

William R. Clark, M.D.

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Education

M.S. in Chemical Engineering, *December 1994*

Purdue University, West Lafayette, IN

Advisor: Professor Linda Wang

Thesis: "Plasma Protein Adsorption to Highly Permeable Hemodialysis Membranes"

Doctor of Medicine, *May 1986*

Indiana University, Indianapolis, IN

B.S. in Chemical Engineering (with distinction), *May 1982*

Purdue University, West Lafayette, IN

Professional Positions

Professor of Engineering Practice

Davidson School of Chemical Engineering, Purdue University

January 2020 – Present

Director, Professional Master's Program

Davidson School of Chemical Engineering, Purdue University

May 2019 – Present

Visiting Professor

Davidson School of Chemical Engineering, Purdue University

January 2017 – May 2019

Researcher

Center for Dialysis Innovation, University of Washington

January 2017 - Present

Affiliate Professor

Department of Mechanical Engineering, University of Washington

January 2016 - Present

Senior Medical Director

Renal Therapeutic Area/Global Medical Affairs

Baxter Healthcare, Deerfield, IL

2013 - 2016

Vice President

Medical Affairs

Gambro Renal Products, Lakewood, CO

2004 – 2013

Chief Medical Officer

NxStage Medical, Lawrence, MA

2002 - 2004

Clinical Assistant Professor of Medicine

Nephrology Section

Indiana University School of Medicine

1994 – 2003

Director of Hemodialysis Research *1994 – 2002*
Scientific Affairs
Baxter Healthcare, Deerfield, IL

Nephrology Fellow *1991 – 1994*
Department of Medicine, Indiana University School of Medicine

Intern/Resident *1988 – 1991*
Department of Medicine, Indiana University School of Medicine

Research Associate *1987 – 1988*
Ash Medical Systems, West Lafayette, IN

Purdue University Teaching Responsibilities

- CHE 59700-008: Medical Devices: Development and Clinical Application (on-campus Fall 2017/Fall 2018/Fall 2019/Fall 2020; on-line Fall 2020)
- CHE 43500: Chemical Engineering Laboratory/Senior Design (Spring 2018)
- CHE 59700-030: Financial Analysis and Management of Projects (Spring 2018/2019/2020)
- CHE 59700-H: Analytical Approach to Healthcare Delivery (on-campus: Fall 2018/Spring 2019/Fall 2019/Fall 2020 on-line: Summer 2020)
- CHE 59700-010: Professional Master's Capstone (Fall 2019/Spring 2020/Summer 2020/Fall 2020)
- HONR 39900 (Honors College): Technology in Medicine (Spring 2020)

Board Certification

- National Board of Medical Examiners *1989*
- American Board of Internal Medicine (Internal Medicine) *1991*
- American Board of Internal Medicine (Nephrology) *1994*

Awards/Achievements

- Tau Beta Pi *1981*
- Omega Chi Epsilon *1981*
- Outstanding Fellow, Department of Medicine, Indiana University School of Medicine *1993*
- Bernd Tersteegen Award (Deutsche Dialyse Gesellschaft niedergelassener Arzte e. V.) *1996*
- Outstanding Alumnus, Purdue University School of Chemical Engineering *2012*
- International Vicenza Award *2019*

Academic Service

- Organizing Committee, International Conference on Continuous Renal Replacement Therapies (1995-2013), San Diego, CA
- Steering Committee (Membrane/Flux Subcommittee), HEMO Study, National Institutes of Health (1995-2002)
- Member, AAMI Dialysis Standards Committee, 1998-2001
- Member, Acute Dialysis Quality Initiative (ADQI) (2000-present)
- Member, NIH/HCFA Task Force on Daily Dialysis (2001)

- Member, European Uremic Toxin (UrTox) Work Group (2000-2002)
- Board of Trustees, International Society for Artificial Organs, 1998-2002
- Executive Council, International Society of Blood Purification (2001-2004)
- Editorial Board (previous memberships): Home Hemodialysis International, Clinical Nephrology, Seminars in Dialysis, Blood Purification
- Ad hoc manuscript reviewer: Blood Purification, PLoS One
- Abstract Review Committee (Clinical Nephrology/ESRD), American Society of Nephrology Annual Meeting 1996, 2000, 2002
- Program Committee, American Society for Artificial Internal Organs Annual Meeting (2000 and 2001)
- Guest editor, Seminars in Dialysis: “Principles of Hemodialysis” series (2000-2002)
- Guest editor, Seminars in Dialysis: “Quantifying Dialysis Dose” special issue (2001)
- Guest Editor, Artificial Organs: “Advances in the Dialytic Management of Acute Renal Failure” special issue (2003)
- Visiting Professor, Veterans General Hospital, Taipei, Taiwan (Dec 11-13, 2001)
- Visiting Professor, Instituto Nacional De Ciencias Medicas Y Nutricion Salvador Subirán, Mexico City, Mexico (August 19, 2003)
- Permanent Visiting Scholar, International Renal Research Institute of Vicenza (IRRIV), Vicenza, Italy (July 2016 - present)
- Editorial Board/Associate Editor, Blood Purification (April 2018 – present)
- American Society of Nephrology Dialysis Core Curriculum 2020: Basic Principles of Dialysis: Hemodialyzers- Structure, Classification and Properties

Publications

1. HJ Moynihan, C Lee, WR Clark, NH-L Wang: Urea hydrolysis by immobilized urease in a fixed-bed reactor. *Biotech Bioeng* 1989;24:951-963.
2. WR Clark, MH Murphy, KJ Alaka, BA Mueller, SO Pastan, WL Macias. Urea kinetics in continuous hemofiltration. *ASAIO J* 1992;38:664-667.
3. WR Clark: Diffuse demyelinating lesions of the brain after rapid development of hypernatremia. *West J Med* 1992;157:571-3.
4. BA Mueller, WR Clark, MA Kraus, WL Macias: Vancomycin and tobramycin clearances in continuous hemofiltration. *Ann Pharmacother* 1993;27:1285-1286.
5. WR Clark, BA Mueller, KJ Alaka, WL Macias: A comparison of metabolic control by continuous and intermittent therapies in acute renal failure. *J Am Soc Nephrol* 1994;4:1413-1420.
6. WR Clark, WL Macias, BA Molitoris, NHL Wang: β_2 -microglobulin membrane adsorption: equilibrium and kinetic characterization. *Kidney Int* 1994;46:1140-1146.
7. WR Clark, WL Macias, BA Molitoris, NHL Wang: Plasma protein adsorption to highly permeable hemodialysis membranes. *Kidney Int* 1995;48:481-487.
8. WL Macias, WR Clark: Azotemia control by extracorporeal therapies in patients with acute renal failure. *New Horizons* 1995;3:688-698.
9. WL Macias, KJ Alaka, MH Murphy, ME Miller, WR Clark, BA Mueller: Impact of the nutritional regimen on protein catabolism and nitrogen balance in patients with acute renal failure. *JPEN* 1996;20:56-62.
10. WR Clark, BA Mueller, MA Kraus, WL Macias: Solute control in acute renal failure: Prescription and delivery of adequate extracorporeal therapy. *Semin Dial* 1996;9:133-139.

11. WL Macias, WR Clark: Acid-base balance in continuous renal replacement therapy. *Sem Dial* 1996;9:145-151.
12. G Bottoms, J Fessler, E Murphey, M Johnson, H Latshaw, B Mueller, WR Clark, W Macias: Efficacy of convective removal of plasma mediators of endotoxic shock by continuous venovenous hemofiltration. *Shock* 1996;5:149-154.
13. WR Clark, BA Mueller, MA Kraus, WL Macias: Solute control by extracorporeal therapies in acute renal failure. *Am J Kid Dis* 1996;28 (Suppl3):S21-S27.
14. WR Clark, MV Rocco, AJ Collins: Quantification of hemodialysis: Analysis of methods and relevance to clinical outcome. *Blood Purif* 1997;15:92-111.
15. MK Scott, WL Macias, MA Kraus, WR Clark, MA Carfagna, BA Mueller: Intradialytic vancomycin administration: dialysis membrane effects. *Pharmacotherapy* 1997;17:256-262.
16. ED Murphey, JF Fessler, GD Bottoms, H Latshaw, M Johnson, BA Mueller, WR Clark, WL Macias: Effects of continuous venovenous hemofiltration on cardiopulmonary function in a porcine model of endotoxin-induced shock. *Am J Vet Res* 1997;58:408-413.
17. WR Clark, BA Mueller, MA Kraus, WL Macias: Extracorporeal therapy requirements for patients with acute renal failure. *J Am Soc Nephrol* 1997;8:804-812.
18. WR Clark: BA Mueller, MA Kraus, WL Macias: Dialysis prescription and kinetics in acute renal failure. *Adv Ren Replace Ther* 1997;4:64-71.
19. WR Clark: Effect of intermittent hemodialysis on metabolic control in acute renal failure. *Home Hemodialysis International* 1997;1:28-31.
20. WR Clark, BA Mueller, MA Kraus, WL Macias: The role of renal replacement therapy quantification in acute renal failure. *Am J Kidney Dis* 1997;30 (Suppl 4):S10-S14.
21. MK Scott, BA Mueller, WR Clark: Vancomycin mass transfer characteristics of high flux cellulose dialyzers. *Nephrol Dial Transplant* 1997;12:2647-2653.
22. WR Clark, C Ronco: Renal replacement therapy in acute renal failure: Solute removal mechanisms and dose quantification. *Kidney Int* 1998;53 (Suppl 66):S133-S137.
23. WR Clark, BA Mueller, MA Kraus, WL Macias: Quantification of creatinine kinetic parameters in patients with acute renal failure. *Kidney Int* 1998;54:554-560.
24. LW Henderson, WR Clark: Modeling and the middle molecule. *Semin Dial* 1998;11:228-230.
25. WR Clark, PJ Soltys: Extracorporeal systems for renal replacement therapy in acute renal failure. *Home Hemodialysis International* 1998;2:30-33.
26. WR Clark, BA Mueller, MA Kraus, WL Macias: Renal replacement therapy quantification in acute renal failure. *Nephrol Dial Transplant* 1998;13 (suppl 6):86-90.
27. MK Scott, BA Mueller, WR Clark: Dialyzer-dependent changes in solute and water permeability with bleach reprocessing. *Am J Kidney Dis* 1999;33:87-96.
28. WR Clark, JK Leypoldt, LW Henderson, BA Mueller, MK Scott, EF Vonesh. Quantifying the effect of changes in the hemodialysis prescription on effective solute removal with a mathematical model. *J Am Soc Nephrol* 1999;10:601-610.
29. KM Sowinski, SR Abel, WR Clark, BA Mueller: Effect of gender on the pharmacokinetics of ofloxacin. *Pharmacotherapy* 1999;19:442-446.
30. WR Clark, BA Mueller, MK Scott, S Bander: Low-molecular weight protein removal by high-flux dialyzers: Basic mechanisms and effect of reprocessing. *Sem Dial* 1999;12:349-354.

31. WR Clark, C Ronco: CRRT efficiency and efficacy in relation to solute size. *Kidney Int* 1999;56 (Suppl 72):S3-S7.
32. WR Clark, RJ Hamburger, MJ Lysaght: Effect of membrane composition and structure on performance and biocompatibility in hemodialysis. *Kidney Int* 1999;56:2005-2015.
33. WR Clark, JH Shinaberger: Clinical evaluation of a new high-efficiency hemodialyzer: Polysynthane (PSN™). *ASAIO J* 2000;46:288-292.
34. WR Clark, JH Shinaberger: Effect of dialysate-side mass transfer resistance on small solute removal in hemodialysis. *Blood Purif* 2000;18:260-263.
35. WR Clark: Hemodialyzer membranes and configurations: A historical perspective. *Sem Dial* 2000;13:309-311.
36. WR Clark, LW Henderson: Renal vs continuous vs intermittent therapies for removal of uremic toxins. *Kidney Int* 2001;59 (Suppl. 78):S298-S303.
37. WR Clark: Quantitative characterization of hemodialyzer solute and water transport. *Sem Dial* 2001;14:32-36
38. WR Clark, C Ronco: Determinants of hemodialyzer performance and the effect on clinical outcome. *Nephrol Dial Transplant* 2001;16 (Suppl. 3):56-60.
39. WR Clark, C Ronco: Factors influencing therapy delivery in acute dialysis. *Contrib Nephrol* 2001;132:304-312.
40. WR Clark: What clinically important advances in understanding and improving dialyzer function have occurred recently? *Sem Dial* 2001;14:162-163.
41. WR Clark, C Ronco: Reconciling differences in effective solute removal between intermittent and continuous therapies. *Sem Dial* 2001;14:289-294.
42. C Ronco, WR Clark: Factors affecting hemodialysis and peritoneal dialysis efficiency. *Sem Dial* 2001;14:257-262.
43. LW Henderson, WR Clark, AK Cheung: Quantification of middle molecule removal in dialysis. *Sem Dial* 2001;14:294-299.
44. R Vanholder, A Argiles, U Baurmeister, P Brunet, WR Clark, G Cohen, P De Deyn, R Deppisch, B Descamps-Latscha, T Henle, A Jorres, Z Massy, M Rodriguez, B Stegmayr, ML Wratten: Uremic toxicity: Present state of the art. *Int J Artif Organs* 2001;24:695-725.
45. WR Clark, D Gao: Low-molecular weight proteins in end-stage renal disease: Potential toxicity and dialytic removal mechanisms. *J Am Soc Nephrol* 2002;13:S41-S47.
46. WR Clark, D Gao: Properties of membranes used for hemodialysis therapy. *Sem Dial* 2002;15:1-5.
47. WR Clark, D Gao: Determinants of uremic toxin removal. *Nephrol Dial Transplant* 2002;17 (Suppl. 1):1-5.
48. WR Clark, D Gao: Membranes for dialysis: Composition, structure, and function. *Contrib Nephrol* 2002;137:70-77.
49. Acute Dialysis Quality Initiative Workgroup: The first international consensus conference on continuous renal replacement therapy. *Kidney Int* 2002;62:1853-1863.
50. RL Mehta, WR Clark, M Schetz: Techniques for assessing and achieving fluid balance in acute renal failure. *Curr Opin Crit Care* 2002;8:535-43.

51. CK Poh, PA Hardy, Z Liao, Z Huang, K Moey, WR Clark, D Gao: Use of magnetic resonance imaging to measure the local ultrafiltration rate in hemodialyzers. *J Membrane Sci* 2002;204:195-205.
52. WR Clark, MA Kraus: Dialysis in acute renal failure: Is more better? *Int J Artif Organs* 2002;25:1119-1122.
53. WR Clark, M Leblanc, NW Levin: The Acute Dialysis Quality Initiative – Part IV: Membranes for CRRT. *Adv Renal Replace Ther* 2002;9:265-267.
54. R Vanholder, R De Smet, G Glorieux, A Argilés, U Baurmeister, P Brunet, WR Clark, G Cohen, PP De Deyn, R Deppisch, B Descamps-Latscha, T Henle, A Jörres, HD Lemke, ZA. Massy, J Passlick-Deetjen, M Rodriguez, B Stegmayr, P Stenvinkel, C Tetta, C Wanner, W Zidek, For the European Uremic Toxin Work Group (EUTox): Review on uremic toxins: Classification, concentration, and interindividual variability. *Kidney Int* 2003;63:1934-1943.
55. R Vanholder, R De Smet, G Glorieux, A Argilés, U Baurmeister, P Brunet, WR Clark, G Cohen, PP De Deyn, R Deppisch, B Descamps-Latscha, T Henle, A Jörres, HD Lemke, ZA. Massy, J Passlick-Deetjen, M Rodriguez, B Stegmayr, P Stenvinkel, C Tetta, C Wanner, W Zidek, For the European Uremic Toxin Work Group: New insights in uremic toxins. *Kidney Int* 2003;63 (Suppl. 84):S6-S10.
56. WR Clark: Renal replacement therapy in acute renal failure. *Artif Organs* 2003;27:253-254.
57. Z Liao, W Zhang, CK. Poh, Z Huang, PA. Hardy, MA. Kraus, WR. Clark, D Gao: Kinetic comparison of different acute dialysis therapies. *Artif Organs* 2003;27:802-807.
58. WR. Clark, JE Turk, MA Kraus, D Gao: Dose determinants in continuous renal replacement therapy. *Artif Organs* 2003;27:815-820.
59. C. Poh, P. Hardy, WR Clark, Gao, D.Y. Effect of flow baffles on the dialysate flow distribution in hollow-fiber hemodialyzers: a non-intrusive experimental study using MRI. *J Biomech Eng* 2003;125:481-489.
60. C. Poh, P. Hardy, Z. Liao, Z. Huang, WR Clark, Gao, D.Y. Effect of spacer yarns on the dialysate flow distribution in hemodialyzers: A *MRI* study. *ASAIO J* 2003;49:440-448.
61. Z. Liao, WR Clark, Gao, D.Y. A numerical and experimental study of mass transfer in the artificial kidney. *J Biomech Eng* 2003;125:472-480.
62. WR Clark, JF Winchester: Middle molecules and small-molecular-weight proteins in ESRD: Properties and strategies for their removal. *Adv Renal Replace Ther* 2003;10:270-278.
63. AK Cheung, NW Levin NW, T Greene, L Agodoa , J Bailey, G Beck, WR Clark, AS Levey, JK Leypoldt, DB Ornt, MV Rocco, G Schulman, S Schwab, B Teehan, and G Eknoyan: Effects of high-flux hemodialysis on clinical outcomes: Results of the HEMO Study. *J Am Soc Nephrol* 2003;14: 3251-3263.
64. Z Huang, E Klein, B Li, CK Poh, Z Liao, WR Clark, D Gao: A new method to evaluate the local clearance at different annular rings inside hemodialyzers. *ASAIO J* 2003;49:692-697.
65. WR Clark, JE Turk: The NxStage System One. *Sem Dial* 2004;17:167-170.
66. WR Clark, C Ronco: Continuous renal replacement techniques. *Contrib Nephrol* 2004;144:264-277.
67. Z Liao, E Klein, CK Poh, Z Huang, PA. Hardy, S Morti, WR Clark, D Gao. A modified equivalent annulus model for the hollow fiber hemodialyzer. *Int J Artif Organs* 2004;27:110-117.
68. A Nissenson, R Agarwal, M Allon, A Cheung, WR Clark, T Depner, J Diaz-Buxo, C Kjellstrand, A Klinger, K Martin, K Norris, R Ward, J Wish: Improving outcomes in CKD and ESRD patients: Carrying the torch from training to practice. *Sem Dial* 2004;17:380-97.
69. Z Huang, D Gao, WR Clark: Convective renal replacement therapies for acute renal failure and end-stage renal disease. *Hemodial Int* 2004;8:386-393.

70. JA Kellum, R Bellomo, C Ronco, W Clark, NW Levin: The 3rd International Consensus Conference of the Acute Dialysis Quality Initiative (ADQI). *Int J Artif Organs* 2005;28:441-4.
71. WR Clark, E Paganini, D Weinstein, R Bartlett, G Sheinfeld, C Ronco: Extracorporeal ultrafiltration for acute exacerbations of chronic heart failure: Report from the Acute Dialysis Quality Initiative. *Int J Artif Organs* 2005;28:466-476.
72. Z Huang, WR Clark, D Gao: Determinants of small solute clearance in hemodialysis. *Semin Dial* 2005;18:30-35.
73. Z Huang, WR Clark, D Gao: Factors influencing low-molecular-weight solute clearance during hemodialysis. *Hemodial Int* 2005;9:332-337.
74. AK Cheung, MV Rocco, G Yan, JK Leypoldt, NW Levin, TA Greene, L Agodoa, J Bailey, GJ Beck, WR Clark, AS Levey, DB Ornt, G Schulman, S Schwab, B Teehan, G Eknoyan: Serum beta-2 microglobulin levels predict mortality in dialysis patients: results of the HEMO study. *J Am Soc Nephrol.* 2006;17:546-55.
75. WR Clark, JJ Letteri, S Uchino, R Bellomo, C Ronco: Recent clinical advances in the management of critically ill patients with acute renal failure. *Blood Purif* 2006;24:487-498.
76. Z Huang, JJ Letteri, WR Clark, W Zhang, D Gao, C Ronco: Ultrafiltration rate as dose surrogate in pre-dilution hemofiltration. *Int J Artif Organs* 2007;30:124-132
77. WR Clark, E Rocha, C Ronco: Solute removal by hollow fiber dialyzers. *Contrib Nephrol* 2007;158:20-33.
78. A Tolwani, E Paganini, M Joannidis, N Zamperetti, A Verbine, V Vidyasagar, W Clark, C Ronco: Treatment of patients with cardiac surgery associated-acute kidney injury. *Int J Artif Organs.* 2008;31:190-6.
79. Z Huang, JJ Letteri, WR Clark, C Ronco: Operational characteristics of continuous renal replacement therapy modalities used for critically ill patients with acute kidney injury. *Int J Artif Organs* 2008;31:525-34
80. Z Huang, D Gao, JJ Letteri, WR Clark: Blood-membrane interactions during dialysis. *Semin Dial* 2009;22:623-8.
81. WR Clark, F Garzotto, M Neri, A Lorenzin, M, Zaccaria, C Ronco: Data analytics for continuous renal replacement therapy: Historical limitations and recent technology advances. *Int J Artif Organs* 2016;39(8):399-406.
82. M Neri M, G Villa, F Garzotto, S Bagshaw, R Bellomo, J Cerda, F Ferrari, S Guggia, M Joannidis, J Kellum, JC Kim, RL Mehta, Z Ricci, A Trevisani, S Marafon, WR Clark, JL Vincent, C Ronco: Nomenclature for renal replacement therapy in acute kidney injury: basic principles. *Crit Care.* 2016;20(1):318
83. WR Clark, M Neri, F Garzotto, SL Goldstein, Z Ricci, C Ronco: The future of critical care: Renal support in 2027. *Crit Care* 2017;21:92.
84. WR Clark, M Leblanc, Z Ricci, C Ronco: Quantification and dosing of renal replacement therapy in acute kidney injury: A reappraisal. *Blood Purif* 2017;44:140-155.
86. Z Ricci, F Guzzi, G Tuccinardi, L Di Chiara, W Clark, SL Goldstein, C Ronco: Dose prescription and delivery in neonates with congenital heart diseases treated with continuous veno-venous hemofiltration. *Ped Crit Care Med* 2017;18(7):623-629

87. WR Clark, X Ding, H Qiu, Z Ni, P Chang, P Fu, J Xu, M Wang, Y Li, J Wang, C Ronco: Renal replacement therapy practices for critically ill patients with acute kidney injury in China. *PLOS One* 2017;12(7):e0178509
88. WR Clark, F Ferrari, La Manna, C Ronco: Extracorporeal sorbent technologies: basic concepts and clinical application. *Contrib Nephrol* 2017;190:43-57
89. S Romagnoli, WR Clark, Z Ricci, C Ronco: Renal replacement therapy for AKI: When, how much, and when to stop? *Best Practice and Research: Best Pract Res Clin Anaesth* 2017;31:271-85
90. WR Clark, D Gao, M Neri, C Ronco: Solute transport in hemodialysis: Advances and limitations of current membrane technology. *Contrib Nephrol* 2017;191:84-99.
91. C Ronco, M Neri, A Lorenzin, F Garzotto, WR Clark: Multidimensional classification of dialysis membranes. *Contrib Nephrol* 2017;191:115-126.
92. A Lorenzin, M Neri, WR Clark, F Garzotto, A Brendolan, F Nalesso, N Marchionna, M Zanella, M Sartori, GB Fiore, C Ronco: Modeling of internal filtration in TheraNova dialyzers. *Contrib Nephrol* 2017;191:127-141.
93. WR Clark, C Ronco: 40 years of CRRT: Membranes and sorbents. *Contrib Nephrol* 2018;194:70-79
94. WR Clark, C Ronco: 40 years of CRRT: Advances in machine technology. *Contrib Nephrol* 2018;194:80-89
95. C Ronco, WR Clark: Haemodialysis membranes. *Nature Rev Nephrol* 2018;14:394-410.
96. C Ronco, SM Bagshaw, R Bellomo, WR Clark, F Husain-Syed, JA Kellum, Z Ricci, T Rimmelé, M Ostermann: AKI treatment: from renal replacement therapy to extracorporeal kidney support and extracorporeal organ support. *Intensive Care Med* (invited review)
97. WR Clark, N Laal Dehghani, Narsimhan V, C Ronco: New perspectives on extracorporeal renal replacement therapy for end-stage renal disease: (I) Uremic toxins. *Blood Purif* 2019;48:299–314
98. WR Clark, F Mohagerani, Narsimhan V, C Ronco: New perspectives on extracorporeal renal replacement therapy for end-stage renal disease: (II) Membranes/dialyzers. *Blood Purif* (invited review)
99. WR Clark, F Mohagerani, Narsimhan V, C Ronco: New perspectives on extracorporeal renal replacement therapy for end-stage renal disease: (III) Mass transfer. *Blood Purif* (invited review)
100. WR Clark, F Mohagerani, Narsimhan V, C Ronco: New perspectives on extracorporeal renal replacement therapy for end-stage renal disease: (IV) Future directions. *Blood Purif* (invited review)

Invited Presentations

1. Cleveland Clinic Foundation, Intensive Care Nephrology and Chronic Dialysis Update, Cleveland, OH: “Patient Needs and Dialytic Therapy Choice in the ICU ARF Setting.” Presented May 12, 1995.
2. Association for the Advancement of Medical Instrumentation Annual Meeting, Anaheim CA. “Dialysis/Membrane Technology.” Presented May 21, 1995.
3. Lapeyronie Hopital, Nephrology Service, Montpellier, France: “Membrane-Protein Interactions During Hemodialysis.” Presented July 12, 1995.
4. Beth Israel Medical Center, Evolving Dialysis IV, New York, NY: “Protein Removal During High-Flux Hemodialysis.” Presented October 20, 1995.
5. PanAmerican Society for Dialysis and Transplantation Annual Meeting, Mexico City, Mexico. “Hemofiltration,” Presented November 2, 1995.

6. PanAmerican Society for Dialysis and Transplantation Annual Meeting, Mexico City, Mexico. "Preliminary Results of NIH Adequacy Study." Presented November 3, 1995.
7. First Annual International Symposium on CRRT, San Diego, CA. "Prescription and Delivery of Adequate Extracorporeal Therapy in Acute Renal Failure," Presented November 9, 1995.
8. American Society for Artificial Internal Organs Annual Meeting, Washington, DC. "Dialysis Dose in Acute Renal Failure: Blood vs Dialysate-Side Modeling," Presented May 2, 1996.
9. Annual Asian Colloquium in Nephrology, Singapore. "The Importance of Dialysis Dose in Acute Renal Failure," Presented September 27, 1996.
10. Annual Asian Colloquium in Nephrology, Singapore. "Overview of the NIH Adequacy Trial," Presented September 27, 1996.
11. Annual Meeting of Deutsche Dialyse Gesellschaft niedergelassener Arzte e.V, Mannheim, Germany. "Plasma Protein Adsorption to Highly Permeable Dialysis Membranes," Presented November 15, 1996.
12. First Annual International Symposium on Dialysis Schedule in Hemodialysis and Peritoneal Dialysis, Perugia, Italy. "Inefficiency Factor of Intermittent Treatments and Dialysis Dose in Acute Renal Failure," Presented November 22, 1996.
13. Second Annual International Symposium on CRRT, San Diego, CA. "Extracorporeal Therapy Requirements for Patients with Acute Renal Failure," Presented February 9, 1997.
14. Third International Symposium on Daily Home Hemodialysis, Denver, CO. "Rationale for Ultra-Frequent Acute Hemodialysis," Presented February 17, 1997.
15. International Society for Artificial Organs Annual Meeting, Providence, RI. "Kinetics of Solute Removal During CRRT," Presented June 29, 1997.
16. European Dialysis and Transplant Association (EDTA) Annual Meeting, Geneva, Switzerland. "On-line monitoring of the delivery of the hemodialysis prescription." Presented September 22, 1997.
17. American Society of Nephrology Dialysis Forum, San Antonio, TX. "Solute Removal During CRRT." Presented November 1, 1997.
18. American Society of Nephrology Dialysis Forum, San Antonio, TX. "Monitoring and Assessment of Dialysis Dose in CRRT." Presented November 1, 1997.
19. Beth Israel Evolving Dialysis Annual Meeting. "Effect of Changes in Dialytic Frequency, Duration, and Flow Rates on Solute Kinetics and Effective Clearances." Presented December 5, 1997.
20. Fourth International Symposium on Daily Home Hemodialysis, Nashville, TN. "Hemodialysis Systems for Nocturnal and Continuous Hemodialysis." Presented February 24, 1998.
21. Third International Conference on CRRT, San Diego, CA. "Dialysis Dose Prescription and Delivery with CRRT." Presented March 5, 1998.
22. Dialysearzte Workshop, Prien, Germany. "Interaction Between Membrane Flux and Biocompatibility." Presented March 20, 1998.
23. First International Course of Critical Care Nephrology, Vicenza, Italy. "The Importance of the Dose of RRT in ARF." Presented May 22, 1998.
24. Severance Dialysis Symposium, Seoul, Korea. "Clinical Benefits of On-Line Hemodiafiltration." Presented June 21, 1998.
25. Annual Asian Colloquium in Nephrology, Kuala Lumpur, Malaysia. "New Dialysis Membrane Technology." Presented August 5, 1998.

26. American Society of Nephrology Postgraduate Course on ICU Nephrology, Philadelphia, PA. "Dialysis Dose in the ICU." Presented October 24, 1998.
27. National Conference on Dialysis: Advances in ESRD 1999, Tarpon Springs, FL. "Solute Kinetics and Therapy Quantification in Acute Renal Failure." Presented January 21, 1999.
28. National Conference on Dialysis: Advances in ESRD 1999, Tarpon Springs, FL. "Is the clinical effectiveness of single-use high-efficiency cellulosic dialyzers equivalent to that of reused high-flux dialyzers?" Presented January 21, 1999.
29. Renal Grand Rounds, Loyola Medical Center, Chicago, IL: "Extracorporeal Therapy of Acute Renal Failure". Presented February 4, 1999.
30. Fifth International Symposium on Daily Home Hemodialysis, Charlotte, NC. "Solute Kinetics in Relation to Dialysis Frequency, Duration, and Flow Rates." Presented March 1, 1999.
31. Fourth International Conference on CRRT, San Diego, CA: "Dialysis Dose Prescription and Delivery with Dialytic Techniques in Acute Renal Failure". Presented March 11 and 13, 1999.
32. Dialysearzte Workshop, Prien, Germany. "Membrane technology at the end of the century." Presented March 19, 1999.
33. Renal Grand Rounds, Johns Hopkins Medical Center, Baltimore, MD: "Dialytic Therapy of Acute Renal Failure". Presented March 26, 1999.
34. American Filtration and Separation Society Annual Meeting, Boston, MA: "The Effect of Reprocessing on the Effective Permeability of Highly Permeable Membranes". Presented April 7, 1999.
35. Philippine Society of Nephrology Annual Meeting, Manila, Philippines: "Dialysis Prescription and Kinetics in Acute Renal Failure". Presented April 16, 1999.
36. Fourth International Conference on Continuous Hemofiltration, Darmstadt, Germany: "CRRT Efficiency and Efficacy in Relation to Solute Size". Presented May 15, 1999.
37. ESRD Network 9/10 Nephrology Conference, Indianapolis, IN: "Technological Advances: Do They Help?" Presented May 19, 1999.
38. North American Annual Symposium on Dialysis and Transplantation, Kapalua, Hawaii. "Flux and Biocompatibility Characteristics of Hemodialysis Membranes". Presented July 19, 1999.
38. International Faculty of Artificial Organs (INFA) Intensive Course on Artificial Membranes in Medical Applications, Warsaw, Poland. "Factors Determining Effective Solute Removal During Hemodialysis". Presented August 28, 1999.
39. Annual Meeting of the Mexican Society of Nephrology, Huatulco, Mexico. "Biocompatibility in Hemodialysis". Presented September 9, 1999.
40. Stuart Kleit Symposium, National Kidney Foundation of Indiana, Merrillville, IN. "Continuous Renal Replacement Therapy in the Management of Acute Renal Failure". Presented September 24, 1999.
41. American Society of Nephrology Clinical Symposium Therapy Options in Acute Renal Failure, Miami, FL. "The Case for CRRT". Presented November 6, 1999.
42. American Society of Nephrology Postgraduate Course on CRRT, Miami, FL. "Removal of middle and large size solutes by CRRT". Presented November 4, 1999.
43. Fourth International Congress on Uraemic Toxicity, Vienna, Austria. "Comparison of uremic toxin removal by glomerular filtration and continuous, semi-continuous, and intermittent renal replacement therapies". Presented November 23, 1999.

44. Annual Membrane Technology Conference, Newton, MA: "Hemodialysis: Where To?". Presented December 7, 1999.
45. International Conference on Dialysis: Advances in ESRD 2000, Tarpon Springs, FL. "Effect of blood-side and dialysate-side mass transfer resistance on small solute removal in hemodialysis". Presented January 13, 2000.
46. Annual Conference on Dialysis Vascular and Venous Access, Aspen, CO. "Dialytic Therapy Options in Acute Renal Failure". Presented February 26, 2000.
47. Sixth International Symposium on Daily Home Hemodialysis, San Francisco, CA. "Overview of Mass Transfer in Hemodialysis". Presented February 28, 2000.
48. Fifth Annual International Symposium on CRRT, San Diego, CA: "Factors Influencing Effective Solute Removal in CRRT". Presented March 2, 2000.
49. International Symposium on Intensive Care and Emergency Medicine, Brussels, Belgium. "Solute Removal Mechanisms in CRRT". Presented March 22, 2000.
50. Eighth Asian Pacific Congress of Nephrology, Taipei, Taiwan. "Recent Advances in Hemodialysis and Impact on Outcomes". Presented March 28, 2000.
51. First Annual International Symposium on Pediatric CRRT, Miami, FL. "Determinants of Solute Removal in CRRT". Presented June 24, 2000.
52. Annual Scientific Meeting of the American Society of Artificial Internal Organs, New York, NY. "Dialysis Membranes". Presented June 28, 2000.
53. Annual Scientific Meeting of the American Society of Artificial Internal Organs, New York, NY. "Renal Support Choices in the Critically Ill Patient: When, How, and Why". Presented June 30, 2000.
54. North American Annual Symposium on Dialysis and Transplantation, Kapalua, Hawaii. "Dialytic Therapy Options in Acute Renal Failure". Presented July 5, 2000.
55. European Dialysis and Transplant Society Annual Meeting (Satellite Symposium), Nice, France: "Dialytic Removal of Low-Molecular Weight Proteins". Presented September 18, 2000.
56. Mexican Society of Nephrology Annual Meeting, Guadalajara, Mexico: "Advances in Hemodialysis". Presented October 6, 2000.
57. American Society of Nephrology Post-Graduate Course on Hemodialysis, Toronto, Canada: "Overview of Mass Transfer in Hemodialysis". Presented October 11, 2000.
58. American Society of Nephrology Annual Meeting, Toronto, Canada, Invited Mini-lecture: "Effect of Membrane Characteristics on Flux, Biocompatibility, and Adequacy in Hemodialysis". Presented October 13, 2000.
59. Annual Dialysis Conference, New Orleans, LA. "Membrane Processes in Hemodialysis: Diffusion, Convection, Adsorption". Presented February 28, 2001.
60. Sixth Annual International Symposium on CRRT, San Diego, CA: "Vascular access, membrane, and circuit issues in CRRT". Presented March 8, 2001.
61. NIH/HCFA Task Force on Daily Dialysis, Bethesda, MD: "Industry Roundtable: Baxter Perspective". Presented April 11, 2001.
62. National Kidney Foundation Clinical Nephrology Meetings, Orlando, FL. "Determination of Hemodialysis Adequacy in Acute Renal Failure". Presented April 17, 2001.
63. North American Membrane Society (NAMS) Annual Conference, Lexington, KY. "Membrane determinants of solute removal in hemodialysis". Presented May 18, 2001.

64. Second International Course on Critical Care Nephrology, Vicenza, Italy. "Prescription of Adequate Renal Replacement Therapy in Acute Renal Failure". Presented May 24, 2001.
65. Second International Course on Critical Care Nephrology, Vicenza, Italy. "Membranes and Filters for CRRT". Presented May 24, 2001.
66. American Society of Nephrology Post-Graduate Course on CRRT, San Francisco, CA: "Solute Control and Dose in CRRT". Presented October 13, 2001.
67. American Society of Nephrology Post-Graduate Course on CRRT, San Francisco, CA: "CRRT Technique: Principles and Operating Characteristics". Presented October 13, 2001.
68. Cleveland Clinic Foundation, Nephrology Update 2001, Cleveland, OH: "Dialysis Membrane Technologies: How Are They the Same and How Are They Different?" Presented November 6, 2001.
69. Veterans General Hospital (Visiting Professorship), Taipei, Taiwan: "Quantification of Hemodialysis". Presented December 11, 2001.
70. Veterans General Hospital (Visiting Professorship), Taipei, Taiwan: "Kinetics of Solute Removal in Different Dialysis Therapies". Presented December 12, 2001.
71. Veterans General Hospital (Visiting Professorship), Taipei, Taiwan: "Renal Replacement Therapy in Acute Renal Failure". Presented December 13, 2001.
72. Renal Grand Rounds, Columbia University School of Medicine, New York, NY: "Kinetics of Solute Removal in Different Dialysis Therapies". Presented February 11, 2002.
73. Annual Course on Pediatric Dialysis, Tampa, FL: "The Biology of Dialysis". Presented March 1, 2002.
74. Annual Dialysis Conference, Tampa, FL. "Understanding Diffusion, Convection, and Adsorption in Dialysis". Presented March 3, 2002.
75. Annual Dialysis Conference, Tampa, FL. "Dialysis Membrane Properties Influencing the Balance Between Middle Molecule Removal and Albumin Loss". Presented March 5, 2002.
76. Annual Dialysis Conference, Tampa, FL. "Design and Membrane Characteristics of Hemodialyzers". Presented March 5, 2002.
77. Annual International Symposium on CRRT, San Diego, CA: "Dose Prescription and Delivery with Dialytic Techniques". Presented March 14, 2002
78. Annual International Symposium on CRRT, San Diego, CA: "Effect of Modality, Membrane, and Operation Characteristics on Dose". Presented March 16, 2002
79. Annual International Symposium on CRRT, San Diego, CA: "Dose of Dialysis: How Should it be Measured and Prescribed?". Presented March 16, 2002.
80. NANT Annual Symposium, Pittsburgh, PA: "Industry Review: What's New in Dialysis?". Presented April 7, 2002.
81. University of Chicago Renal Grand Rounds, Chicago, IL: "Renal Replacement Therapy in Acute Renal Failure". Presented April 11, 2002.
82. National Kidney Foundation Hemodialysis Course, Chicago, IL: "CRRT: Baxter's Perspective". Presented April 15, 2002.
83. ANNA Annual Symposium, Orlando, FL: "Beyond Clearance and Ultrafiltration: The Dialyzer Membrane and its Effects on Dialysis Patients". Presented May 24, 2002.
84. First International Course on Hemodialysis Technology, Vicenza, Italy. "Membranes for Dialysis: Composition, Structure, and Function." Presented June 21, 2002.

85. Nephrology Grand Rounds, Mayo Clinic, Rochester, MN. "Dialysis Dose in Acute Renal Failure". Presented August 6, 2002.
86. Invited Lecture, Mayo Clinic, Rochester, MN. "New Developments in Hemodialysis Membranes". Presented August 6, 2002.
87. Kidney Dialysis Foundation (KDF) State-of-the-Art Nephrology Course, Singapore: "Dialytic Management of Acute Renal Failure". Presented September 24, 2002.
88. Japanese Society for Artificial Organs, Sapporo, Japan: "Metabolic Control and Treatment Dose in Acute Renal Replacement Therapies". Presented October 3, 2002.
89. American Society of Nephrology Post-Graduate Course on Hemodialysis, Philadelphia, PA: "Determinants of Diffusive Solute Transport". Presented October 30, 2002.
90. American Society of Nephrology Annual Meeting, Philadelphia, PA, Invited presentation for "Novel Alternatives to Hemodialysis" symposium: "An Overview of Solute Removal in Non-Diffusive Modalities". Presented November 3, 2002.
91. International Conference on Dialysis: Advances in ESRD 2003, Miami, FL: "Acute Dialysis Quality Initiative (ADQI) Introduction and Definition of Acute Renal Failure." Presented January 30, 2003.
92. Annual International Symposium on CRRT, San Diego, CA: "CRRT>SLED>IHD: True or False". Presented March 8, 2003.
93. National Kidney Foundation Clinical Nephrology Meetings, Dallas, TX. "Assessing Kidney Function in the Patient with Acute Kidney Failure". Presented April 3, 2003.
94. Keystone ESRD Conference, Orlando, FL. "Daily Dialysis: The Options". Presented May 2, 2003.
95. Keystone ESRD Conference, Orlando, FL. "Treatment of Acute Renal Failure". Presented May 2, 2003.
96. Network 9/10 Annual Meeting, Indianapolis, IN: "Impact of the HEMO and ADEMEX Studies on Clinical Practice". Presented May 15, 2003.
97. National Kidney Foundation of Maine Annual Meeting, Portland, ME: "Hemofiltration in the Management of Acute and Chronic Renal Failure". Presented September 6, 2003.
98. National Kidney Foundation of Illinois Annual Meeting, Chicago, IL: "Alternative Modalities for the Management of Renal Failure". Presented September 14, 2003.
99. Midwest CRRT Symposium, Indianapolis, IN: "Dialysis Dosing in the Intensive Care Unit". Presented October 2, 2003.
100. American Society of Nephrology Post-Graduate Course on Peritoneal Dialysis, San Diego, CA: "Determinants of Diffusive and Convective Solute Transport". Presented November 12, 2003.
101. Third Symposium on Extra-renal Therapy in Intensive Care, Paris, France: "Are All Dialysis Methods Equivalent in Dose Delivery?" Presented December 4, 2003.
102. Third Symposium on Extra-renal Therapy in Intensive Care, Paris, France: "Non-conventional Renal Replacement Therapy in ARF" Presented December 5, 2003
103. International Society for Hemodialysis: Ultrafiltration and Beyond Symposium, San Antonio, TX: "Hemofiltration – Is It Better than Hemodialysis? Presented February 7, 2004.
104. National Kidney Foundation of Singapore, NephroAsia 2004, Singapore: "Polymers and Membranes in Haemodialysis". Presented February 12, 2004.
105. National Kidney Foundation of Singapore, NephroAsia 2004, Singapore: "Large Molecular Weight Uremic Toxins: Clinical Implications and Modalities for Removal". Presented February 12, 2004.

106. National Kidney Foundation Spring Clinical Meeting, Chicago, IL: "Fundamentals of Hemodialysis and Hemofiltration". Presented April 29, 2004.
107. Third International Course on Critical Care Nephrology, Vicenza, Italy. "Consensus and Recommendations from ADQI: Membranes, Techniques, and Operational Characteristics". Presented June 4, 2004.
108. Third International Course on Critical Care Nephrology, Vicenza, Italy. "Which Treatment for ARF in the ICU: CRRT". Presented June 4, 2004.
109. Third International Course on Critical Care Nephrology, Vicenza, Italy. "Membranes and Filters for CRRT". Presented June 4, 2004.
110. Da Fundacao Pro-Renal Symposium, Curitiba, Brazil: "Short Daily vs Nocturnal Hemodialysis". Presented July 16, 2004.
111. American Society of Nephrology Post-Graduate Course on Hemodialysis, St. Louis, MO: "Determinants of Diffusive and Convective Solute Transport". Presented October 27, 2004.
112. Annual Conference on Dialysis, Tampa, FL: "Uremic Toxins". Presented February 27, 2005.
113. Annual Conference on Dialysis, Tampa, FL: "Laboratory and Clinical Studies of Efficiency of Various Volumes of HDF". Presented March 2, 2005.
114. National Kidney Foundation Spring Clinical Meeting, Washington, DC: "Dialysis Prescription in Acute Kidney Disease: Frequency vs Dose". Presented May 6, 2005.
115. Hong Kong Society of Nephrology Annual Meeting, Hong Kong, China: "Determinants of Treatment Dose in CRRT". Presented September 10, 2005.
116. Hong Kong Society of Nephrology Annual Meeting, Hong Kong, China: "Factors Influencing the Outcome of Patients Treated with CRRT". Presented September 11, 2005.
117. American Society of Nephrology Post-Graduate Course, Philadelphia, PA: "Factors Influencing Dialytic Mass Transfer". Presented November 8, 2005.
118. University of Utah, Nephrology Grands Rounds, Salt Lake City, UT: "Dialytic Management of ARF in the ICU". Presented December 7, 2005.
119. Annual Conference on Dialysis, San Francisco, CA: "Uremic Toxins". Presented February 25, 2006.
120. Annual Conference on Dialysis, San Francisco, CA: "The Wide Spectrum of Uremic Toxins". Presented February 27, 2006.
121. Conference on Continuous Blood Purification, Nanjing, China: "Determinants of Dose in CBP therapy". Presented May 13, 2006.
122. Kidney Disease Foundation State-of-the-Art Nephrology Course, Singapore: "Update on Hemodialysis Adequacy Trials". Presented September 10, 2006.
123. Kidney Disease Foundation State-of-the-Art Nephrology Course, Singapore: "New Dialysis Technologies". Presented September 10, 2006.
124. Kidney Disease Foundation State-of-the-Art Nephrology Course, Singapore: "Dialytic Management of Acute Renal Failure in the ICU". Presented September 10, 2006.
125. University of Pennsylvania, Joint Critical Care/Nephrology Conference: "Dialytic Management of Acute Renal Failure". Presented November 3, 2006.
126. Hong Kong Society of Critical Care Medicine Annual Meeting, Hong Kong, China: "CRRT Dose Prescription: Practical Considerations". Presented November 11, 2006.

127. Hong Kong Society of Critical Care Medicine Annual Meeting, Hong Kong, China: "Recent Clinical Advances in the Management of Critically Ill Patients with Acute Renal Failure". Presented November 11, 2006.
128. World Congress of Internal Medicine, Taipei, Taiwan: "Extracorporeal Ultrafiltration in Refractory Congestive Heart Failure". Presented November 13, 2006.
129. Indian Society of Nephrology, Bhubaneswar, India: "Recent Clinical Advances in the Management of Critically Ill Patients with Acute Renal Failure". Presented December 2, 2006.
130. Karolinska University Post-Graduate Course on Critical Care Nephrology, Stockholm, Sweden: "Dose Determinants in CRRT". Presented December 5, 2006.
131. Indian Society of Critical Care Medicine Annual Congress, Kochin, India: "CRRT Dose: Practical Considerations". Presented February 7, 2007.
132. Indian Society of Critical Care Medicine Annual Congress, Kochin, India: "Dialytic Management of Critically Ill Patients with Acute Renal Failure". Presented February 8, 2007.
133. Indian Society of Critical Care Medicine Annual Congress, Kochin, India: "Debate: CRRT is the Preferred Modality for Managing Critically Ill Patients with Acute Renal Failure". Presented February 11, 2007.
134. Annual Conference on Dialysis, Denver, CO: "Uremic Toxins". Presented February 17, 2007.
135. International Consensus Conference in Intensive Care Medicine, Montreal, Canada: "Which renal replacement techniques can we use?" Presented May 4, 2007.
136. International Course on Critical Care Nephrology, Vicenza, Italy. "CRRT Operating Characteristics". Presented May 31, 2007.
137. Nephrology Club of Eastern Province, Saudi Arabia, Al Khobar, Saudi Arabia: "CRRT vs SLED". Presented June 26, 2007.
138. CRRT Symposium, Dubai, United Arab Emirates: "Dialytic Management of Critically Ill Patients with Acute Renal Failure". Presented June 27, 2007.
139. North American Annual Symposium on Dialysis and Transplantation, Wailea, Hawaii: "Recent Clinical Advances in the Management of Critically Ill Patients with Acute Renal Failure". Presented July 10, 2007.
140. North American Annual Symposium on Dialysis and Transplantation, Wailea, Hawaii: "Reassessment of Hemodialysis Adequacy in ESRD". Presented July 12, 2007.
141. University of Kentucky Nephrology Conference, Lexington, KY: "Recent Clinical Advances in the Management of Critically Ill Patients with Acute Renal Failure". Presented July 24, 2007
142. University of California – Los Angeles Nephrology Conference, Los Angeles, CA: "Recent Clinical Advances in the Management of Critically Ill Patients with Acute Renal Failure". Presented August 29, 2007
143. Midwest CRRT Conference, Indianapolis, IN: "Improving the Chances of Renal Recovery". Presented September 21, 2007.
144. CRRT in Critical Care/Nephrology Symposium, Edmonton, Canada: "Intensity of Therapy: CRRT Dosing". Presented November 9, 2007.
145. Australian Symposium on Critical Care Nephrology, Melbourne, Australia: "CVVHD vs CVVH vs CVVHDF". Presented November 30, 2007.

146. University of Louisville Nephrology Conference, Louisville, KY: "Recent Clinical Advances in the Management of Critically Ill Patients with Acute Renal Failure". Presented January 11, 2008.
147. Annual International Symposium on CRRT, San Diego, CA: "Solute Control and Dose". Presented February 27, 2008.
148. Annual International Symposium on CRRT, San Diego, CA: "Operating Principles of CRRT". Presented February 27, 2008.
149. University of Cincinnati Nephrology Conference, Cincinnati, OH: "Recent Clinical Advances in the Management of Critically Ill Patients with Acute Renal Failure". Presented April 9, 2008.
150. Karolinska University Post-Graduate Course on Critical Care Nephrology, Stockholm, Sweden: "Determinants of Treatment Dose in CRRT". Presented April 16, 2008.
151. Asia Pacific Congress of Nephrology, Kuala Lumpur, Malaysia: "Outcome Comparisons of Intermittent and Continuous Dialysis Modalities in Acute Kidney Injury: What Do They Mean?" Presented May 6, 2008.
152. Asia Pacific Congress of Nephrology, Kuala Lumpur, Malaysia: "Renal Recovery After Acute Kidney Injury" Presented May 6, 2008.
153. Cleveland Clinic Innovations in Uremia Research Conference, Cleveland, OH: "Blood-Membrane Interactions and Solute Clearance". Presented May 15, 2008.
154. Chinese Society of Critical Care Medicine, Hangzhou, China: "Delivery of Renal Replacement Therapy in the ICU for AKI: Patient Outcome Considerations". Presented May 24, 2008.
155. West China Hospital Symposium on Acute Kidney Injury, Chengdu, China: "Factors Influencing the Outcome of Critically Ill Patients with Acute Kidney Injury". Presented June 14, 2008.
156. West China Hospital Symposium on Acute Kidney Injury, Chengdu, China: "The Acute Renal Failure Trial Network (ATN) Study: Implications for Clinical Practice". Presented June 14, 2008.
157. DaVita Clinical Conference, Ontario, CA: "Factors Influencing the Outcome of Critically Ill Patients with AKI". Presented June 19, 2008.
158. IMIM Congress, Acapulco, Mexico: "CRRT: Standard of Care for the Management of Critically Ill Patients with AKI". Presented August 22, 2008.
159. Catholic Medical Center Annual Nephrology Conference, Seoul, Korea: "Dialytic Management of the Septic AKI Patient". Presented September 21, 2008.
160. Good Samaritan Hospital Nephrology Seminar, Cincinnati, OH: "Dialytic Management of AKI". Presented October 7, 2008.
161. Tampa General Hospital Nephrology Seminar, Tampa, FL: "Dialytic Management of AKI in the ICU: Recent Clinical Outcome Data". Presented October 14, 2008.
162. Asia Pacific Congress of Critical Care Medicine, Sydney, Australia: "The ATN Trial: Implications for Clinical Practice". Presented October 30, 2008.
163. Asia Pacific Congress of Critical Care Medicine, Sydney, Australia: "Renal Recovery After AKI: Clinical and Health Economic Implications". Presented October 30, 2008.
164. ExtraRenal Therapy in Intensive Care (ERTIC) congress, Paris, France: "Dialysis Dose in Practice". Presented December 12, 2008.
165. ExtraRenal Therapy in Intensive Care (ERTIC) congress, Paris, France: "Enhancements in Technology: Modified Membranes". Presented December 12, 2008.

166. Annual International Symposium on CRRT, San Diego, CA: "Operating Principles of CRRT". Presented February 25, 2009.
167. Annual International Symposium on CRRT, San Diego, CA: "Dialysis Dose Prescription and Delivery". Presented February 26, 2009
168. Australia New Zealand Intensive Care Society Annual Meeting, Noosa, Australia: "Why the RENAL Trial is Important and Needed". Presented March 13, 2009.
169. Blood Purification Conference, Jinan, China: "Extracorporeal Management of the Septic Patient". Presented March 15, 2009.
170. Blood Purification Conference, Jinan, China: "Update from the 2009 CRRT Conference: CRRT Dose". Presented March 15, 2009.
171. Critical Care Nephrology Conference, Wuhan, China: "Recent Clinical Advances in Managing Critically Ill Patients with AKI". Presented March 16, 2009.
172. Malaysian Society of Nephrology Annual Congress, Johor Bahru, Malaysia: "Staging of AKI: Does it Make a Difference?" Presented April 26, 2009.
173. Malaysian Society of Nephrology Annual Congress, Johor Bahru, Malaysia: "Improving Outcome of AKI in the ICU: Are we Getting Better?" Presented April 26, 2009.
174. Critical Care Nephrology Conference, Hangzhou, China: "CRRT vs IHD: A Critical Analysis". Presented May 9, 2009.
175. Critical Care Nephrology Conference, Hangzhou, China: "Highlights from the 2009 CRRT Conference". Presented May 9, 2009.
176. University of Minnesota Nephrology Conference, Minneapolis, MN: "Improving Outcomes of AKI in the ICU: Are We Getting Better?" Presented June 16, 2009.
177. North American Society for Dialysis and Transplantation Annual Meeting, Maui, Hawaii: "Dialytic Management of AKI in the ICU". Presented July 14, 2009.
178. North American Society for Dialysis and Transplantation Annual Meeting, Maui, Hawaii: "The Role of AKI in the Development of ESRD". Presented July 16, 2009.
179. Webinar: "Fluid Overload in Critically Ill Patients with AKI". Presented August 3, 2009.
180. Critical Care Conference, Auckland, New Zealand: "CRRT of SLED for AKI in the ICU?" Presented August 12, 2009.
181. International Society for Hemodialysis Annual Congress, Hong Kong, China: "The Role of Convection in Different Dialysis Modalities Used for AKI". Presented August 30, 2009.
182. International Society for Hemodialysis Annual Congress, Hong Kong, China: "Dose of CRRT: Does it Really Matter". Presented August 30, 2009.
183. Prince of Wales Hospital Clinical Conference, Hong Kong, China: "Extracorporeal Approaches to Immunomodulation in Septic Conditions". Presented August 31, 2009.
184. Critical Care Nephrology Conference, Seoul, Korea: "CRRT for the Management of Critically Ill Patients with AKI". Presented September 4, 2009.
185. Taiwan Society of Nephrology Annual Meeting, Tainan, Taiwan: "Recent Clinical Advances in the Management of Critically Ill Patients with Acute Kidney Injury". Presented December 13, 2009.
186. Asian Intensive Care Congress, Hong Kong, China: "Evidence-Based Management of Critically Ill Patients with Acute Kidney Injury". Presented December 14, 2009.

187. Annual Congress of SRLF, Paris, France: “Innovative Approaches to the Extracorporeal Management of Critically Ill Septic Patients”. Presented January 22, 2010.
188. UCLA Renal Conference, Los Angeles, CA: “Dialytic Management of Acute Kidney Injury”. Presented March 3, 2010.
189. Changi General Hospital Critical Care Conference, Singapore: “Update in Acute Kidney Injury”. Presented April 23, 2010.
190. Malaysian Society of Nephrology Annual Congress, Kuching, Malaysia: “Dialysis Dose in the Critically ill: Does It Really Matter?” Presented April 24, 2010.
191. Malaysian Society of Nephrology Annual Congress, Kuching, Malaysia: “Intermittent, SLED or Continuous: Which to Choose?” Presented April 24, 2010.
192. University of Missouri Renal Grand Rounds, Columbia, Missouri: “Dialytic Management of Critically Ill Patients with Acute Kidney Injury”. Presented May 24, 2010.
193. Hôpitaux Universitaires de Genève (HUG) Nephrology Conference, Geneva, Switzerland: “New Developments in CRRT and AKI”. Presented September 3, 2010.
194. Swiss Society of Intensive Care Medicine Annual Congress, Lausanne, Switzerland: “Do We Need CRRT Doses of 35 mL/kg/hr?” Presented September 4, 2010.
195. Swiss Society of Intensive Care Medicine Annual Congress, Lausanne, Switzerland: “Should We Stress Endotoxin or Cytokine Removal in Sepsis?” Presented September 4, 2010.
196. International Society of Blood Purification Annual Congress, Los Angeles, CA: “CRRT: It is Costly and We Don’t Have Many Nurses. When and Why Should We Use It?” Presented September 26, 2010.
197. Malaysian Society of Nephrology Critical Care Nephrology Post-Graduate Course, Kuala Lumpur, Malaysia: “Modality of RRT in ICU: Continuous, Intermittent or In-between?” Presented October 1, 2010.
198. Malaysian Society of Nephrology Critical Care Nephrology Post-Graduate Course, Kuala Lumpur, Malaysia: “What is the appropriate dose for CRRT?” Presented October 1, 2010.
199. Japanese Society of Acute Blood Purification, Yokohama, Japan: “Current status of acute blood purification in critical care in the world”. Presented October 23, 2010.
200. Japanese Society of Acute Blood Purification, Yokohama, Japan: “The RENAL Trial: More Evidence Supporting the Clinical Benefits of the AN69 Membrane for CRRT”. Presented October 24, 2010.
201. Iberian Meeting Advances in Intensive Care in Nephrology, Malaga, Spain: “What Does the Future Hold for Renal Replacement Therapy?” Presented November 23, 2010.
202. Hong Kong Society of Critical Care Medicine, Hong Kong, China: “The RENAL Trial: Clinical Outcomes”. Presented December 12, 2010.
203. Hong Kong Society of Critical Care Medicine, Hong Kong, China: “Extracorporeal Approaches to Immunomodulation in Septic Conditions”. Presented December 12, 2010.
204. Ohio State University Nephrology Conference, Columbus, OH: “Renal Replacement Therapy for Acute Kidney Injury”. Presented January 7, 2011.
205. International Society for Hemodialysis Annual Congress, New Delhi, India: “Extracorporeal Therapy of Sepsis”. Presented March 4, 2011.
206. International Society for Hemodialysis Annual Congress, New Delhi, India: “The Story of Membranes in Dialysis”. Presented March 4, 2011.

207. 18th International Intensive Care Symposium of the Turkish Society of Intensive Care Medicine, Istanbul, Turkey: "Choice of Modality and Timing of CRRT for Best Patient Outcome in Acute Kidney Injury." Presented April 30, 2011.
208. Chinese Society of Critical Care Medicine Annual Congress, Guangzhou, China: "Is your critically ill patient drowning?" Presented May 27, 2011.
209. Chinese Society of Critical Care Medicine Annual Congress, Guangzhou, China: "Non-renal application of CRRT: ADQI report" Presented May 27, 2011.
210. Chinese Society of Critical Care Medicine Annual Congress, Guangzhou, China: "Extracorporeal approaches to immunomodulation in septic conditions beyond the IVOIRE study" Presented May 27, 2011.
211. Annual Critical Care Conference in Thailand, Bangkok, Thailand: "Fluid Overload in Critical Illness". Presented July 13, 2012.
212. Annual Critical Care Conference in Thailand, Bangkok, Thailand: "New Trends in CRRT". Presented July 14, 2012.
213. Renal Support in the Critically Ill Conference, Melbourne, Australia: "Fluids and "Balance" – How Far Have We Come?" Presented July 17, 2012.
214. Cedar-Sinai Medical Center Renal Grand Rounds, Los Angeles, CA: "Renal Recovery After Acute Kidney Injury". Presented October 2, 2012.
215. London Acute Kidney Injury Network: AKI Academy, London, UK: "Innovative Extracorporeal Therapies in AKI". Presented November 30, 2012.
216. Renal Grand Rounds, VA Medical Center, San Antonio, Texas: "CRRT in the Management of Acute Kidney Injury". Presented February 6, 2013.
217. Annual Dialysis Conference, Seattle, WA: "Approach in the Management of Cardiorenal Syndrome". Presented March 11, 2013.
218. Annual Dialysis Conference, Seattle, WA: "A comparison of solute and fluid removal in different dialytic modalities". Presented March 11, 2013.
219. WCN AKI Satellite Symposium, Shanghai, China: "Renal Recovery After AKI: Clinical and Health Economic Considerations". Presented June 6, 2013.
220. International Course on Critical Care Nephrology, Vicenza, Italy: "The CRRT Machine: a multitasking platform?" Presented June 12, 2013.
221. International Course on Critical Care Nephrology, Vicenza, Italy: "New Membranes and their use in CRRT". Presented June 13, 2013.
222. Israeli Society of Critical Care Medicine, Haifa, Israel: "New Data About Citrate Anticoagulation in CRRT". Presented June 28, 2013.
223. International Society for Hemodialysis Annual Meeting, Shanghai, China: "Renal Recovery After Severe AKI Requiring RRT: New Clinical Findings". Presented September 12, 2014.
224. International Society for Hemodialysis Annual Meeting, Shanghai, China: "Health Economics of Severe AKI Requiring RRT". Presented September 12, 2014.
225. Japan Society for Blood Purification in Critical Care Annual Meeting, Chiba City, Japan: "Membrane Evolution in Acute Blood Purification: Beyond AKI". Presented October 10, 2014.
226. AKI Forum, Shanghai, China: "Renal Recovery After AKI". Presented March 29, 2015.

227. AKI Forum, Shanghai, China: “Drug Dosing During Acute RRT”. Presented March 29, 2015.
228. Critical Care Nephrology Course/International Critical Care Medicine Forum, Mexico City, Mexico: “Fluid Balance in CRRT”. Presented July 22, 2015.
229. Critical Care Nephrology Course/International Critical Care Medicine Forum, Mexico City, Mexico: “AKI and Long-Term Dialysis Dependence”. Presented July 22, 2015.
230. International Critical Care Medicine Forum, Mexico City, Mexico: “Fluid Balance in AKI Patients”. Presented July 23, 2015.
231. International Society for Hemodialysis Annual Meeting, Kuala Lumpur, Malaysia: “Treatment Options for Fluid Overload in Cardiorenal Syndrome”. Presented September 14, 2015.
232. International Society for Hemodialysis Annual Meeting, Kuala Lumpur, Malaysia: “Dialysis Dosing in AKI”. Presented September 15, 2015.
233. International Society for Hemodialysis Annual Meeting, Kuala Lumpur, Malaysia: “Drug Dosing During RRT for AKI”. Presented September 15, 2015.
234. University of Washington College of Engineering, Department of Mechanical Engineering Seminar Series, Seattle, WA: “Artificial Kidney: Clinical and Technological Overview”. Presented March 8, 2016.
235. International Renal Research Institute of Vicenza (IRRIV), Vicenza, Italy: “Management of Fluid Overload in Critically Ill Patients”. Presented July 28, 2016.
236. International Renal Research Institute of Vicenza (IRRIV), Vicenza, Italy: “RRT Dose in AKI: New Perspectives”. Presented August 1, 2016.
237. International Society for Blood Purification Annual Meeting, Hiroshima, Japan: “Membrane Evaluation in Acute Blood Purification”. Presented September 8, 2016.
238. International Society for Blood Purification Annual Meeting, Hiroshima, Japan: “What is the Best Kinetic Modeling Approach in Dialysis?” Presented September 8, 2016.
239. Annual Dialysis Conference, Long Beach, CA: “RRT Initiation in AKI: Early or Late?”. Presented March 12, 2017.
240. Annual Dialysis Conference, Long Beach, CA: “Managing Fluid Overload in the ICU”. Presented March 12, 2017.
241. Annual Dialysis Conference, Long Beach, CA: “The Future of Extracorporeal Therapies”. Presented March 13, 2017.
242. Annual Dialysis Conference, Long Beach, CA: “Advances in Hemodialysis Technology”. Presented March 13, 2017.
243. AKI Forum, Shanghai, China: “Future of Critical Care: Renal Support in 2027”. Presented April 1, 2017.
244. AKI Forum, Shanghai, China: “Dosing of CRRT: A Reappraisal”. Presented April 1, 2017.
245. Chinese Society of Critical Care Medicine Annual Meeting, Xi’an, China: “Septic AKI: What Happens to the Kidney?” Presented May 27, 2017.
246. Chinese Society of Critical Care Medicine Annual Meeting, Xi’an, China: “Blood Purification and Immune Regulation”. Presented May 27, 2017.
247. Chinese Society of Critical Care Medicine Annual Meeting, Xi’an, China: “Evolution of CRRT Over the Next Decade”. Presented May 27, 2017.
248. Chinese Society of Critical Care Medicine Annual Meeting, Xi’an, China: “Timing of RRT in AKI: Early or Late?”. Presented May 28, 2017.

249. International Course on Critical Care Nephrology, Vicenza, Italy: “Extracorporeal Membrane Separation Techniques for Sepsis”. Presented June 15, 2017.
250. International Society for Hemodialysis Annual Meeting, Bangkok, Thailand: “The Future of Critical Care: Renal Support in 2027”. Presented August 3, 2017.
251. International Society for Hemodialysis Annual Meeting, Bangkok, Thailand: “Evolution of Extracorporeal Organ Support in Critically Ill Patients”. Presented August 4, 2017.
252. 1st Asia Pacific AKI CRRT Conference, Kuala Lumpur, Malaysia: “Dialysis Dose in AKI”. Presented August 20, 2017.
253. 1st Asia Pacific AKI CRRT Conference, Kuala Lumpur, Malaysia: “The Future of Critical Care: Renal Support in 2027”. Presented August 20, 2017.
254. 1st Asia Pacific AKI CRRT Conference, Kuala Lumpur, Malaysia: “Integrating Multidisciplinary Support Team for CRRT Delivery”. Presented August 20, 2017.
255. Japanese Society for Artificial Organs Annual Meeting, Tokyo, Japan: “Hemodialysis Membranes: State of the Art Review”. Presented September 2, 2017.
256. Japanese Society for Artificial Organs Annual Meeting, Tokyo, Japan: “The Future of Critical Care: Renal Support in 2027”. Presented September 3, 2017.
257. Zhongshan Hospital/Fudan University Course on Quality in CRRT, Shanghai, China: “Establishing a Framework for Quality Metric Development in CRRT”. Presented September 17, 2017.
258. Zhongshan Hospital/Fudan University Course on Quality in CRRT, Shanghai, China: “Integrating Multidisciplinary Support Team for CRRT Delivery: Quality Considerations”. Presented September 17, 2017.
259. International Course on Critical Care Nephrology, Vicenza, Italy: “Membranes for CRRT”. Presented June 12, 2018.
260. International Course on Critical Care Nephrology, Vicenza, Italy: “Membrane and Filter-Related Problems in CRRT”. Presented June 14, 2018.
261. University of Washington Innovations in Dialysis/Expediting Advances Symposium: “Hemodialysis Membranes: State-of-the-Art”. Presented August 20, 2018.
262. Asia-Pacific AKI/CRRT Conference, Taipei, Taiwan: “Advances in CRRT: Where are We Today?” Presented September 23, 2018.
263. West Lake International Critical Care Blood Purification Conference, Hangzhou, China: “40 Years of CRRT: Membranes and Sorbents”. Presented November 3, 2018.
264. International Course on Critical Care Nephrology, Vicenza, Italy: “Membranes for CRRT”. Presented May 28, 2019.
265. International Course on Critical Care Nephrology, Vicenza, Italy: “Membrane and Filter-Related Problems in CRRT”. Presented May 30, 2019.
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