

## STEPHEN L. MATSON

Dr. Stephen Matson is currently engaged in founding ConTechs Associates Inc., a not-for-profit entity that aims to team up senior engineering volunteers in the U.S. with engineering professors and students in developing countries for the purpose of performing project work with both educational and societal value. He is also principal of Arete Technologies, a consulting and contract research firm that specializes in membranes and membrane processes, bioseparations and biocatalysis, and intellectual property management. During his largely industrial career, Matson has innovated in several areas of separations and biotechnology; his professional interests currently include functional membranes as platforms for advanced chemical processing -- e.g., membrane reactors, affinity membranes, process intensification, and high-throughput DNA sequencing.

In 1984 Matson co-founded Sepracor Inc. to commercialize his earlier research in membrane reactors as applied to chiral separations. Sepracor, now a mid-cap specialty pharmaceutical firm focused on developing improved single-isomer and active-metabolite drugs (e.g., Lunesta<sup>®</sup>, Brovana<sup>®</sup>, Xopenex<sup>®</sup>, and Allegra<sup>®</sup>), currently has product sales in excess of \$1 billion/yr and employs 2,300 people. He has also played key roles in the start-up of a number of other technology companies (largely Sepracor spin-offs) in fields as diverse as combinatorial chemistry, chiral synthesis, biochromatography, and blood filtration. Previous industrial employment included ten years at GE's Research and Development Center and two years as director of research for Bend Research.

In 2008 Dr. Matson accepted a part-time position as Professor of the Practice with the Department of Chemical and Biological Engineering at Tufts University. Prior to that, he was employed for two years at Worcester Polytechnic Institute (WPI), where he held the James H. Manning Chair as Professor of Chemical Engineering and served as student advisor to WPI's Interdisciplinary and Global Systems Division.

He has authored 24 technical articles or book chapters and holds 25 issued U.S. patents. He has served as a director of the American Institute of Chemical Engineers and is a past president and director of the North American Membrane Society.

Dr. Matson has received the Professional Progress Award of the American Institute of Chemical Engineers in 1993 and is a Fellow of the American Institute for Medical and Biological Engineering. In 1995 he was inducted into the National Academy of Engineering. In 2008 he was designated one of "One Hundred Chemical Engineers of the Modern Era" by AIChE.

### **PROFESSIONAL EXPERIENCE**

#### **TUFTS UNIVERSITY, Medford, MA**

*Professor of the Practice, (2008-present)*

Part-time faculty position in the Dept. of Chemical & Biological Engineering.

**CONTECHS ASSOCIATES INC., Harvard, MA**

*Executive Director (2004-present)*

Founder of non-profit organization seeking to provide a platform for the recruitment, organization, and support of project teams assembled to work on chemical-engineering-related problems important to developing countries (e.g., Bolivia). ConTechs endeavors to catalyze the formation of project teams comprised of engineering students and their professors in developing countries, working in collaboration with engineering volunteers from the U.S.

**ARETE TECHNOLOGIES INC., Harvard, MA**

*Principal (1990-present)*

Consulting/R&D firm focused on synthetic membranes, chiral process technology, drug discovery, biomedical engineering, and intellectual property management.

**WORCESTER POLYTECHNIC INSTITUTE, Worcester, MA**

James H. Manning Professor of Chemical Engineering (2002-2003)

Adjunct Professor of Chemical Engineering (2001-2002)

**SEPRACOR INC., Marlborough, MA**

*Senior Consultant (1992-2002)*

*Vice President, Science and Technology (1991-1992)*

*Vice President, Research and Development (1984-1990)*

Co-founder and senior technology manager in start-up focused on development of bioactive membranes for enantioselective catalysis and protein purification. As inventor of the company's core technology, participated in all aspects of corporate development (e.g., company organization, business planning, financing, staffing, and execution of its R&D programs). Managed interdisciplinary R&D staff and interfaced with corporate clients, development partners, and academic collaborators. Board of Directors member through 1990. Most recent consulting activity focused largely on drug discovery technology and intellectual property.

**OTTER COAST AUTOMATION INC., Westborough, MA**

*President and CEO (1998-2001)*

Co-founder of now-defunct company established to develop and commercialize a proprietary reaction platform for semi-automated, solid-phase combinatorial chemistry.

**BEND RESEARCH INC., Bend, OR**

*Director of Research (1982-1984)*

General management responsibility for all R&D activity in this contract research firm. Specific duties included program planning, proposal writing, contract negotiation, project direction and staffing, and final approval of company proposals and reports. Participated in corporate fund-raising and in establishment of a manufacturing/marketing affiliate.

**GENERAL ELECTRIC R&D CENTER**, Schenectady, NY

*Staff Chemical Engineer (1973-1982)*

Research and development in membrane separations, biochemical processing, and mass transfer in polymer/solvent systems – e.g., ultrathin polymeric membranes for gas separations, facilitated-transport and Donnan dialysis membranes, microbial leaching, and polymer process technology.

**N.Y. STATE DEPT. OF ENVIRONMENTAL CONSERVATION**, Albany, NY

*Engineer, Research Unit (1971-1972)*

Development of heterogeneous catalysts for automotive emissions control.

**EDUCATION**

**University of Pennsylvania**, Philadelphia, PA

Ph.D. in Chemical Engineering, 1979; Dissertation: "Membrane Reactors"

**Cornell University**, Ithaca, NY

M.S. in Chemical Engineering, 1974

Thesis: "Kinetics of the Ruthenium-Catalyzed Reduction of NO by H<sub>2</sub>"

B.S. in Chemical Engineering, 1971

Senior Thesis: "The DC Electric Field Effect on Chemisorption of O<sub>2</sub> on NiO"

**Registered Professional Engineer, State of New York** (No. 059530-1)

**PROFESSIONAL AFFILIATIONS, HONORS, AND ACTIVITIES**

**Professional Societies:**

American Institute of Chemical Engineers (Past Director)

North American Membrane Society (Past President and Director)

American Association for the Advancement of Science

American Chemical Society

**Awards:**

National Academy of Engineering (inducted 1995)

Fellow, American Inst. for Medical and Biological Engineering (inducted 1997)

American Institute of Chemical Engineers

Named as one of "One Hundred Engineers of the Modern Era", 2008

Professional Progress Award, 1993

Outstanding Paper Award, LA National Meeting, 1997

Gary Leach Service Award, Planning Process Team, 1998

Gary Leach Service Award, Career Services Task Force, 1998

R&D 100 Award Winner, 1988 (Sepracor; membrane reactors)

R&D 100 Award Winner, 1984 (Bend Research; facilitated O<sub>2</sub> transport)

**Academic Affiliations:**

Tufts University, Dept. of Chemical & Biochemical Engineering  
Professor of the Practice, 2008-  
Industrial Advisory Board, 1999  
Worcester Polytechnic Institute, Dept. of Chemical Engineering  
Professor of Chemical Engineering (James H. Manning Chair), 2002-2003  
Adjunct Professor (PQP/IQP co-advisor), 2001-2002  
Cornell University, School of Chemical Engineering  
Advisory Council Member, 1994-2001  
Alumni Secondary School Committee, 1984-1985

**Boards of Directors and Scientific Advisory Boards:**

454 Corporation (Scientific Advisory Board), 2001-2006  
American Institute of Chemical Engineers, 1997-1999  
North American Membrane Society, 1994-1997  
Otter Coast Automation Inc., 1998-2001  
HemaSure Inc. (Scientific Advisory Board), 1994-1997  
SeptraChem Inc., 1995-1996  
Sepracor Inc., 1984-1990  
Bend Research Inc., 1982-1984  
Deschutes Independent School, 1983-1984

**Editorial Board Member:**

Journal of Membrane Science, 1984-2007

**Professional Activities:**

National Academy of Engineering  
Committee on Membership, 2005-2008  
Peer Committee, 2001-2004  
American Institute of Chemical Engineers  
Director, 1997-1999  
Planning Process Team (Chair)  
Career Services Task Force (Member and Board Liaison)  
Women's Initiatives Committee (Sponsor)  
Professional Development Committee (Board Liaison)  
Separation Division (Board Liaison)  
Member, Awards Selection Committees, 1992-1999  
North American Membrane Society  
Past President, 1996-1997; Director, 1994-1997  
Finance Committee (Chair), 1994-1997  
Student Fellowships Committee (Chair), 1993-1996  
Reviewer for numerous technical journals and funding agencies

**Continuing Education Courses (of 12 attended, 6 taught):**

2001: Solid-State Behavior of Pharmaceutical Dosage Forms  
2000: Drug Stability  
Drug Metabolism

Microreactors in Chemical Engineering  
1999: Introduction to Bioinformatics  
Medical and Experimental Genetics  
1997: Laboratory Automation and Robotics  
1993: Crystallization Operations

**U.S. PATENTS (generally with foreign counterparts)**

Matson, S.L., "Apparatus for Maintaining the Separation Efficiency of Immobilized Liquid Membranes in Gas Separation," U.S. 4,119,408 (Oct. 10, 1978).

Matson, S.L., "Maintaining the Separation Efficiency of Immobilized Liquid Membranes in Gas Separation Methods and Apparatus," U.S. 4,174,374 (Nov. 13, 1979).

Walmet, G.E. and S.L. Matson, "Packaged Membrane System and Replacement Method," U.S. 4,187,086 (Feb. 5, 1980).

Kimura, S.G., W.J. Ward, and S.L. Matson, "Facilitated Separation of a Select Gas Through an Ion Exchange Membrane," U.S. 4,318,714 (Mar. 9, 1982).

Flock, J.W. and S.L. Matson, "Slurry Granulation-Steam Stripping Process for Solvent Removal," U.S. 4,408,040 (Oct. 4, 1983).

Flock, J.W., S.L. Matson, and P.H. Bollenbeck, "Process for Recovery of Solid Thermoplastic Resins from Solutions Thereof in Organic Solvents," U.S. 4,423,207 (Dec. 27, 1983).

Matson, S.L., "Energy-Efficient Process for the Stripping of Gases from Liquids," U.S. 4,444,571 (Apr. 24, 1984).

Matson, S.L., E.K. Lee, D.T. Friesen, and D.J. Kelly, "Acid Gas Scrubbing by Composite Solvent-Swollen Membranes," U.S. 4,737,166 (Apr. 12, 1988).

Matson, S.L. and T. J. Stanley, "Phase Transfer Catalysis," U.S. 4,754,089 (June 28, 1988)

Matson, S.L., "Production of Low-Alcohol Beverages by Membrane Extraction," U.S. 4,778,688 (Oct. 18, 1988).

Matson, S.L. and J.A. Quinn, "Method and Apparatus for Conducting Catalytic Reactions with Simultaneous Product Separation and Recovery," U.S. 4,786,597 (Nov. 22, 1988).

Matson, S.L., "Method for Catalyst Containment in Multiphase Membrane Reactor Systems," U.S. 4,795,704 (Jan. 3, 1989).

- Matson, S.L., "Method for Resolution of Stereoisomers in Multiphase and Extractive Membrane Reactor Systems," U.S. 4,800,162 (Jan. 24, 1989).
- Matson, S.L., "Apparatus for Production of Low-Alcohol Beverages by Membrane Extraction," U.S. 4,816,407 (Mar. 28, 1989.)
- Friesen, D.T, D.J. Kelly, E.K.L. Lee, and S.L. Matson, "Gas Separation by Composite Solvent-Swollen Membranes," U.S. 4,824,443 (Apr. 25, 1989).
- Lee, E.K.L., V.J., Kalyani, and S.L. Matson, "Production of Low-Alcohol Beverage by Membrane Extraction," U.S. 4,933,198 (June 12, 1990).
- Lee, E.K.L., V.J. Kalyani, and S.L. Matson, "Production of Low-Alcohol Beverage by Membrane Extraction," U.S. 5,013,436 (May 7, 1991).
- Lee, E.K.L., V.J. Kalyani, and S.L. Matson, "Process of Treating Alcoholic Beverages by Vapor-Arbitrated Pervaporation," U.S. 5,013,447 (May 7, 1991).
- Wald, S.A., S.L. Matson, C.M. Zepp, and D.R. Dodds, "Method for Resolution of Stereoisomers," U.S. 5,057,427 (Oct. 15, 1991).
- Matson, S.L., S.A. Wald, C.M. Zepp, and D.R. Dodds, "Method for Membrane Reactor Resolution of Stereoisomers," U.S. 5,077,217 (Dec. 31, 1991).
- Matson, S.L., "Method and System for Removing Radon from Radon-Containing Water," U.S. 5,100,555 (Mar. 31, 1992).
- Lee, E.K.L., V.J. Kalyani, and S.L. Matson, "Process of Treating Alcoholic Beverages by Vapor-Arbitrated Pervaporation," U.S. 5,143,526 (Sept. 1, 1992).
- Matson, S.L., "Radon Removal System and Process," U.S. 5,194,158 (Mar. 16, 1993).
- Barberich, T.J., S.L. Matson, and W.J. Wechter, "Antipyretic and Analgesic Methods Using Optically Pure R-Ketorolac," U.S. 5,382,591 (Jan. 17, 1995).
- Matson, S.L. and P. Zhou, "Method and Apparatus for Organic Synthesis," U.S. 6,309,608 (Oct. 30, 2001).

## **PUBLICATIONS AND PRESENTATIONS**

### **1. JOURNAL ARTICLES AND BOOK CHAPTERS**

- Matson, S.L., The Kinetics of the Ruthenium-Catalyzed Reduction of Nitric Oxide by Hydrogen, M.S. Thesis, Cornell Univ., Ithaca, NY, 182 pp., (1974).
- Matson, S.L. and S.G. Kimura, "Permselective Membranes for the Removal of H<sub>2</sub>S from Coal Gas." American Chemical Society, Division of Fuel Chemistry Preprints, 21:4 (1976), 66-77.
- Matson, S.L., C.S. Herrick, and W.J. Ward, "Progress on the Selective Removal of H<sub>2</sub>S from Gasified Coal Using an Immobilized Liquid Membrane," Ind. Eng. Chem. Proc. Des. Develop., 16 (1977), 370-374.
- Matson, S.L. and J.A. Quinn, "Knudsen Diffusion Through Non-Circular Pores," AIChE J., 23 (1977), 768-770.
- Matson, S.L. and P. Harriott, "The Kinetics of the Ruthenium-Catalyzed Reduction of Nitric Oxide by H<sub>2</sub>" Ind. Eng. Chem. Prod. Res. Develop., 17 (1978), 322-328.
- Kimura, S.G., W.J. Ward, and S.L. Matson, "Application of Facilitated Transport Membranes to Industrial Gas Separations," in Recent Developments in Separation Science, Vol. 5, N.N. Li (ed.). CRC Press, Cleveland, Ohio, (1979) pp. 11-25.
- Matson, S.L., Membrane Reactors, Ph.D. Dissertation, University of Pennsylvania, Philadelphia, PA, 378 pp. (1979).
- LeBlanc, O.H., W.J. Ward, S.L. Matson, and S.G. Kimura, "Facilitated Transport in Ion-Exchange Membranes," J. Memb. Sci., 6 (1980) 339-343.
- Matson, S.L., J.L. Lopez, and J.A. Quinn, "Separation of Gases with Synthetic Membranes," Chem. Eng. Sci., 38:4 (1983) 503-524.
- Michaels, A.S. and S.L. Matson, "Membranes in Biotechnology: State of the Art," Desalination, 53 (1985) 231-258.
- Lopez, J., S.L. Matson, J. Marchese, and J.A. Quinn, "Diffusion Through Composite Membranes: A Two-Dimensional Analysis," J. Memb. Sci., 27 (1986) 301-325.
- Matson, S.L., W.J. Ward, S.G. Kimura, and W. R. Browall, "Membrane Oxygen Enrichment: Economic Assessment," J. Memb. Sci., 29 (1986) 79-96.
- Matson, S.L., "Membrane Bioseparations and Bioconversions: An Overview," pp. 65-82 in Proceedings of the International Membrane Conference,

- M. Malaiyandi, O. Kutowy, and F. Talbot, Eds., National Research Council of Canada, Ottawa, Ontario (1986).
- Matson, S.L. and J.A. Quinn, "Membrane Reactors in Bioprocessing," Ann. N.Y. Acad. Sci., 469 (1986) 152-165.
- Johnson, B.M., R.W. Baker, S.L. Matson, K.L. Smith, I.C. Roman, M.E. Tuttle, and H.K. Lonsdale, "Liquid Membranes for the Production of Oxygen-Enriched Air: II. Facilitated-Transport Membranes," J. Memb. Sci., 31 (1987) 31-67.
- Matson, S.L. and H.K. Lonsdale, "Liquid Membranes for the Production of Oxygen-Enriched Air: III. Process Design and Economics," J. Memb. Sci., 31 (1987) 69-87.
- Catalytic Membrane Reactors: Concepts and Applications, (author of 3 chapters), Catalytica Associates, Mt. View, CA, 1988.
- Matson, S.L. and J.L. Lopez, "Multiphase Membrane Reactors for Enzymatic Resolution: Diffusional Effects on Stereoselectivity," Chap. 33 in Frontiers in Bioprocessing, S.K. Sikdar, P. Todd, and M. Bier, Eds., CRC Press, 1989, pp. 391-403.
- Lopez, J.L., S.L. Matson, T.J. Stanley, and J.A. Quinn, "Liquid/Liquid Extractive Membrane Reactors," pp. 27-66 in Extractive Bioconversions, Bioprocess Technologies Series, B. Mattiasson and O. Holst, Eds., Marcel Dekker, 1991.
- Lopez, J.L., S. Wald, S.L. Matson, and J.A. Quinn, "Multiphase Membrane Reactors for Separating Stereoisomers," Ann. N.Y. Acad. Sci., 613 (1991) 155-166.
- Matson, S.L. and J.A. Quinn, "Membrane Reactors," Chap. 43 (pp. 809-832) in Membrane Handbook, W.S. Ho and K.K. Sirkar, Eds., Van Nostrand Reinhold, NY, 1992.
- Matson, S.L., "Membrane Bioseparations," Chap. 8 (pp. 353-413) in Membrane Separations Technology: Principles and Applications, R.D. Noble and S. A. Stern, Eds., Elsevier Publishing Co., NY, 1995.
- Lopez, J.L. and S.L. Matson, "A Multiphase/Extractive Membrane Reactor for Production of Diltiazem Chiral Intermediate," J. Memb. Sci., 31 (1996) 189-211.
- Matson, S.L. and J.L. Anderson, "John A. Quinn: Selected Career Achievements," Ind. Eng. Chem. Res., 41 (2002) 311-315.

## **2. TECHNICAL MEETINGS AND SYMPOSIA**

### **Gordon Research Conferences**

- 2000: Membranes: Materials and Processes – Discussion Leader
- 1997: Membranes: Materials and Processes – Session Chair
- 1993: Membranes: Materials and Processes – Conference Co-Chair
- 1991: Reverse Osmosis, Ultrafiltration, and Gas Separation – Conference Vice-Chair
- 1990: Synthetic Membranes" – Invited Speaker
- 1989: Reverse Osmosis, Ultrafiltration, and Gas Separation – Invited Speaker  
Reactive Polymers, Ion Exchangers, and Adsorbents – Invited Speaker
- 1988: Synthetic Membranes – Invited Speaker
- 1986: Synthetic Membranes – Session Chair;  
Separation and Purification – Invited Speaker
- 1982: Synthetic Membranes – Session Chair and Coauthor
- 1981: Separation and Purification – Invited Speaker
- 1980: Synthetic Membranes – Coauthor
- 1979: Transport in Biological and Synthetic Membranes – Invited Speaker

### **Selected University Seminars, Professional Addresses, & Technical Presentations**

- 2008: Univ. of Penn., School of Engineering & Applied Sciences (commencement)
- 2007: Univ. of Penn., John A. Quinn Lecture  
AIChE Boston local section speaker
- 2006: Ohio State University (IGERT seminar)
- 2005: Int'l. Congress on Catalysis in Membrane Reactors, Cetraro, Italy (plenary)  
AIChE, Cincinnati (session "In Honor of John Anderson")
- 2001: Membrane Conference on Technology/Planning
- 2000: National Research Council, Board on Chemical Systems & Technology  
(contributor, "Beyond the Molecular Frontier: Challenges for Chemistry  
and Chemical Engineering")
- 1999: Ravello Symposium on "Catalysis in Membrane Reactors"
- 1997: AIChE, Los Angeles  
(recipient, "Outstanding Paper Award" & organizer of "Best Session")  
NAMS, Baltimore (session chair)
- 1996: ICOM '96, Yokohama (invited speaker)  
Smart Functions in Biological Systems, SPIE '96, San Diego (invited speaker)
- 1994: AIChE, San Francisco (Professional Progress Award Lecture)

### **PERSONAL**

Born July 22, 1949, Jamestown, NY	15 Withington Lane; Harvard, MA 01451
Excellent health: 5'10", 180 lbs	ph: (978) 456-3852
Married 36 years, two children (32 & 28)	fax: (978) 456-9560
Personal interests: mountain climbing, cycling, STEM education	e-mail: <a href="mailto:smatson@contechs.org">smatson@contechs.org</a>