., and A. M. Lenhoff, "Improved Parametric Representation of Water Dielectric Data for Lifshitz Theory Calculations", *J. Coll. Interf. Sci.*, **179**, 637-639 (1996).
45. Lenhoff, A. M., P. E. Pjura, J. G. Dillmore and T. S. Godlewski, Jr., "Ultracentrifugal Crystallization of Proteins: Transport - Kinetic Modelling, and Experimental Behavior of Catalase", *J. Cryst. Growth*, **180**, 113-126 (1997).
46. Oberholzer, M. R., J. M. Stankovich, S. L. Carnie, D. Y. Chan and A. M. Lenhoff, "2-D and 3-D Interactions in Random Sequential Adsorption of Charged Particles", *J. Coll. Interf. Sci.*, **194**, 138-153 (1997).

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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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).
53. Neal, B. L., D. Asthagiri and A. M. Lenhoff, "Molecular Origins of Osmotic Second Virial Coefficients of Proteins", *Biophys. J.*, **75**, 2469-2477 (1998).
54. Velev, O. D., T. A. Jede, R. F. Lobo and A. M. Lenhoff, "Microstructured Porous Silica Obtained via Colloidal Crystal Templates", *Chem. Mater.*, **10**, 3597-3602 (1998).
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).
56. Neal, B. L., D. Asthagiri, O. D. Velev, A. M. Lenhoff and E. W. Kaler, "Why is the Osmotic Second Virial Coefficient Related to Protein Crystallization?", *J. Cryst. Growth*, **196**, 377-387 (1999).
57. Yuan, Y., and A. M. Lenhoff, "Characterization of Phase Separation in Mixed Surfactant Films by Liquid Tapping Mode AFM", *Langmuir*, **15**, 3021-3025 (1999).
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60. Yuan, Y., M. R. Oberholzer and A. M. Lenhoff, "Size Does Matter: Electrostatically Determined Surface Coverage Trends in Protein and Colloid Adsorption", *Coll. Surf. A*, **165**, 125-141 (2000).
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).

63. Johnson, C. A., Y. Yuan and A. M. Lenhoff, "Adsorbed Layers of Ferritin at Solid and Fluid Interfaces Studied by Atomic Force Microscopy", *J. Coll. Interf. Sci.*, **223**, 261-272 (2000).
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).
66. Ruppert, S., S. I. Sandler and A. M. Lenhoff, "Correlation between the Second Osmotic Virial Coefficient and the Solubility of Proteins", *Biotech. Prog.*, **17**, 182-187 (2001).
67. Moretti, J. J., S. I. Sandler and A. M. Lenhoff, "Phase Equilibria in the Lysozyme-Ammonium Sulfate-Water System", *Biotech. Bioeng.*, **70**, 498-506 (2000).
68. Chang, R. C., D. Asthagiri and A. M. Lenhoff, "Measured and Calculated Effects of Mutations in Bacteriophage T4 Lysozyme on Interactions in Solution", *Proteins: Struct. Func. Gen.*, **41**, 123-132 (2000).
69. Pjura, P. E., A. M. Lenhoff, S. A. Leonard and A. P. Gittis, "Protein Crystallization by Design: Chymotrypsinogen without Precipitants", *J. Mol. Biol.*, **300**, 235-239 (2000).
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).
72. DePhillips, P., and A. M. Lenhoff, "Determinants of Protein Retention Characteristics on Cation Exchange Adsorbents", *J. Chrom. A*, **933**, 57-72 (2001).
73. Asthagiri, D., M. R. Schure and A. M. Lenhoff, "Calculation of Hydration Effects in the Binding of Anionic Ligands to Basic Proteins", *J. Phys. Chem. B*, **104**, 8753-8761 (2000).
74. Velev, O. D., and A. M. Lenhoff, "Colloidal Crystals as Templates for Porous Materials", *Curr. Opinion Coll. Interf. Sci.*, **5**, 56-63 (2000).
75. Hloucha, M., J. F. M. Lodge, A. M. Lenhoff and S. I. Sandler, "A Patch-Antipatch Representation of Specific Protein Interactions", *J. Cryst. Growth*, **232**, 195-203 (2001).
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).
77. Tessier, P. M., O. D. Velev, A. T. Kalambur, A. M. Lenhoff, J. F. Rabolt and E. W. Kaler, "Structured Metallic Films for Optical and Spectroscopic Applications via Colloidal Crystal Templating", *Adv. Mats.*, **13**, 396-400 (2001).
78. Dokou, E., M. A. Barteau, N. J. Wagner and A. M. Lenhoff, "Effect of Gravity on Colloidal Deposition Studied by Atomic Force Microscopy", *J. Coll. Interf. Sci.*, **240**, 9-16 (2001).

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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83. Tessier, P. M., S. D. Christesen, K. K. Ong, E. M. Clemente, A. M. Lenhoff, E. W. Kaler and O. D. Velev, "On-line Spectroscopic Characterization of Sodium Cyanide with Nanostructured Gold SERS Substrates", *Appl. Spectr.*, **56**, 1524-1530 (2002).
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85. Yuan, Y., O. D. Velev and A. M. Lenhoff, "Mobility of Adsorbed Proteins Studied by Fluorescence Recovery after Photobleaching", *Langmuir*, **19**, 3705-3711 (2003).
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87. Yuan, Y., and A. M. Lenhoff, "Measurement of Mobility of Adsorbed Colloids by Lateral Force Microscopy", *J. Colloid Interf. Sci.*, **267**, 352-359 (2003).
88. Lenhoff, A. M., "A Natural Interaction: Chemical Engineering and Molecular Biophysics", *AIChE J.*, **49**, 806-812 (2003).
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).
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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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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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104. Berger, B. W., C. J. Blamey, U. P. Naik, B. J. Bahnson and A. M. Lenhoff, "The Roles of Additives and Precipitants in Crystallization of Calcium- and Integrin-Binding Protein", *Cryst. Growth Des.*, **5**, 1499-1507 (2005).
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