

Curriculum Vita.

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1. EDUCATION.

University of Notre Dame
Princeton University
Princeton University

B.S. Chemical Engng., 6/74
M.A. Chemical Engng., 6/76
Ph.D. Chemical Engng., 1/80

2. PRINCIPAL POSITIONS.

Senior Fellow, Biomedical Engineering Center, U. New Mexico, 05/05 - present
Distinguished User, Molecular Foundry, Lawrence-Berkeley National Lab, 09/06 - present
Associate Director, NIH Predoctoral Program in Biotechnology 9/01 - present
Editorial Board, *Separation Science and Technology*, 1/97-present.
Washington State University, Professor, Chemical Engng., 8/87-present.
Sabbatical Leave at University of Delaware, 9/03-12/03.
Sabbatical Leave at Immunex Corp., Seattle, WA, 8/94-5/95.
University of Notre Dame, Assistant Professor, Chemical Engng., 9/80-8/87.
FMC Corporation, COGAS Division, Design Engineer, 2/80-8/80.
NASA (Marshall Space Flight Ctr.) USRA Visiting Scientist, 1/79-2/80.
Cities Service Research Center, Cranbury, New Jersey, Research Engineer, 5/75-6/76.

3a. RESEARCH INTERESTS. Areas of ongoing research include:

Multidimensional MEMS Proteomics Chips
Biological Separations, esp. Equilibrium-Gradient Methods
Chromatography, especially Protein Ion Exchange
Centrifugal Fractionation of Cells, Organelles and Proteins
Hydrodynamic and Electrical Instabilities.

3b. ACADEMIC INTERESTS (Courses Taught)

Graduate Instruction:

Mass, Heat, and Momentum Transport (Fall, Spring)
Kinetics; Protein Biotechnology; Research Methods
Mathematical Methods in Engineering
Biological Separations/Downstream Processing

Undergraduate Instruction:

ChE Thermodynamics Phase Equilibrium
Undergraduate ChE Laboratory; Plant Design and Economics
Fluid Dynamics and Heat Transfer
Conventional Separations (Unit Ops); Modern Separations Processes (Elective)
Bioprocess Engineering (Elective); Downstream Processing (Elective)

4. HONORS, AWARDS, APPOINTMENTS.

Councilor, American Electrophoresis Society, 10/05 - present

Distinguished User, Molecular Foundry, Lawrence-Berkeley National Lab, 09/06 - present

Senior Fellow, Biomedical Engineering Center, U. New Mexico, 05/05 – present

Program Co-Chair, American Electrophoresis Society, CEPHarm Meeting, Jersey City, 10/06

Program Co-Chair, American Electrophoresis Society, AIChE Natl Meeting, San Francisco, 11/03

Panelist, NSF CAREER review panel on Biotechnology, 12/01, 12/02

Head, USRA-NASA review panel on Microgravity Biotechnology, 12/96, 7/98, 1/01.

Invited to write book chapter for “*The Encyclopedia of Bioprocess Technology*” F07.

Invited to write book chapter for “*The Handbook of Isoelectric Focusing and Proteomics*” F02.

Invited to write book chapter for “*The Encyclopedia of Bioprocess Technology*,” F97.

Invited to write book chapter for “*Separation Processes in Biotechnology*,” F96.

Electro-separations 2020 Workshop Sponsored by NSF, EPRI and DOE, October 9-11, 1995.

PNL Affiliate Staff Scientist (PASS, Battelle Pacific Northwest Labs) 1994-1997.

Outstanding Professor in Chemical Engineering (Undergraduate Academic, WSU) 1990.

Editorial Advisory Board, Industrial and Engineering Chemistry Research, 1990-1991.

Special Issue Editor, *Separation Science and Technology*, Special Issue on Bio-separations, Vol.

23(8-9), Marcel Dekker, Inc., New York 1988.

National Program Committee Chair for Industrial and Engineering Chemistry Division of the American Chemical Society, 1987-1991.

Panelist, National Science Foundation, Minority Graduate Fellowship Evaluation Panel in Engineering, Served: 1985, 1987, 1989.

NASA-USRA Visiting Scientist, Bio-separations Branch at Marshall Space Flight Center, Huntsville, Alabama, 1/79 - 2/80.

5. PROFESSIONAL ACTIVITIES.

Consulting: INTEL Corp., Fluor-Daniels, Inc., Protasis Corp., Calibrant Technol.

American Electrophoresis Society, 2001-present, Program Chair, 2003 Fall Meeting.

American Chemical Society (I&EC, BIOT & Analytical Chemistry Divisions).

National Program Committee Chair, I&EC Division of the ACS, 1987-90.

6. COLLABORATORS.

Prof. Abraham **Lenhoff**, Dept. Chemical Engng, U. Delaware, Newark DE, Rockville MD: Nonlinear ionic transport theory applied to ion exchange

Prof. Peter **Myers**., School of Chemistry, University of Liverpool: Application of electric field-gradient focusing to the preparative recovery of low molecular weight organic molecules.

Prof. Frantisek **Svec**, Chemistry Department, University of California at Berkeley: Gradient monoliths.

Dr. Brent **Larsen**, Berlex Corp., Mountainview CA: Preparative electrofocusing.

Dr. Scott **Sibbett**, INTEL Corp., Rio Rancho NM: Microchannel electrophoresis.

Dr. Marvin **Warner**, PNNL, Richland WA: Microscale Optical Detection using Quantum Dots.

Prof. P. **Dutta**, WSU-MME: Isoelectric focusing of proteins in a polymeric chip.

Prof. W. **Dong**, WSU-BE: Microfluidic FRET platform for cardiac biomarkers in whole blood.

Prof. B. **Van Wie**, WSU, Prof. J. **Cheng**, WSU, Prof. D. **Moffett** WSU: Bioamplified Sensors.

Prof. G. **Lopez**, H. **Sang**, S. **Brueck**, UNM (NIRT): Fundamentals of nanometer scale separation chips.

7a. INVITED LECTURES AND SYMPOSIA.

Universities and Institutes...

University of New Mexico, Albuquerque, NM, 11/27/07, "Strategies for Scaling Electrophoretic Separations."

Molecular Foundry, Lawrence-Berkeley National Laboratory, Berkeley, CA, 10/5/07, "New Electrofocusing Methods."

University of New Mexico, Albuquerque, NM, 10/25/05, "New Separation Technologies for Multidimensional Proteomics Microchips."

Korea University, Seoul, Korea, 7/04/05; "Hybrid Labchips for Proteomics."

Brigham Young University, Provo, UT, 4/2/04, "Preparative Electrofocusing at 10 kV."

NIST (Gaithersburg), 12/10/03 "How to Scale Capillary Electrofocusing by 1,000,000x"

University of Delaware, Newark, DE, 10/23/03, "How to Scale Capillary Electrofocusing by 1,000,000x."

University of Alberta, Alberta, Canada, 9/24/01, "Advances in Electrofocusing."

University of Idaho, Moscow, Idaho, 10/16/97, "Isoelectric Focusing at High Voltages."

Virginia Polytechnic Institute, Blacksburg, Virginia, 1/28/92, "Preparative-Scale Electrophoresis."

University of Idaho, Moscow, Idaho, 9/23/87; "Toward Industrial Electrophoresis of Proteins."

University of Arizona, Tucson, Arizona (Center for Separation Science, 1/15/87; "Magnetic Stabilization of Weakly Conducting Fluids."

UCLA, Los Angeles, California, 1/16/87; "Magnetic Stabilization of Weakly Conducting Fluids."

University of Iowa, Iowa City, Iowa, 4/17/87; "Magnetic Stabilization of Weakly Conducting Fluids."

University of Colorado, Boulder, Colorado, 2/13/86; "Stable, Unstable and Stabilized Natural Convection in Continuous Flow Electrophoresis."

Northwestern University, Evanston, Illinois, 5/14/85; "Large-Scale Continuous Flow Electrophoresis."

Yale University, New Haven, Connecticut, 1/25/85; "High-Resolution Continuous Flow Electrophoresis."

Northwestern University, Evanston, Illinois, 9/17/83; "The Effect of Electric Fields on Carrier-Mediated Transport."

KAIST (Korea Advanced Institute for Science and Technology) Seoul, Korea, 5/27/83; "Scale-up of the Free-Flow Electrophoresis Device."

Korea University, Seoul, Korea, 5/26/83; "Using Electric Fields to Control Transmembrane Fluxes."

Seoul National University, Seoul, Korea, 5/25/83; "Continuous Flow Electrophoresis with Solute Recycle."

Interdepartmental Seminars...

Dept. Chemistry, Washington State University, Pullman, Washington, 4/04/03; "Electrophoresis in Proteomics."

Biosystems Engng, Washington State University, Pullman, Washington, 3/08/00; "How Electrophoresis is Used in Bioprocessing."

Dept. Chemistry, Washington State University, Pullman, Washington, 10/11/93; "Industrial-Scale Electrophoresis."

NIH Biotechnology Symposium, Washington State University, Pullman, Washington, 10/13/90, "New Purification Technologies for Proteins: A Chemical Engineering Approach."

Dept. Agricultural Engineering, Washington State University, Pullman, Washington, 1/12/89; "Electrophoresis in Downstream Processing."

Dept. Physics, Washington State University, Pullman, Washington, 1/12/88; "Electrically-Induced Secondary Flows."

Dept. Mechanical Engineering, University of Notre Dame, Notre Dame, Indiana, 3/23/86; "Stable, Unstable and Stabilized Natural Convection in an Electrically-Heated Slit."

Industrial Seminars...

- Amgen, Inc., Seattle, 5/2/2005; “Internal pH Shift in Protein Ion Exchange.” C. F. Ivory
- Calibrant Biosystems, Rockville MD, 12/12/2003; “Tutorial on Modeling Isotachopheresis.” C. F. Ivory
- Calibrant Biosystems, Rockville MD, 11/1/2002; “Preparative Isotachopheresis.” C. F. Ivory
- Genentec, Point San Bruno CA 10/30/2002; “Dynamic Electrofocusing.” C. F. Ivory
- Applied Biosystems International, Framingham MA, 1/16/2002; “Dynamic Electrofocusing.” C. F. Ivory
- Immunex, Inc., Seattle, Washington, 6/22/2001; “Advances in Electrofocusing.” C. F. Ivory
- Ecotas '2000 in London, U.K., October 6, 2000, “Microfabricated Electrofocusing Devices,” C. F. Ivory.
- Ecotas '99 in Sherborn, MA, October 8-9, 1999, “Electronically-Controlled Electrofocusing,” C. F. Ivory.
- Waters Corporation, New Milford, MA, Sept. 9, 1998, “Electrophoretic Focusing without Ampholytes,” Z. Huang and C. F. Ivory.
- Immunex, Inc., Seattle, Washington, 8/19/97; “Isoelectric Focusing at High Voltages.”
- Battelle Pacific Northwest Laboratory, Richland, Washington, 6/4/96 Purification and Concentration of Charged Molecules using Electronically-Controlled Electric Field Gradients.”
- Protein Design Labs, Inc., Mountain View, CA, 5/26/94; “New Electrofocusing Technologies for Analytical, Preparative and Industrial Protein Processing.”
- Applied Biosystems, Inc., Seattle, CA, 5/25/94; “Electrophoretic Focusing Without pH Gradients.”
- Immunex, Inc., Seattle, Washington, 4/29/94; “New Electrofocusing Technologies for Analytical, Preparative and Industrial Protein Processing.”
- ZymoGenetics, Seattle, Washington, 4/28/94; “Electrophoretic Focusing Without pH Gradients.”
- ZymoGenetics, Seattle, Washington, 6/11/93; “Industrial Electrophoresis.”
- Battelle Pacific Northwest Laboratory, Richland, Washington, 6/3/93; “Electro-Ultrafiltration.”
- Genentec, Inc., South San Francisco, California, 11/25/91; “A New Apparatus for Free-Fluid Electrophoresis.”
- Battelle Pacific Northwest Laboratory, Richland, Washington, 5/14/90; “Zone Electrophoresis in Downstream Processing.”
- PPG, Pittsburgh, Pennsylvania, 6/23/89; “Preparative High Performance Capillary Electrophoresis.”
- PPG, Pittsburgh, Pennsylvania, 7/28/88; “Electrophoresis and Electrochromatography.”
- E. I. DuPont de Nemours, Wilmington, Delaware, 7/30/85; “Industrial-Scale Continuous Flow Electrophoresis.”
- Dow Chemical Company, Midlands, Michigan, 4/4/85; “Industrial-Scale, High Resolution, Continuous Flow Electrophoresis.”
- Georgia Kaolin, Dry Branch, Georgia, 3/21/85; “Scale-Up of Electrostatic Beneficiation and Dewatering Processes for Kaolin.”
- Battelle Memorial Laboratory, Columbus, Ohio, 12/18/84; “High Resolution, Continuous Flow Electrophoresis.”
- Cetus Corporation, Emeryville, California, 11/23/84; “Continuous Flow Electrophoresis with Recycle.”
- Cutter Laboratories, Berkeley, California, 11/21/84; “Mathematical Modeling of Diffusional Effects in the Philpot-Harwell Device.”
- Miles Laboratories, Elkhart, Indiana, 1/17/84; “The Application of Electrophoresis in Industrial Separations.”

Invited Papers

- Plenary: 32th International Symposium on Capillary Chromatography and Electrophoresis* in Riva del Garda, May 26-30, 2008, “A New Separation Science – Part2: Electrofocusing of Trace Pharmaceuticals, C. F. Ivory and J. Burke.
- Plenary: 31th International Symposium on Capillary Chromatography and Electrophoresis* in Albuquerque NM, Nov 28-30, 2007, “Equilibrium and Non-equilibrium Gradient Focusing Methods,” C. F. Ivory.

- Invited:* AICHE Annual Meeting, in Salt Lake City, UT, Nov 5-8, 2007, "Dispersion in Microchannel Electrophoresis," C. F. Ivory
- Invited:* PittCon Meeting, in Chicago, Feb 25-Mar 1, 2007, "Potential Gradient-Focusing Methods," C. F. Ivory
- Plenary:* 29th International Symposium on Capillary Chromatography and Electrophoresis in Riva del Garda, Italy, May 29-June 2, 2006, "Simultaneous 2D Electrofocusing," C. F. Ivory.
- Invited:* Technical Advisory Board Workshop on Biomarker Discovery and Validation (Sponsored by the Canary Foundation; Organized by INTEL Corp.), Santa Clara CA, February 7-8, 2006, "Toward an N-Dimensional Separations Chip," C. F. Ivory.
- Keynote:* 20th International Symposium on Microscale Bioseparations in Amsterdam, January 12-17, 2006, "A Comparison of Several New and Conventional Microchip Electrofocusing Techniques," C. F. Ivory.
- Plenary:* 28th International Symposium on Capillary Chromatography and Electrophoresis in Las Vegas, May 18-22, 2005, "Electrofocusing Proteins in a Velocity Gradient," C. F. Ivory.
- Invited:* 18th International Symposium on Microscale Bioseparations in New Orleans, February 12-17, 2005, "Performance Bottlenecks in Field-Gradient Focusing: Symptoms and Solutions," C. F. Ivory and J. M. Burke.
- Plenary:* 27th International Symposium on Capillary Chromatography and Electrophoresis in Riva del Garda, Italy, May 31-June 4, 2004, "Dynamic Electrofocusing at Milligram Scales," C. F. Ivory.
- American Electrophoresis Society, San Francisco CA, Nov. 16-20, 2003, Session on "Emerging Technologies: Electrokinetic Separations," "Separation, Concentration and Manipulation of Proteins using a Computer-Controlled Electrode Array," C. F. Ivory. (*Invited Speaker*)
- Plenary:* 26th International Symposium on Capillary Chromatography and Electrophoresis in Las Vegas, May 18-22, 2003, "Electrofocusing Non-Amphoteric Ionic Solutes," C. F. Ivory.
- American Electrophoresis Society, Indianapolis IN, Nov. 3-6, 2002, Session on "Applications of Electrophoresis," "Extreme Electrofocusing," C. F. Ivory. (*Invited Speaker*)
- 23rd International Symposium on Chromatography, Olympia, London, U.K., Oct. 1-5, 2000, Session on "Capillary Electrophoresis and Electrochromatography," "Dynamic Electrofocusing," C. F. Ivory. (*Invited Speaker*)
- Gordon Conference, Colby-Sawyer College, So. New London, N.H., July 31– August 5, 1994, Separation and Purification, "Electrophoresis in Downstream Processing," C. F. Ivory. (*Invited Speaker*)
- Keystone Symposium on Molecular and Cellular Biology, in Santa Fe, New Mexico, Jan. 15–21, 1993, Symposium on Protein Purification and Biochemical Engineering, "Electrophoresis in Bench-top and Large Scale Processing," C. F. Ivory, *Plenary Speaker*.
- US/Germany Workshop on Downstream Processing of High-Value Proteins, Goslar, Germany, October 24-25, 1991. Preparative-Scale Electrophoresis. *Organizers:* D. I. C. Wang, H. Hustedt and K. H. Kroner.
- PACHEC '88 Meeting in Acapulco, Mexico, October 19-22, 1988, Symposium on Liquid Chromatography Applied in Biological Separations, "Electrochromatography," C. F. Ivory.
- National and International Symposia...*
- AICHE Annual Meeting, in Salt Lake City, UT, Nov 5-8, 2007, "Isoelectric Focusing In Contraction-Extraction Microchannels," J. Shim, P. Dutta, C. F. Ivory
- AICHE Annual Meeting, in Salt Lake City, UT, Nov 5-8, 2007, "Equilibrium Gradient-Focusing Methods," C. F. Ivory
- AICHE Annual Meeting, in Salt Lake City, UT, Nov 5-8, 2007, "Protein Separation By Isoelectric Focusing Coupled With Isotachophoresis On A Microfluidic Device." H. Cui, T. Z. Jubery, P. Dutta, C. F. Ivory

- AICHE Annual Meeting, in Salt Lake City, UT, Nov 5-8, 2007, "An Extended Theory of Adsorption in an Ion Exchange Resin," A-M. Hardin, C. F. Ivory
- AICHE Annual Meeting, in Salt Lake City, UT, Nov 5-8, 2007, "Modeling A Preparative-Scale Dynamic Field Gradient Focusing Instrument N. I. Tracy, C. F. Ivory
- AICHE Annual Meeting, in Salt Lake City, UT, Nov 5-8, 2007, "Design Considerations for Dynamic Field Gradient Focusing," J. M. Burke, C. F. Ivory
- AICHE Annual Meeting, in San Francisco, Nov 12-17, 2006, "Continuous Voltage Gradients and Their Application to True Moving Bed Electrophoresis," B. M. Thome, C. F. Ivory
- AICHE Annual Meeting, in San Francisco, Nov 12-17, 2006, "A Self-Contained Solid-State Micro-Valve for Electrokinetic Separations in a Networked Microfluidic Chip," H. Cui, N. H. A. Mamun, Z. Huang, P. Dutta, C. F. Ivory
- AICHE Annual Meeting, in San Francisco, Nov 12-17, 2006, "Simultaneous 2d Electrofocusing," C. F. Ivory
- AICHE Annual Meeting, in San Francisco, Nov 12-17, 2006, "Isotachophoresis: from Grams to Nanograms," C. F. Ivory, S. Harrison
- AICHE Annual Meeting, in San Francisco, Nov 12-17, 2006, "Performance Bottlenecks in Dynamic Field Gradient Focusing," J. M. Burke, C. F. Ivory
- AICHE Annual Meeting, in San Francisco, Nov 12-17, 2006, "Study of FET Flow Control and Electrostatic Response of Charged Molecules in Nanofluidic Channels," Y-J. Oh, D. N. Petsev, C. F. Ivory, C-H. Chung, S. R. J. Brueck, G. P. Lopez, S. M. Han
- AICHE Annual Meeting, in San Francisco, Nov 12-17, 2006, "The Effect of Buffer Salt Species and Concentration on the Internal pH of a Strong Anion Exchange Resin," A-M. Hardin, C. F. Ivory
- AICHE Annual Meeting, in San Francisco, Nov 12-17, 2006, "Preparative-Scale Dynamic Field Gradient Focusing: Proof of Concept," N. I. Tracy, C. F. Ivory
- AICHE Annual Meeting, in San Francisco, Nov 12-17, 2006, "Two Dimensional Simulation of Nonlinear Electrophoresis of Proteins and Experimental Demonstration in a Microfluidic Chip," H. Cui, N. H. A. Mamun, P. Dutta, and C. F. Ivory
- CE Pharm Annual Meeting in Jersey City NJ, October 2-7, 2006, "Toward an N-Dimensional Separations Chip," C. F. Ivory.
- ACS National Meeting in San Francisco, Sept. 10-18, 2006, Symposium on Downstream Processing: Advances in Chromatographic Separations, "Internal pH shift in protein ion exchange," A-M. Hardin and C. F. Ivory.
- ACS National Meeting in San Francisco, Sept. 10-18, 2006, Symposium on Downstream Processing: Alternatives to Chromatographic Separations, "Multi-dimensional electrofocusing," H. Cui, P. Dutta and C. F. Ivory.
- ACS National Meeting in San Diego, March 13-18, 2005, Symposium on Systems Biotechnology: Developments and Applications, "Multi-stage isoelectric focusing in a polymeric microfluidic chip," H. Cui and C. F. Ivory.
- ACS National Meeting in Anaheim, March 28-April 1, 2004, Symposium on High-Resolution Purification and Chromatography, "Role of Interior Electrical Potentials in Ion Exchange," C. F. Ivory.
- ACS National Meeting in Anaheim, March 28-April 1, 2004, Symposium on High-Resolution Purification and Chromatography, "True moving-bed electrophoresis: Increasing the scale of binary enantiomer separations by using RO to reduce solvent volumetric flows," B. Thome and C. F. Ivory.
- ASME IMECE Annual Meeting, in Washington DC, Nov 15-21, 2003 "High Resolution Separation of Proteins in a Polymeric Micro-Fluidic Chip." P. Dutta (*speaker*), K. Horiuchi, H. Cui and C. F. Ivory
- AICHE Annual Meeting, in San Francisco, Nov 16-22, 2003 "Modeling Dynamic Field Gradient Focusing," Noah Tracy and C. F. Ivory
- AICHE Annual Meeting, in San Francisco, Nov 16-22, 2003 "Debottlenecking of Electrofocusing for use in Proteomics." Jeff Burke and C. F. Ivory

- ACS National Meeting in Boston, August 18-23, 2002, Symposium on Advances in Bioseparations, "Enantiomer Separations by Continuous Electrophoresis," Brian Thome and C. F. Ivory.
- AICHE Annual Meeting in Reno, Nov. 4-8, 2001, Symposium on Advances in Electrophoresis I: Fundamentals, "Protein Fractionation using Automated Electric Field Gradient Focusing," Zheng Huang and C. F. Ivory.
- AICHE Annual Meeting in Reno, Nov. 4-8, 2001, Symposium on Advances in Electrophoresis II: Materials and Methods, "Advances in Electrofocusing," C. F. Ivory and Noah Tracy.
- AICHE Annual Meeting in Reno, Nov. 4-8, 2001, Symposium on Advances in Biotech. Processing, "Enantiomer Pair Processing by Continuous Electrophoresis," Brian Thome and C. F. Ivory.
- ACS National Meeting in San Diego, April 1-5, 2001, Symposium on Biological Separations -Theory and Practice Symposium, "Enantiomer Separations by Continuous Electrophoresis," C. F. Ivory.
- ACS National Meeting in San Francisco, March 26-30, 2000, Symposium on Bioseparations, "Preparative Isoelectric Focusing at High Voltages," C. F. Ivory.
- ACS National Meeting in Anaheim, March 21-25, 1999, Symposium on Bioseparations, "Electrophoretic Focusing without Ampholytes," Z. Huang and C. F. Ivory.
- ACS National Meeting in San Diego, March 13-18, 1994, Symposium on Preparative Bioseparations, "Electrophoretic Focusing without Ampholytes," C. F. Ivory, W. S. Koegler, and W. A. Gobie.
- ACS National Meeting in San Diego, March 13-18, 1994, Symposium on Electrophoretic Bioseparations, "Electric Field-Gradient Focusing," C. F. Ivory, W. S. Koegler, R. D. Greenlee and V. Surdigio.
- AICHE Annual Meeting in Miami, Nov. 1-6, 1992, Transport Phenomena in Bioseparations-I, "High Performance Electrophoresis," C. F. Ivory, W. Koegler and W. A. Gobie.
- Third International Symposium on Field-Flow Fractionation in Park City, Utah, October 3-4, 1992, "A Hybrid Rotor for Continuous Bioprocessing" C. F. Ivory, M. Gilmartin, W. A. Gobie, C. A. McDonald and R. L. Zollars.
- ACS National Meeting in San Francisco, April 5-9, 1992, Symposium on Preparative Bioseparations, "Electro-Ultrafiltration," C. F. Ivory, and W. A. Gobie.
- AICHE Annual Meeting in Los Angeles, Nov. 17-22, 1991, Symposium on Downstream Processing-II, "A New Apparatus for Free-Fluid Electrophoresis," W. A. Gobie and C. F. Ivory.
- AICHE Annual Meeting in Los Angeles, Nov. 17-22, 1991, Symposium on Transport Phenomena in Bioseparations-II, "Electrically Driven Ultrafiltration," W. A. Gobie and C. F. Ivory.
- ACS National Meeting in Boston, April 22-27, 1990, Symposium on Advances in Chromatography, "Continuous Centrifugal Field-Flow Fractionation," C. F. Ivory, R. L. Zollars and C. A. McDonald.
- ACS National Meeting in Boston, April 22-27, 1990, Symposium on Chromatography and Separation Science Emphasizing Biological Separations. IV Preparative and Large-Scale Electrophoresis, "Free-Flow Zone Electrophoresis in Downstream Processing," C. F. Ivory and W. A. Gobie.
- ACS National Meeting in Boston, April 22-27, 1990, Symposium on Chromatography and Separation Science Emphasizing Biological Separations. V. Electrochromatography, "Counteracting Chromatographic Electrophoresis (CACE)," W. A. Gobie and C. F. Ivory.
- ASME Winter Annual Meeting in San Francisco, Dec. 11 - 15, 1989, Symposium on Fluid Dynamics: Bioprocess Engineering, "Zone Electrophoresis in Downstream Processing," C. F. Ivory and W. A. Gobie.
- AICHE Annual Meeting in San Francisco, Nov. 5-10, 1989, Symposium on Separation of Bioactive Compounds, "Mathematical Models for Gel Permeation Chromatography and Gel Electrochromatography," C. F. Ivory and T. Adhi.
- AICHE Annual Meeting in San Francisco, Nov. 5-10, 1989, Symposium on Concentration from Dilute Solution, "Countercurrent Electrochromatography," C. F. Ivory and W. A. Gobie.
- ACS National Meeting in Miami, September 11-15, 1989, Symposium on New Advances in Protein Purification, "Analytical, Preparative and Large-Scale Zone Electrophoresis," C. F. Ivory and W. A. Gobie.

- AICHE Annual Meeting in Washington, D.C., Nov. 27 - Dec. 2, 1988, Symposium on Transport Processes in Bioseparation Systems, "Electrochromatography," C. F. Ivory and W. A. Gobie.
- WEST '88 Meeting in Seattle, Washington, October 17-18, 1988, Symposium on Biotechnology, "Continuous Purification with Electrical and Centrifugal Fields," C. F. Ivory.
- ACS National Meeting in Toronto, June 5-11, 1988, Symposium on Large-Scale Separations, "A State-of-the-Art Review of Electrophoresis in Downstream Processing," C. F. Ivory.
- ACS National Meeting in Toronto, June 5-11, 1988, Symposium on Novel Bioseparations, "Kinetic and Electrostatic Enhancement of Facilitated Transport of Biomolecules," L. A. Dall-Bauman and C. F. Ivory.
- AICHE Annual Meeting in New York, November 15-20, 1987, Symposium on Recent Advances in Separation Science-I, "Affinity-Mediated Protein Transport," L. A. Dall-Bauman and C. F. Ivory.
- NAMS First Annual North American Meeting in Cincinnati, June 3-5, 1987, "Kinetic and Electrostatic Enhancement of Facilitated Transport of Biomolecules" L. A. Dall-Bauman and C. F. Ivory.
- AICHE Annual Meeting in New York, November 15-20, 1987, Symposium on Recent Advances in Separation Techniques, "Continuous Counteracting Chromatographic Electrophoresis," C. F. Ivory and W. A. Gobie.
- AICHE Annual Meeting in New York, November 15-20, 1987, Symposium on Protein and Peptide Purification: New Engineering Approaches, "Recycle Continuous Flow Electrophoresis: Theory and Experiment," W. A. Gobie and C. F. Ivory.
- AICHE Annual Meeting in New York, November 15-20, 1987, Symposium on Fundamental Research in Heat and Mass Transfer, "Pattern Formation in Conductive Films," R. S. Turk and C. F. Ivory.
- AICHE Annual Meeting in Miami, November 2-10, 1986, Symposium on Recent Advances in Separation Science-I, "Magnetic Stabilization of the Continuous Flow Electrophoresis Device," C. F. Ivory, J. B. Beckwith, W. A. Gobie, R. Hergenrother and M. Malec.
- ACS National Meeting in Anaheim, Sept. 7-12, 1986, Symposium on Advances in Biological Separations Technology, "A Mathematical Model of the Annular Continuous Flow Electrophoresis Device," C. F. Ivory and J. B. Beckwith.
- AICHE Annual Meeting in Chicago, November 10-14, 1985, Symposium on Membrane Separations, "Coupling of Charge and Mass Fluxes in Facilitated Transport Membranes for Gas Separations," C. F. Ivory, P. M. Gallagher and A. L. Athayde.
- ACS National Meeting in Chicago, Sept. 8-13, 1985, Symposium on Recovery of Fermentation Products, Recent Advances and Mathematical Models, "High Resolution, High Yield Continuous Flow Electrophoresis," W. A. Gobie and C. F. Ivory.
- AICHE Annual Meeting in Chicago, November 10-14, 1985, Symposium on Fundamental Research in Heat and Mass Transfer, "Diffusion-Reaction Problems with Partial Reaction Equilibrium: Solution by Composite Flux Technique," P. M. Gallagher, A. L. Athayde and C. F. Ivory.
- ACS National Meeting in Chicago, Sept. 8-13, 1985, Symposium on Recent advances in Membrane Separation Science, "The Effect of AC Electric Fields on Carrier-Mediated Transport," A. L. Athayde and C. F. Ivory.
- AICHE Annual Meeting in San Francisco, November 25-30, 1984, Symposium on Recent Advances in Biotechnology, "High Resolution Free-Flow Electrophoresis," W. A. Gobie, J. B. Beckwith and C. F. Ivory.
- AICHE Annual Meeting in Anaheim, California, May 20-23, 1984, Symposium on Recent Developments in Separation Technology, "The Effect of Electric Fields on Facilitated Transport," A. L. Athayde and C. F. Ivory.
- Electrophoresis '83 Meeting in Tokyo, Japan, May 9-12, 1983, Sponsored by the Electrophoresis Society, Inc., "Scale-Up of the Free Flow Electrophoresis Device," C. F. Ivory.

AICHE Annual Meeting in Los Angeles, November 14-18, 1982, Symposium on Recent Advances in Membrane Research, “Electrically Forced Facilitation in Carrier-Mediated Membrane Transport,” C. F. Ivory.

AICHE Annual Meeting in San Francisco, November 25-29, 1979, Symposium on Fundamental Research in Heat and Mass Transfer, “Measurement of Rate Coefficients in Slurries of Porous Spheres,” C. F. Ivory.

Posters...

ACS National Meeting in Anaheim, March 28-April 1, 2004, Analytical Chemistry “Isoelectric focusing in a polymeric micro-fluidic chip,” Huanchun Cui and C. F. Ivory.

AICHE Annual Meeting, in San Francisco, Nov 16-22, 2003 “Modeling Dynamic Field Gradient Focusing,” Noah Tracy and C. F. Ivory

AICHE Annual Meeting, in San Francisco, Nov 16-22, 2003 “Debottlenecking of Electrofocusing for use in Proteomics,” Jeff Burke and C. F. Ivory

AICHE Annual Meeting in Reno, Nov. 4-8, 2001, Poster Session: Electrophoresis Society and Awards Session, “Isoelectric Focusing using a Defined Buffer,” Noah Tracy and C. F. Ivory.

Recovery of Biological Products X in Cancún, Mexico, June 3-8, 2001, "Separation of Stereoisomers by Continuous Flow Electrophoresis," C. F. Ivory and B. Thome.

ACS National Meeting in San Diego, April 1-5, 2001, Poster Session, “Electronically-Controlled Electrofocusing,” Z. Huang and C. F. Ivory.

HPLC2000 in Seattle, June 23-30, 2000, Poster Session, “Protein Purification using a Digitally-Controlled Electric Field Gradient,” Z. Huang and C. F. Ivory.

ACS National Meeting in San Francisco, March 26-30, 2000, Poster Session, “Digitally Controlled Electrofocusing,” Z. Huang and C. F. Ivory.

ACS National Meeting in San Francisco, March 26-30, 2000, Poster Session, “Preparative Separation of Enantiomers by Free-Flow Electrophoresis,” B. Thome and C. F. Ivory.

Recovery of Biological Products IX in Whistler, British Columbia, Canada, May 21-25, 1999, "Dynamic Electrofocusing of Proteins," Z. Huang and C. F. Ivory.

The Whitaker Foundation in Snowbird, Utah, August 16-18, 1991, Biomedical Engineering Research Conference, “Continuous Centrifugal Field-Flow Fractionation (Poster).”

HPCE '90 in San Francisco, January 29, 1990, Second International Symposium on High Performance Capillary Electrophoresis, “Temperatures in Capillary Electrophoresis (Poster),” W. A. Gobie and C. F. Ivory.

ACS National Meeting in New York, April 13-18, 1986, First International Conference on Separations Science and Technology, “Kinetic Enhancement of Carrier-Mediated Transport: The Effect of Immobilized pH Gradients on Protein Flux (Poster),” L. Dall and C. F. Ivory.

Second Annual Congress on Automation, Scale-Up and the Economics of Biological Process Engineering, February 7-8, 1985, “Large Scale Free Flow Electrophoresis (Poster),” C. F. Ivory.

7b. CHAIRED SESSIONS AND SYMPOSIA.

32th International Symposium on Capillary Chromatography and Electrophoresis in Riva del Garda, May 26-30, 2008, Session on “Multi-Fluid Techniques,” C. F. Ivory.

CE Pharm Annual Meeting in Jersey City NJ, October 2-7, 2006, AES Symposium on "Fundamental and Advanced Electrophoresis," B. Fathollahi (Caliper Life Sciences) and C. F. Ivory.

ACS National Meeting in San Diego CA, March 13-18, 2005, Symposium on “Combinatorial and High-Throughput Analysis of Biological Systems,” Vadim Klyushnichenko (Epic Therapeutics), Jeff Varner (Genencor) and C. F. Ivory.

- ACS National Meeting in Anaheim CA, March 28-April 1, 2004, Symposium on “High-Throughput Screening/Genomics and Proteomics,” Huimin Zhao (U. Illinois), Jeff Varner (Genencor) and C. F. Ivory.
- ACS National Meeting in Boston, August 18-23, 2002, Symposium on “Generation and Analysis of Product Variants,” Fred Jacobsen (Genentec), Dana Anderson (Genentec) and C. F. Ivory.
- Recovery of Biological Products VIII. Tucson, Arizona, October 20-25, 1996, Session on *Advances in Electrokinetic Separations*, Co-sponsored by the American Chemical Society, Division of Biochemical Technology and The Engineering Foundation. *Organizers*: C. F. Ivory, WSU and Pier-Giorgio Righetti, University di Milano.
- ACS Division of Analytical Chemistry. San Diego, March 13-19, 1994, Symposium on *Critical Issues in Downstream Processing*, Co-sponsored by the Analytical Chemistry Division and the Biotechnology Secretariat. *Organizers*: C. F. Ivory, WSU and Bruce Compton, AutoImmune, Inc., Lexington, MA.
- ACS Division of Analytical Chemistry. San Francisco, April 5-10, 1992, Symposium on Preparative Bioseparations, Co-sponsored by the Analytical Chemistry and the Agricultural Chemistry Divisions. *Organizers*: C. F. Ivory, WSU and Jean Rivier, Salk Institute.
- AIChE Annual Meeting, Los Angeles, Nov. 17-22, Area 15c, “Electrokinetic Methods in Downstream Processing,” *Organizers*: C. F. Ivory, WSU and T. Scott, Oak Ridge Nat’l Lab.
- ACS Division of Industrial and Engineering Chemistry. Boston, April 22-27, 1990, Symposium on Analytical, Preparative and Large-Scale Electrophoresis, Co-sponsored by the Industrial and Engineering Chemistry Division and by the Analytical Chemistry Division. *Organizers*: C. F. Ivory, WSU and A. G. Ewing, Pennsylvania State University.
- PACHEC ’88 Meeting in Acapulco, Mexico, October 19-22, 1988, Symposium on Liquid Chromatography in Biological Separations. Sponsored by the Instituto Mexicano de Ingenieros Quimicos. *Organizer*: C. F. Ivory.
- ACS Division of Industrial and Engineering Chemistry. Anaheim, Sept. 7-12, 1985: *Advances in Biological Separations Technology*, Sponsored by the Industrial and Engineering Chemistry Division and Co-Sponsored by the Microbial and Biotechnology Division. *Organizer*: C. F. Ivory with James E. Rollings, Worcester Polytechnic Inst. and T. Alan Hatton, MIT.
- ACS Division of Industrial and Engineering Chemistry. Chicago, Sept. 8-13, 1985: *Recent Advances in Membrane Separation Science*, Sponsored by the Industrial and Engineering Chemistry Division and Co-Sponsored by the Microbial and Biotechnology Division. *Organizer*: C. F. Ivory with R. Larter, Dept. Chemistry, Purdue University, Indianapolis Campus.

7c. SHORT COURSES, WORKSHOPS AND TUTORIALS.

- Technical Advisory Board Workshop on Biomarker Discovery and Validation (Sponsored by the Canary Foundation; Organized by INTEL Corp.), Santa Clara CA, February 7-8, 2006
- Lecturer on *Electrophoresis: From microscale to macroscale*, “Advances in Electrophoretic Techniques in Environmental, Material, and Biotechnology: Fundamentals and Selected Applications,” November 2001, Reno, Nevada. Sponsored by the *AIChE and the Electrophoresis Society*. *Organizer*: Pedro Arce, Florida State University. *Staff*: Pedro Arce (FSU), Neil Ivory (WSU) and Nancy Stellwagon (Biochemistry, U. Iowa).
- Electro-Separations 2020, Arlington, VA, October 9-11, 1995. Sponsored by EPRI and NSF. *Organizer*: C. Byers (ORNL)
- Bioprocess Workshop, Seattle, Washington, October 19, 1989. *Biotechnology Needs and Assets in Washington State*. *Organizers*: C. F. Ivory and A. Maret.
- Lecturer on *Downstream Processing of Biological Material* in workshop entitled “Interfacing Fermentation with Recombinant DNA Technology,” Sheraton Hotel, August 9-10, 1986, San Francisco, Calif. Sponsored by the *Society of Industrial Microbiology*. *Organizer*: Rich Bailey,

Engenics Corporation, Menlo Park, Calif. *Staff*: Harvey Blanch (Berkeley), Neil Ivory (Notre Dame), Doug Munnecke (Genencor), Terry Papoutsakis (Rice), Carol Talkington (Engenics).

Tutorial entitled "Biological Separations," Chicago Marriott, Sept. 8, 1985, Chicago, Illinois. Sponsored by the Industrial and Engineering Chemistry Division of the American Chemical Society. *Organizer*: C. F. Ivory, Dept. Chemical Engineering, University of Notre Dame.

8. GRANTS AND SPONSORED PROGRAMS.

NSF, CBET- 0756823, "Collaborative Proposal: Nanoparticle Separations in Nanochannels Using Fluidic Field-Effect Transistors," 05/08-04/10. CF Ivory at WSU: \$140,000; S. Han at UNM: \$160,000

Washington State **Life Science Discovery Fund**, "Rapid Fingerprinting of Cardiac Biomarkers," 01/07-12/10. \$750,000

Pfizer Corporation, "Integrated Capillary Chromatography (ICC): Microfluidic Platform Technology," 01/07-12/08. \$121,000

NSF, CTS-0626471, "A Four-Dimensional (4D) Microchip for Proteomics," 08/06-07/08. \$200,000

NSF-NIRT, CTS-0404124, "Fundamental Understanding of Microfluidics for Advanced Bioseparation and Analysis" 08/04-07/09. \$1,000,000

Berlex Corporation, "Preparative Fractionation of Protein Isoforms," 11/03-6/04. \$104,000

NSF, CTS-0300802, "Integrated, Multistage Isoelectric Focusing on a PDMS Microchip" 6/03-6/06. \$280,000

NSF-REU, CTS-0300802, "Integrated, Multistage Isoelectric Focusing on a PDMS Microchip" 6/03-6/06. \$6,000

NSF, BIO-0096745, "Micropreparative Purification of Proteins by Dynamic Focusing," 03/01-02/04. \$344,733

NSF-REU, BIO-0096745, "Micropreparative Purification of Proteins by Dynamic Focusing," 03/01-02/04. \$12,000

NSF, BES-9970972, "Preparative Isolation and Recovery of Protein Isoforms via Electronic Focusing," 10/99-9/02. \$170,089

NSF-REU, BES-9970972, "Preparative Isolation and Recovery of Protein Isoforms via Electronic Focusing," 10/99-9/02. \$10,000; \$12,000

NSF, BES-9417239, "Focusing of Proteins in a Multi-Chamber Electro-Ultrafiltration (MEUF) Column," 7/95-6/97. \$149,760

NSF-REU, BES-9417239, "Focusing of Proteins in a Multi-Chamber Electro-Ultrafiltration (MEUF) Column," 7/95-6/97. \$10,000

NSF, CTS-9406702, "A Hybrid Rotor for Continuous Field-Flow Fractionation," 5/95-4/97. \$85,173

NSF-REU, CTS-9406702, "A Hybrid Rotor for Continuous Field-Flow Fractionation," 5/95-4/97. \$10,000

Battelle PNL, 206028-A-L2, "Membrane Separation and Recovery of Colorants," 4/94-4/95. \$20,690

Zymogenetics, "Construction of a Preparative Membrane Electrophoresis Device," 5/94-4/95. \$5,000

NSF, DIR-9014793, "Preparative High-Performance Capillary Electrophoresis," 5/90-4/91. \$34,629

The Whitaker Foundation, "Continuous Centrifugal Field-Flow Fractionation," 3/89-2/92. \$178,000

NSF, CBT-8813864, "Large-Scale Zone Electrophoresis with Solute Recycle," 11/88-10/90. \$120,161

WTC (Wash. Technol. Ctr.), "Free-Fluid Electrophoresis Applied in Bioprocessing," 7/89-12/89. \$20,000

PPG, "Preparative High Performance Capillary Zone Electrophoresis Using Colligated Hollow Fibers," 10/88-3/89. \$26,940

WTC (Wash. Technol. Ctr.), "Continuous, Free-Fluid Electrophoresis Applied in Bioprocessing," 7/88-7/89. \$20,000

NSF, CPE-8414218, "Construction of a Modified Continuous Flow Electrophoresis Device with Solute Recycle," 6/84-5/87. \$138,869

CE (Combustion Engineering, Inc.), "The Beneficiation and Dewatering of Kaolin in an Electrostatic Field," 3/85-2/86. \$10,000

- NSF, CPE-8211483, "Stability Analysis of a Proposed Continuous Flow Electrophoresis Device," 10/82-3/85. \$74,804
- NSF, CPE-8105154, (Research Initiation) "Internal Staging of the Continuous Flow Electrophoresis Device with Solute Recycle," 3/81-9/83. \$48,000
- EPA, IWERC Project 8003/4, "Process Modifications/New and Innovative Industrial Processes for Minimization of Environmental Pollutants," 11/80-1/82. \$31,419

Training Grants¹

- NIGMS (NIH), "Predoctoral Research Training Grant in Biotechnology," 9/04-8/09. \$923,426
- NIGMS (NIH), "Predoctoral Research Training Grant in Biotechnology," 9/99-8/04. \$923,426
- NIGMS (NIH), "Predoctoral Research Training Grant in Biotechnology," 9/94-8/99. \$824,707
- NIGMS (NIH), "Predoctoral Research Training Grant in Biotechnology," 9/89-8/94. \$476,846

9. REFERENCES. On request.

10. PUBLICATIONS IN REFEREED JOURNALS.

- Leatzow, D. and C. F. Ivory, "Preparative-scale Isoelectric Focusing of Protein Isoforms in a Vortex-Stabilized Electrophoresis Device," *Final draft*
- Burke, J.M. and C. F. Ivory, "Characterization of voltage degradation in dynamic field gradient focusing," *Electrophoresis*, **29**(5):1013-25 (2008)
- Shim J., P. Dutta and C. F. Ivory, "Effects of ampholyte concentration on protein behavior in on-chip isoelectric focusing," *Electrophoresis*, **29**(5):1026-35 (2008).
- Shim, J. and Dutta, P., and Ivory, C. F., "Effects of Dissociation Constants on protein Separation in on-Chip Isoelectric Focusing," *Journal of Nanoscience and Nanotechnology* (2008) *In Press*
- Tracy, N.I., Z. Huang and C. F. Ivory, "Design and construction of a preparative-scale dynamic field gradient focusing apparatus," *Biotechnol Prog.*, **24**(2):444-51 (2008).
- Oh Y.J., T. C. Gamble, D. Leonhardt, C. H. Chung, S. R. Brueck, C. F. Ivory, G. P. Lopez, D. N. Petsev, and S. M. Han, "Monitoring FET flow control and wall adsorption of charged fluorescent dye molecules in nanochannels integrated into a multiple internal reflection infrared waveguide," *Lab Chip* **8**(2):251-8 (2008).
- Tracy N. I. and C. F. Ivory, "Assessing the scalability of dynamic field gradient focusing by linear modeling," *J Sep Sci.* **31**(2):341-52 (2008).
- Tuñón, P. G., Wang, Y., Myers, P., Bartle, K.D., Bowhill, L., Ivory, C.F., Ansell, R.J., "Electrophoretic field gradient focusing: An investigation of the experimental parameters," *Electrophoresis*, **29**(2):457-65 (2008)
- Horiuchi K., P. Dutta and C. F. Ivory, "Electroosmosis with Step Changes in Zeta Potential in Microchannel Electrophoresis," *AIChE J.*, **53**(10) 2521-2533 (2007).
- Harrison, S. and C. F. Ivory, "An Analytical Expression which Predicts the Location of Stationary, Steady-State Zone Positions in Isotachopheresis," *J. Separation Science*, **30**(18):3255-61 (2007).
- Shim, J., P. Dutta, and C. F. Ivory, "Finite-volume methods for isotachopheretic separation in microchannels." *Numerical Heat Transfer Part a-Applications* **52**(5): 441-461 (2007).
- Thome, B. and C. F. Ivory, "True moving bed electrophoresis using stepped electric field gradients," *Electrophoresis*, **28**(10):1477-1487 (2007).
- Cui, H., N. H., P. Dutta and C. F. Ivory, "Isotachopheresis of Proteins in a Microfluidic chip with T-Junctions: Experiment and 2D Simulation," *Electrophoresis*, (7):1138-45 (2007).

¹ There are 21 training faculty from various life-science departments, 3 from chemical engineering. Faculty duties include instruction in core courses, supervision of lab rotations and graduate research, interaction with industrial sponsors (graduate student cooperative appointments) and participation in the seminar series.

- Ivory, C. F., Several New Electrofocusing Techniques, *Electrophoresis*, (1-2):15-25 (2007).
- Cui, H., N. H., Z. Huang, P. Dutta and C. F. Ivory, "Dynamic Electric Valving for Electrokinetic Separation in a Networked Microfluidic Chip," *Anal. Chem.*, 79(4):1456-65 (2007).
- Thome, B. and C. F. Ivory, "Increasing the Scale of True Moving Bed electrophoretic separations using filtration to reduce solvent volumetric flows between sections II and III," *J. Chromatogr.* 1138(1-2) 291-300 (2007).
- Shim J-S., P. Dutta and C. F. Ivory, "Modeling and Simulation of Isoelectric Focusing in Two-Dimensional Geometries," *Electrophoresis*. 28(4):572-86 (2007)
- Hardin, A. M. and C. F. Ivory, "Buffer salt effect on pH in the interior of an anion exchange resin," *J. Colloid Interface Sci.*, 302(2) 560-7 (2006).
- Thome, B. and C. F. Ivory, "Continuous Voltage Gradients and Their Application to True Moving Bed Electrophoresis," *J. Chromatogr.* 1129(1) 119-28 (2006).
- Bottenus D., and C. F. Ivory, "Effects of Increased Voltage on Resolution in Isoelectric Focusing of Myoglobin Variants," *Electrophoresis*. 27(17) 3325-31 (2006).
- Bottenus, D. and C. F. Ivory, "On-Line Optical Fiber Detection in a Preparative Vortex-Stabilized Free-Flow Electrofocusing Apparatus," *Biotechnology Progress* 22(3) 842-846 (2006).
- Cui, H., K. Horiuchi, P. Dutta and C. F. Ivory, "Multistage isoelectric focusing in a Poly(dimethylsiloxane) microfluidic chip," *Analytical Chemistry* 77(24) 7878-86 (2005).
- Petsev, D. N., G. P. Lopez, C. F. Ivory, S. S. Sibbett, "Microchip Protein Separation by Electric Field Gradient Focusing," *Lab-on-a-Chip*, 5(6) 587-597 (2005).
- Cui, H., K. Horiuchi, P. Dutta and C. F. Ivory, "Isoelectric focusing in a Poly(dimethylsiloxane) microfluidic chip," *Analytical Chemistry* 77(5):1303-9 (2005).
- Ivory, C. F., "Preparative Free-Flow Electrofocusing in a Vortex-Stabilized Annulus," *Electrophoresis*, 25 360-374 (2004).
- Ross, D., C. F. Ivory, L. E. Locascio, and K. E. Van Cott, "Peak Compression and Resolution for Electrophoretic Separations in Diverging Microchannels," *Electrophoresis*, 25(21-22) 3694-3704 (2004).
- Tracy, N. and C. F. Ivory, "Modeling Two-Component Isoelectric Focusing Buffers in a Vortex-Stabilized Electrophoresis Apparatus," *Biotechnol. Progress* 20(1) 193-199 (2004).
- Tracy, N. and C. F. Ivory, "Preparative Focusing of Proteins Using Binary Buffers in a Vortex-Stabilized, Free-Flow Apparatus," *Electrophoresis* 25(12) 1748-1757 (2004).
- Ista, L. K., G. P. Lopez, C. F. Ivory, M. J. Ortiz, T. A. Schifani, C. D. Schwappach, and S. S. Sibbett, "Microchip Countercurrent Electro-separation," *Lab-on-a-Chip*, 3(4) 266-272 (2003).
- Thome, B. and C. F. Ivory, "Development of a Segmented Model for a Continuous Electrophoretic Moving Bed Enantiomer Separation," *Biotechnol. Progr.*, 19(6) 1703-12 (2003)
- Thome, B. and C. F. Ivory, "Continuous Fractionation Of Enantiomer Pairs In Free Solution Using An Electrophoretic Analog Of Simulated Moving Bed Chromatography, " *J. Chromatography A* 953 263-277 (2002).
- C. F. Ivory, "Temperature Profiles in the Thermal Entrance Region of Electrically-Heated, Laminar Flow in a Slit, *Chemical Engineering Science*, 55 601-613 (2000).
- C. F. Ivory, A Brief Review of Alternative Electrofocusing Techniques, *Separation Science and Technology*, 35(11) 1777-1793 (2000)
- Huang, Z. and C. F. Ivory, "Dynamic Field-Gradient Focusing," *Analytical Chem.*, 71(8) 1628 (1999).
- Greenlee, R. L. and C. F. Ivory, "Focusing Proteins in a Conductivity Gradient," *Biotechnology Progress*, 14(2) 300-309 (1998).
- Koegler, W. S. and C. F. Ivory, "Field-Gradient Focusing: A Novel Method for Protein Separation," *Biotechnology Progress*, 12(6) 822-836 (1996).
- Koegler, W. S. and C. F. Ivory, "Focusing Proteins in an Electric Field Gradient," *J. Chromatogr. A*, 726 229-236 (1996).

- C. F. Ivory, M. Gilmartin, C. McDonald, Gobie, W. A. and R. L. Zollars, "A Hybrid Rotor for Continuous Bioprocessing," *Biotechnology Progress*, **11**(1) 21-32 (1995).
- C. F. Ivory, "The Development of Recycle Zone Electrophoresis," *Electrophoresis*, **11** 919 (1990).
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- C. F. Ivory, W. A. Gobie and T. P. Adhi, "Analytical, Preparative and Large-Scale Zone Electrophoresis," in *Protein Purification*, Ladisch, M. R., R. C. Willson, C-d. C. Painton and S. E. Builder, Eds., ACS Symposium Series 427, American Chemical Society, Washington, D. C. 1990.
- Dall-Bauman, L. and C. F. Ivory, "Protein Separation via Affinity-Mediated Transport," in *Downstream Processing and Bioseparation*, Hamel, J-F. P., J. B. Hunter and S. K. Sikdar, Eds., ACS Symposium Series 419, American Chemical Society, Washington, D. C. 1990.
- Gobie, W. A. and C. F. Ivory, "Continuous Counter-Acting Chromatographic Electrophoresis," *Biotechnology Progress*, **6**(1) 21 (1990).
- C. F. Ivory, "The Prospects for Large-Scale Electrophoresis," *Separation Science and Technology: Special Issue on Bioseparations*, C. F. Ivory, ed., **23**(8-9) 875, Marcel Dekker, Inc., New York (1988).
- Gobie, W. A. and C. F. Ivory, "Recycle Continuous Flow Electrophoresis: Zero Diffusion Theory," *AIChE J.*, **34**(4) 474 (1988).
- Beckwith, J. B. and C. F. Ivory, "The Influence of Diffusion on Elution Profiles in the Philpot-Harwell Electrophoretic Separator," *Chem. Engng. Commun.*, **54**(1-6) 301 (1987).
- Ivory, C. F., W. A. Gobie, J. B. Beckwith, R. Hergenrother and M. Malec, "Electromagnetic Stabilization of Weakly Conducting Fluids," *Science*, **238**(4823) 58 (1987).
- Gallagher, P. M. and C. F. Ivory, "Electrochemical Coupling in Carrier-Mediated Membrane Transport," *J. Membrane Science*, **29** 49 (1986).
- Gobie, W. A. and C. F. Ivory, "High Resolution, High Yield Continuous Flow Electrophoresis," *Separation, Recovery and Purification in Biotechnology*, J. Asenjo and J. Hong, eds., ACS Symposium Series No. 314, Amer. Chem. Soc., New York 1986.
- Gallagher, P. M., A. L. Athayde and C. F. Ivory, "The Combined Flux Technique for Diffusion Reaction Problems in Partial Equilibrium: Application to the Facilitated Transport of Carbon Dioxide in Aqueous Bicarbonate Solutions," *Chem. Engng. Science*, **41**(3) 567 (1986).
- Athayde, A. L. and C. F. Ivory, "Electrical Pumping in Carrier-Mediated Membrane Transport," *J. Membrane Science*, **24**(3) 309 (1985).
- Athayde, A. L. and C. F. Ivory, "The Effect of AC Electric Fields on Carrier-Mediated Membrane Transport," *J. Membrane Science*, **23**(2) 241 (1985).
- Gobie, W. A., J. B. Beckwith and C. F. Ivory, "High Resolution Continuous Flow Electrophoresis," *Biotechnology Progress*, **1**(1) 60 (1985).
- Ivory, C. F., "Transient Electrophoresis of a Dielectric Sphere," *J. Colloid Interface Science*, **100**(1) 239 (1984).
- Turk, R. and C. F. Ivory, "Temperature Profiles in Plane Poiseuille Flow with Electrical Heat Generation," *Chem. Engng. Science*, **39**(5) 851 (1984).
- Ivory, C. F., "Transient Electroosmosis: The Momentum Transfer Coefficient," *J. Colloid Interface Science*, **96**(1) 119 (1983).
- Ivory, C. F., "Continuous Flow Electrophoresis. The Crescent Phenomenon Revisited-II. Nonisothermal Effects," *Electrophoresis*, **2** 31 (1981).
- Ivory, C. F., "Derivation of the Particle Size Weighting Factor in the Measurement of Rate Coefficients in Slurry Reactors," *Chem. Engng. Science*, **36** 1035 (1981).
- Ivory, C. F. and R. L. Bratzler, "The Measurement of Rate Coefficients in Slurry Reactors," *Chem. Engng. Commun.*, **10** 293 (1981).

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- Ivory, C. F., "Continuous Flow Electrophoresis. The Crescent Phenomenon Revisited-I. Isothermal Effects," *J. Chromatogr.*, **195** 165 (1980).

Proceedings

- Dutta, P., K. Horiuchi, H. Cui and C. F. Ivory Proceedings of the IMECE'04, "Band Deformation at a T-Junction While Electrofocusing in a Dog-Leg Microchannel."
- Dutta, P., K. Horiuchi, H. Cui and C. F. Ivory Proceedings of the IMECE'03, "High Resolution Separation of Proteins in a Polymeric Micro-Fluidic Chip."
- C. F. Ivory and W. A. Gobie, "Zone Electrophoresis in Downstream Processing," *Proceedings of the American Society of Mechanical Engineers*, San Francisco, 1989.
- C. F. Ivory, W. Gobie and R. Turk, "Scale-Up of the Free-Flow Electrophoresis Device," in *Electrophoresis '83*, the Proceedings of the Electrophoresis Society Meeting in Tokyo, Japan, May 9-12, 1983.

11. OTHER PUBLICATIONS.

Book Chapters

- Chapter 13:** "Alternative Electrofocusing Techniques," Ivory, C. F., in the *Handbook of Isoelectric Focusing and Proteomics*, S. Ahuja and D. Garfin, eds., CRC Press 2005
- Chapter 9:** "Electrophoresis of Proteins: Batch and Continuous Methods, in *The Encyclopedia of Bioprocess Technology: Fermentation, Biocatalysis and Bioseparations*, M. Flickinger and S. Drew, eds., John Wiley and Sons, Inc. 1999
- Chapter 16:** "Electrically Driven Separations Processes." Analytical and Preparative Methods, in *Downstream Processing in Biotechnology*, J. Asenjo, ed., Marcel Dekker, Inc., New York 1990.

Journal Editorialship (Single Issue)

- Separation Science and Technology*, Special Issue on Bioseparations, C. F. Ivory, Special Issue Editor, Marcel Dekker, Inc., New York 1988.

Patents and Patent Applications

- Patent Disclosure for "A four dimensional microchip platform with highly-parallel separation dimensions in a two-dimensional spatial configuration," C. F. Ivory, P. Dutta, September 2005.
- Patent Disclosure for "Two-dimensional, simultaneous electrofocusing in a chromatographic monolith with biorthogonal focusing gradients grafted into the stationary phase," C. F. Ivory, P. Dutta and F. Svec, November 2005.
- Patent Disclosure for "Size-exclusion electrofocusing in a chromatographic monolith with a fixed spatial SEC parameter gradient grafted into the stationary phase," C. F. Ivory, P. Dutta and F. Svec, November 2005.
- Patent Disclosure for "Isoelectric focusing in a chromatographic monolith with a fixed spatial pH gradient grafted into the stationary phase," C. F. Ivory, P. Dutta and F. Svec, November 2005.
- Patent Disclosure for "Conductivity gradient focusing in a chromatographic monolith with a fixed, spatial charge gradient grafted into the stationary phase," C. F. Ivory, P. Dutta and F. Svec, November 2005.
- Patent Disclosure for "Velocity Gradient Focusing," C. F. Ivory, February 2004. Provisional Patent Application Filed May 2004.
- US Patent Application "Preparative Dynamic Field-Gradient Focusing" C. F. Ivory, N. Tracy, Filed February 2004.
- US Patent Application N°60/446,287 "Dynamic Field Gradient Focusing (Continuation)," C. F. Ivory, Z. Huang and F. Scheutze, Filed Feb. 2003.

- US Patent N° 6,277,258 “Dynamic Field Gradient Focusing,” C. F. Ivory, Z. Huang and F. Scheutze, Filed June 1999, Issued, August. 2001.
- U.S. Patent N° 5,071,536 “High Resolution Continuous Flow Electrophoresis,” C. F. Ivory. Filed November 25, 1985; Issued December 10, 1991.
- U.S. Patent N° 5,200,050 “New Apparatus for Preparative Free-Fluid Electrophoresis,” C. F. Ivory and W. A. Gobie, Filed February 1991, Issued May 30, 1993.
- U. S. Patent N° 5,298,143 “*Electrophoretic Processing*”
Inventors: C. F. Ivory and W. A. Gobie. Issued March 29, 1994.
- Patent Disclosure for “Zone Electric Field Gradient Focusing,” W. A. Gobie and C. F. Ivory, May 1992. first Office Action, February 16, 1993.
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