

## CURRICULUM VITAE

Steven L. Shafer, M.D.

### PERSONAL INFORMATION

Birth Date: April 24, 1954  
Place of Birth: Pasadena, California  
Marital Status: Married, Pamela Flood  
Children: Thomas James, born January 12, 1987  
Rebecca Anne, born September 21, 1991

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### EDUCATIONAL BACKGROUND

1972 - 1974	Princeton University	
1976 - 1978	Princeton University	A.B. 1978
1978 - 1983	Stanford University	M.D. 1983

### BOARD CERTIFICATIONS

1984	National Board of Medical Examiners
1987	American Board of Anesthesiology (#14784, Oct 30, 1987)
1995	American Board of Clinical Pharmacology

### PROFESSIONAL APPOINTMENTS

6/1987-6/2005	Staff Anesthesiologist, Palo Alto VA Medical Center
6/1987-5/1988	Clinical Instructor, Department of Anesthesia, Stanford University
5/1988-8/1994	Assistant Professor, Department of Anesthesia, Stanford University
9/1994-5/2000	Associate Professor, Department of Anesthesia, Stanford University
6/2000-9/2007	Professor, Department of Anesthesia, Stanford University
10/2007-6/2012	Professor, Department of Anesthesiology, Columbia University
2001-present	Adjunct Associate Professor of Bioengineering and Therapeutic Sciences, University of California at San Francisco
10/2007-6/2012	Adjunct Professor, Department of Anesthesia, Stanford University

7/2012-present Professor, Department of Anesthesiology, Perioperative and Pain Medicine, Stanford University

### **HONORS AND AWARDS**

1978 Summa Cum Laude, Department of Biology, Princeton University  
1978 Phi Beta Kappa Honorary Society  
1978 Sigma Xi Honorary Society  
1985 Chief Resident, Department of Anesthesia, University of Pennsylvania  
1988 Research Honors, Department of Anesthesia, Stanford University  
1990 Faculty Teaching Award, Department of Anesthesia, School of Medicine, Stanford University  
  
2003 Fellowship by Election, Royal College of Anaesthetists  
2004 Jobsen Visiting Professor, Sydney, Australia  
2005 Crawford Long Research Lecture, Emory University, Atlanta, GA  
2006 Bernard H. Eliasberg Medal, Mt. Sinai Medical Center, New York, NY  
2007 Rovenstine Lecture, Post Graduate Assembly, New York, NY  
2008 Virginia Apgar Lecture, Columbia University, New York, NY  
2008 Ellis Gillespie Lecture Annual Scientific Meeting of the Australian and New Zealand College of Anaesthetists  
  
2008 FAER Honorary Research Lecture, ASA Annual Meeting  
2008 Charles McLeskey Lecture, Society for Education in Anesthesia  
2008 Rank Visiting Lecturer, Royal College of Anaesthetists, United Kingdom  
2009 Corresponding Member, German Society of Anaesthesiology and Intensive Care Medicine  
  
2009 Stephen J. Prevoznik Lecture, Department of Anesthesiology, University of Pennsylvania  
  
2009 Ralph Waters Visiting Professor, University of Wisconsin, Madison, Wisconsin  
  
2009 R.W. Robertazzi Memorial Panel, Post Graduate Assembly, New York, NY  
  
2010 Founders Day Lecture, Northwestern University  
2010 Leon Goldberg Lecture, University of Chicago  
2010 Burnell Jose Visiting Professor, Adelaide, Australia  
2011 International Society of Anesthetic Pharmacology Lifetime Achievement Award for Outstanding Contributions in the Field of Anesthetic Pharmacology  
  
2011 Recognition Award for Outstanding Contributions to Clinical Pharmacology, Chilean Society of Anesthesiologists  
2011 Terry Davidson Plenary Lecture, International Congress of the Israel Society of Anesthesiologists  
  
2011 Inaugural Cecil Gray Lecture, Liverpool, England  
2011 Henry Rosenberg Lecture, Drexel University  
2011 Lifetime Achievement Award, International Society of Anesthetic Pharmacology

- 2011 Murray Mendelson Lecture, University of Toronto
- 2012 Honorary Fellow, College of Anaesthetists of Ireland
- 2012 Sir Ivan Magill Inaugural Lecture, Dublin, Ireland
- 2012 Reidenberg Lecture, Weill Cornell Medical Center
- 2013 Honorary Member, German Society of Anaesthesiology and Intensive Care Medicine
- 2013 Gold Medal, Royal College of Anaesthetists, London
- 2013 David M. Little Jr. Prize, Anesthesia History Association, San Francisco, (shared with George Bause, Douglas Bacon, Selma Calmes, James Edmonson, Kathryn McGoldrick, Kai Rehder, Alan Sessler, Peter Southorn, and Kenneth Tuman) for the December 2012 issue of *Anesthesia & Analgesia*: "The Giants Behind the Journal."
- 2013 Haugen Lecture, Oregon Health Sciences University, Portland, Oregon
- 2014 Joseph Priestly Lecture, Pennsylvania State / Hershey Medical Center
- 2015 Legends of Anesthesia Lecture, UT Southwestern
- 2015 Lewis Sheiner Award, International Society of Pharmacometrics, Washington, DC
- 2015 Ty Smith Lecture, Society of Technology in Anesthesia, San Diego, California
- 2015 Severinghaus Lecture, Annual Meeting of the American Society of Anesthesiologists, San Diego, California
- 2017 Van Bergen Lecture, Department of Anesthesiology, University of Minnesota, Minneapolis, MN

## **SCHOLARLY PUBLICATIONS**

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### **PEER-REVIEWED JOURNAL ARTICLES (ORIGINAL RESEARCH)**

1. Shafer A, Doze VA, Shafer SL, White PF. Pharmacokinetics and pharmacodynamics of propofol infusions during general anesthesia. *Anesthesiology*. 1988;69:348-56.
2. Shafer SL, Siegel LC, Cooke JE, Scott JC. Testing computer-controlled infusion pumps by simulation. *Anesthesiology*. 1988;68:261-6.
3. Siegel LC, Shafer SL, Martinez GM, Ream AK, Scott JC. Simultaneous measurements of cardiac output by thermodilution, esophageal Doppler, and electrical impedance in anesthetized patients. *J Cardiothorac Anesth*. 1988;2:590-5.
4. Varvel JR, Shafer SL, Hwang SS, Coen PA, Stanski DR. Absorption characteristics of transdermally administered fentanyl. *Anesthesiology*. 1989;70:928-34.
5. Siegel LC, Pearl RG, Shafer SL, Ream AK, Prielipp RC. The longitudinal distribution of pulmonary vascular resistance during unilateral hypoxia. *Anesthesiology*. 1989;70:527-32.
6. Gronert GA, White DA, Shafer SL, Matteo RS. Exercise produces sensitivity to metocurine. *Anesthesiology*. 1989;70:973-7.
7. Shafer SL, Varvel JR, Gronert GA. A comparison of parametric with semiparametric analysis of the concentration versus effect relationship of metocurine in dogs and pigs. *J Pharmacokinet Biopharm*. 1989;17:291-304.
8. Shafer SL, Varvel JR, Aziz N, Scott JC. Pharmacokinetics of fentanyl administered by computer-controlled infusion pump. *Anesthesiology*. 1990;73:1091-102.
9. Raemer DB, Buschman A, Varvel JR, Philip BK, Johnson MD, Stein DA, Shafer SL. The prospective use of population pharmacokinetics in a computer-driven infusion system for alfentanil. *Anesthesiology*. 1990;73:66-72. Erratum in: *Anesthesiology* 1990;73:798.
10. Maitre PO, Shafer SL. A simple pocket calculator approach to predict anesthetic drug concentrations from pharmacokinetic data. *Anesthesiology*. 1990;73:332-6.
11. Maitre PO, Bühner M, Shafer SL, Stanski DR. Estimating the rate of thiopental blood-brain equilibration using pseudo steady state serum concentrations. *J Pharmacokinet Biopharm*. 1990;18:175-87.
12. Jacobs JR, Shafer SL, Larsen JL, Hawkins ED. Two equally valid interpretations of the linear multicompartment mammillary pharmacokinetic model. *J Pharm Sci*. 1990;79:331-3.
13. Shafer SL, Varvel JR. Pharmacokinetics, pharmacodynamics, and rational opioid selection. *Anesthesiology*. 1991;74:53-63.

14. Bailey JM, Shafer SL. A simple analytical solution to the three-compartment pharmacokinetic model suitable for computer-controlled infusion pumps. *IEEE Trans Biomed Eng.* 1991;38:522-5.
15. Varvel JR, Donoho DL, Shafer SL. Measuring the predictive performance of computer-controlled infusion pumps. *J Pharmacokinet Biopharm.* 1992;20:63-94.
16. Shafer SL, Gregg KM. Algorithms to rapidly achieve and maintain stable drug concentrations at the site of drug effect with a computer-controlled infusion pump. *J Pharmacokinet Biopharm.* 1992;20:147-69.
17. Hung OR, Varvel JR, Shafer SL, Stanski DR. Thiopental pharmacodynamics. II. Quantitation of clinical and electroencephalographic depth of anesthesia. *Anesthesiology.* 1992;77:237-44.
18. Bühner M, Maitre PO, Hung OR, Ebling WF, Shafer SL, Stanski DR. Thiopental pharmacodynamics. I. Defining the pseudo-steady-state serum concentration-EEG effect relationship. *Anesthesiology.* 1992;77:226-36.
19. Gustafsson LL, Ebling WF, Osaki E, Harapat S, Stanski DR, Shafer SL. Plasma concentration clamping in the rat using a computer-controlled infusion pump. *Pharm Res.* 1992;9:800-7.
20. Gregg KM, Varvel JR, Shafer SL. Application of semilinear canonical correlation to the measurement of opioid drug effect. *J Pharmacokinet Biopharm.* 1992;20:611-35.
21. Egan TD, Lemmens HJ, Fiset P, Hermann DJ, Muir KT, Stanski DR, Shafer SL. The pharmacokinetics of the new short-acting opioid remifentanyl (GI87084B) in healthy adult male volunteers. *Anesthesiology.* 1993;79:881-92.
22. Dyck JB, Maze M, Haack C, Vuorilehto L, Shafer SL. The pharmacokinetics and hemodynamic effects of intravenous and intramuscular dexmedetomidine hydrochloride in adult human volunteers. *Anesthesiology.* 1993;78:813-20.
23. Dyck JB, Maze M, Haack C, Azarnoff DL, Vuorilehto L, Shafer SL. Computer-controlled infusion of intravenous dexmedetomidine hydrochloride in adult human volunteers. *Anesthesiology.* 1993;78:821-8.
24. Daunt DA, Dunlop CI, Chapman PL, Shafer SL, Ruskoaho H, Vakkuri O, Hodgson DS, Tyler LM, Maze M. Cardiopulmonary and behavioral responses to computer-driven infusion of detomidine in standing horses. *Am J Vet Res.* 1993;54:2075-82.
25. Zornow MH, Maze M, Dyck JB, Shafer SL. Dexmedetomidine decreases cerebral blood flow velocity in humans. *J Cereb Blood Flow Metab.* 1993;13:350-3.
26. Kataria BK, Ved SA, Nicodemus HF, Hoy GR, Lea D, Dubois MY, Mandema JW, Shafer SL. The pharmacokinetics of propofol in children using three different data analysis approaches. *Anesthesiology.* 1994;80:104-22.
27. Lemmens HJ, Dyck JB, Shafer SL, Stanski DR. Pharmacokinetic-pharmacodynamic modeling in drug development: application to the investigational opioid trefentanyl. *Clin Pharmacol Ther.* 1994;56:261-71.

28. Eisenach JC, Shafer SL, Bucklin BA, Jackson C, Kallio A. Pharmacokinetics and pharmacodynamics of intraspinal dexmedetomidine in sheep. *Anesthesiology*. 1994;80:1349-59.
29. Youngs EJ, Shafer SL. Pharmacokinetic parameters relevant to recovery from opioids. *Anesthesiology*. 1994;81:833-42. Erratum in: *Anesthesiology* 1995;82:326.
30. Hu C, Lovejoy WS, Shafer SL. An efficient control strategy for dosage regimens. *J Pharmacokinet Biopharm*. 1994;22:73-94.
31. Hu C, Lovejoy WS, Shafer SL. Comparison of some control strategies for three-compartment PK/PD models. *J Pharmacokinet Biopharm*. 1994;22:525-50.
32. Chaplan SR, Bach FW, Shafer SL, Yaksh TL. Prolonged alleviation of tactile allodynia by intravenous lidocaine in neuropathic rats. *Anesthesiology*. 1995;83:775-85.
33. Gepts E, Shafer SL, Camu F, Stanski DR, Woestenborghs R, Van Peer A, Heykants JJ. Linearity of pharmacokinetics and model estimation of sufentanil. *Anesthesiology*. 1995;83:1194-204.
34. Gambús PL, Gregg KM, Shafer SL. Validation of the alfentanil canonical univariate parameter as a measure of opioid effect on the electroencephalogram. *Anesthesiology*. 1995;83:747-56.
35. Fiset P, Mathers L, Engstrom R, Fitzgerald D, Brand SC, Hsu F, Shafer SL. Pharmacokinetics of computer-controlled alfentanil administration in children undergoing cardiac surgery. *Anesthesiology*. 1995;83:944-55.
36. Hung OR, Whynot SC, Varvel JR, Shafer SL, Mezei M. Pharmacokinetics of inhaled liposome-encapsulated fentanyl. *Anesthesiology*. 1995;83:277-84.
37. Fiset P, Lemmens HL, Egan TD, Shafer SL, Stanski DR. Pharmacodynamic modeling of the electroencephalographic effects of flumazenil in healthy volunteers sedated with midazolam. *Clin Pharmacol Ther*. 1995;58:567-82.
38. Eisenach JC, Hood DD, Tuttle R, Shafer S, Smith T, Tong C. Computer-controlled epidural infusion to targeted cerebrospinal fluid concentrations in humans. *Clonidine*. *Anesthesiology*. 1995;83:33-47.
39. Fiset P, Cohane C, Browne S, Brand SC, Shafer SL. Biopharmaceutics of a new transdermal fentanyl device. *Anesthesiology*. 1995;83:459-69.
40. Billard V, Gambus PL, Barr J, Minto CF, Corash L, Tessman JW, Stickney JL, Shafer SL. The pharmacokinetics of 8-methoxypsoralen following i.v. administration in humans. *Br J Clin Pharmacol*. 1995;40:347-60.
41. Gronert GA, Fung DL, Jones JH, Shafer SL, Hildebrand SV, Disbrow EA. Allometry of pharmacokinetics and pharmacodynamics of the muscle relaxant metocurine in mammals. *Am J Physiol*. 1995;268(1 Pt 2):R85-91.

42. Egan TD, Minto CF, Hermann DJ, Barr J, Muir KT, Shafer SL. Remifentanyl versus alfentanil: comparative pharmacokinetics and pharmacodynamics in healthy adult male volunteers. *Anesthesiology*. 1996;84:821-33.
43. Bailey JM, Mora CT, Shafer SL. Pharmacokinetics of propofol in adult patients undergoing coronary revascularization. The Multicenter Study of Perioperative Ischemia Research Group. *Anesthesiology*. 1996;84:1288-97.
44. Schnider TW, Gaeta R, Brose W, Minto CF, Gregg KM, Shafer SL. Derivation and cross-validation of pharmacokinetic parameters for computer-controlled infusion of lidocaine in pain therapy. *Anesthesiology*. 1996;84:1043-50.
45. Schnider TW, Minto CF, Fiset P, Gregg KM, Shafer SL. Semilinear canonical correlation applied to the measurement of the electroencephalographic effects of midazolam and flumazenil reversal. *Anesthesiology*. 1996;84:510-9.
46. Ginsberg B, Howell S, Glass PS, Margolis JO, Ross AK, Dear GL, Shafer SL. Pharmacokinetic model-driven infusion of fentanyl in children. *Anesthesiology*. 1996;85:1268-75.
47. Hung OR, Dyck JB, Varvel J, Shafer SL, Stanski DR. Comparative absorption kinetics of intramuscular midazolam and diazepam. *Can J Anaesth*. 1996;43:450-5.
48. Hu CP, Lovejoy WS, Shafer SL. Comparison of some suboptimal control policies in medical drug therapy OPERATIONS RESEARCH 1996;44:696-709
49. Minto CF, Schnider TW, Egan TD, Youngs E, Lemmens HJ, Gambus PL, Billard V, Hoke JF, Moore KH, Hermann DJ, Muir KT, Mandema JW, Shafer SL. Influence of age and gender on the pharmacokinetics and pharmacodynamics of remifentanyl. I. Model development. *Anesthesiology*. 1997;86:10-23.
50. Minto CF, Schnider TW, Shafer SL. Pharmacokinetics and pharmacodynamics of remifentanyl. II. Model application. *Anesthesiology*. 1997;86:24-33.
51. Billard V, Gambus PL, Chamoun N, Stanski DR, Shafer SL. A comparison of spectral edge, delta power, and bispectral index as EEG measures of alfentanil, propofol, and midazolam drug effect. *Clin Pharmacol Ther*. 1997;61:45-58.
52. Plunkett JJ, Reeves JD, Ngo L, Bellows W, Shafer SL, Roach G, Howse J, Herskowitz A, Mangano DT. Urine and plasma catecholamine and cortisol concentrations after myocardial revascularization. Modulation by continuous sedation. Multicenter Study of Perioperative Ischemia (McSPI) Research Group, and the Ischemia Research and Education Foundation (IREF). *Anesthesiology*. 1997;86:785-96.
53. Schnider TW, Minto CF, Gambus PL, Andresen C, Goodale DB, Shafer SL, Youngs EJ. The influence of method of administration and covariates on the pharmacokinetics of propofol in adult volunteers. *Anesthesiology*. 1998;88:1170-82.
54. Somma J, Donner A, Zomorodi K, Sladen R, Ramsay J, Geller E, Shafer SL. Population pharmacodynamics of midazolam administered by target controlled infusion in SICU patients after CABG surgery. *Anesthesiology*. 1998;89:1430-43.

55. Zomorodi K, Donner A, Somma J, Barr J, Sladen R, Ramsay J, Geller E, Shafer SL. Population pharmacokinetics of midazolam administered by target controlled infusion for sedation following coronary artery bypass grafting. *Anesthesiology*. 1998;89:1418-29.
56. Shafer SL, Eisenach JC, Hood DD, Tong C. Cerebrospinal fluid pharmacokinetics and pharmacodynamics of intrathecal neostigmine methylsulfate in humans. *Anesthesiology*. 1998;89:1074-88.
57. Gambús PL, Schnider TW, Minto CF, Youngs EJ, Billard V, Brose WG, Hochhaus G, Shafer SL. Pharmacokinetics of intravenous dynorphin A(1-13) in opioid-naïve and opioid-treated human volunteers. *Clin Pharmacol Ther*. 1998;64:27-38.
58. Angst MS, Dyck JB, Azarnoff DL, Goldblum R, Ho B, Gfroerer T, Linton EA, Glynn BP, Shafer SL. Pharmacokinetics, cortisol release, and hemodynamics after intravenous and subcutaneous injection of human corticotropin-releasing factor in humans. *Clin Pharmacol Ther*. 1998;64:499-510.
59. Schnider TW, Shafer SL. Evolving clinically useful predictors of recovery from intravenous anesthetics. *Anesthesiology*. 1995;83:902-5.
60. Schnider TW, Minto CF, Shafer SL, Gambus PL, Andresen C, Goodale DB, Youngs EJ. The influence of age on propofol pharmacodynamics. *Anesthesiology*. 1999;90:1502-16.
61. Struys MM, De Smet T, Depoorter B, Versichelen LF, Mortier EP, Dumortier FJ, Shafer SL, Rolly G. Comparison of plasma compartment versus two methods for effect compartment--controlled target-controlled infusion for propofol. *Anesthesiology*. 2000;92:399-406.
62. Bruhn J, Bouillon TW, Shafer SL. Electromyographic activity falsely elevates the bispectral index. *Anesthesiology*. 2000;92:1485-7.
63. Minto CF, Schnider TW, Short TG, Gregg KM, Gentilini A, Shafer SL. Response surface model for anesthetic drug interactions. *Anesthesiology*. 2000;92:1603-16.
64. Dershwitz M, Walsh JL, Morishige RJ, Connors PM, Rubsamen RM, Shafer SL, Rosow CE. Pharmacokinetics and pharmacodynamics of inhaled versus intravenous morphine in healthy volunteers. *Anesthesiology*. 2000;93:619-28.
65. Pollak PT, Bouillon T, Shafer SL. Population pharmacokinetics of long-term oral amiodarone therapy. *Clin Pharmacol Ther*. 2000;67:642-52.
66. Lameh J, Wang P, Elgart D, Meredith D, Shafer SL, Loew GH. Unraveling the identity of benzodiazepine binding sites in rat hippocampus and olfactory bulb. *Eur J Pharmacol*. 2000;400:167-76.
67. Sinnott CJ, Garfield JM, Zeitlin A, Teo S, Mingdon W, Chen JH, Shafer SL, Strichartz GR. Enantioselective relief of neuropathic pain by systemic mexiletine in the rat. *The Journal of Pain* 2000;1:128-137
68. Lameh J, Wang P, Meredith D, Shafer SL, Loew GH. Characterization of benzodiazepine receptors in the cerebellum. *Prog Neuropsychopharmacol Biol Psychiatry*. 2000;24:979-91.

69. Bruhn J, Bouillon TW, Shafer SL. Bispectral index (BIS) and burst suppression: revealing a part of the BIS algorithm. *J Clin Monit Comput.* 2000;16:593-6.
70. Barr J, Zomorodi K, Bertaccini EJ, Shafer SL, Geller E. A double-blind, randomized comparison of i.v. lorazepam versus midazolam for sedation of ICU patients via a pharmacologic model. *Anesthesiology.* 2001;95:286-98.
71. Barr J, Egan TD, Sandoval NF, Zomorodi K, Cohane C, Gambus PL, Shafer SL. Propofol dosing regimens for ICU sedation based upon an integrated pharmacokinetic-pharmacodynamic model. *Anesthesiology.* 2001;95:324-33.
72. Bruhn J, Bouillon TW, Shafer SL. Onset of propofol-induced burst suppression may be correctly detected as deepening of anaesthesia by approximate entropy but not by bispectral index. *Br J Anaesth.* 2001;87:505-7.
73. Hambleton J, Wages D, Radu-Radulescu L, Adams M, MacKenzie M, Shafer S, Lee M, Smyers J, Wiesehahn G, Corash L. Pharmacokinetic study of FFP photochemically treated with amotosalen (S-59) and UV light compared to FFP in healthy volunteers anticoagulated with warfarin. *Transfusion.* 2002;42:1302-7.
74. Bouillon T, Bruhn J, Radu-Radulescu L, Bertaccini E, Park S, Shafer S. Non-steady state analysis of the pharmacokinetic interaction between propofol and remifentanyl. *Anesthesiology.* 2002;97:1350-62.
75. Short TG, Ho TY, Minto CF, Schnider TW, Shafer SL. Efficient trial design for eliciting a pharmacokinetic-pharmacodynamic model-based response surface describing the interaction between two intravenous anesthetic drugs. *Anesthesiology.* 2002;96:400-8.
76. Bruhn J, Bouillon TW, Hoeft A, Shafer SL. Artifact robustness, inter- and intraindividual baseline stability, and rational EEG parameter selection. *Anesthesiology.* 2002;96:54-9.
77. Bruhn J, Bouillon TW, Radulescu L, Hoeft A, Bertaccini E, Shafer SL. Correlation of approximate entropy, bispectral index, and spectral edge frequency 95 (SEF95) with clinical signs of "anesthetic depth" during coadministration of propofol and remifentanyl. *Anesthesiology.* 2003;98:621-7.
78. Minto CF, Schnider TW, Gregg KM, Henthorn TK, Shafer SL. Using the time of maximum effect site concentration to combine pharmacokinetics and pharmacodynamics. *Anesthesiology.* 2003;99:324-33.
79. Bouillon T, Bruhn J, Radu-Radulescu L, Andresen C, Cohane C, Shafer SL. A model of the ventilatory depressant potency of remifentanyl in the non-steady state. *Anesthesiology.* 2003;99:779-87.
80. Eisenach JC, Hood DD, Curry R, Shafer SL. Cephalad movement of morphine and fentanyl in humans after intrathecal injection. *Anesthesiology.* 2003;99:166-73.
81. Eger EI 2nd, Xing Y, Pearce R, Shafer S, Laster MJ, Zhang Y, Fanselow MS, Sonner JM. Isoflurane antagonizes the capacity of flurothyl or 1,2-dichlorohexafluorocyclobutane to impair fear conditioning to context and tone. *Anesth Analg.* 2003;96:1010-8.

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83. Nava-Ocampo AA, Shafer SL, Velázquez-Armenta Y, Ruiz-Velazco S, Toni B. Mathematical analysis of a pharmacodynamic model without plasma concentrations to extend its applicability. *Med Hypotheses*. 2003;60:453-7.
84. Liao G, Wang J, Guo J, Allard J, Cheng J, Ng A, Shafer S, Puech A, McPherson JD, Foernzler D, Peltz G, Usuka J. In silico genetics: identification of a functional element regulating H2-Ealpha gene expression. *Science*. 2004;306:690-5.
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88. Kreuer S, Bruhn J, Larsen R, Grundmann U, Shafer SL, Wilhelm W. Application of Bispectral Index and Narcotrend index to the measurement of the electroencephalographic effects of isoflurane with and without burst suppression. *Anesthesiology*. 2004;101:847-54.
89. Pollak PT, Shafer SL. Use of population modeling to define rational monitoring of amiodarone hepatic effects. *Clin Pharmacol Ther*. 2004;75:342-51.
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91. Bouillon T, Bruhn J, Radu-Radulescu L, Andresen C, Cohane C, Shafer SL. Mixed-effects modeling of the intrinsic ventilatory depressant potency of propofol in the non-steady state. *Anesthesiology*. 2004;100:240-50.
92. Van Poucke GE, Bravo LJ, Shafer SL. Target controlled infusions: targeting the effect site while limiting peak plasma concentration. *IEEE Trans Biomed Eng*. 2004;51:1869-75.
93. Pollak PT, Shafer SL. Teaching application of clinical pharmacology skills using unusual observations from clozapine overdoses. *J Clin Pharmacol*. 2004;44:141-9.
94. Tzabazis A, Klyukin M, Manering N, Nemenov MI, Shafer SL, Yeomans DC. Differential activation of trigeminal C or Adelta nociceptors by infrared diode laser in rats: behavioral evidence. *Brain Res*. 2005;1037:148-56.

95. Hu C, Horstman DJ, Shafer SL. Variability of target-controlled infusion is less than the variability after bolus injection. *Anesthesiology*. 2005;102:639-45.
96. Karmakar MK, Ho AM, Law BK, Wong AS, Shafer SL, Gin T. Arterial and venous pharmacokinetics of ropivacaine with and without epinephrine after thoracic paravertebral block. *Anesthesiology*. 2005;103:704-11.
97. Guo Y, Shafer S, Weller P, Usuka J, Peltz G. Pharmacogenomics and drug development. *Pharmacogenomics*. 2005;6:857-64.
98. Eger EI 2nd, Shafer S. The complexity of recovery from anesthesia. *J Clin Anesth*. 2005;17:411-2.
99. Petroz GC, Sikich N, James M, van Dyk H, Shafer SL, Schily M, Lerman J. A phase I, two-center study of the pharmacokinetics and pharmacodynamics of dexmedetomidine in children. *Anesthesiology*. 2006;105:1098-110.
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102. Hendrickx JF, Lemmens HJ, Shafer SL. Do distribution volumes and clearances relate to tissue volumes and blood flows? A computer simulation. *BMC Anesthesiol*. 2006 Jun 13;6:7.
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106. Kern SE, Allen J, Wagstaff J, Shafer SL, Yaksh T. The pharmacokinetics of the conopeptide contulakin-G (CGX-1160) after intrathecal administration: an analysis of data from studies in beagles. *Anesth Analg*. 2007;104:1514-20.
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5. Howell S, Shafer SL, Reves JG, Sladen R. Clinical drug level predictions and practice. *Int Anesthesiol Clin*. 1995;33:91-100.
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17. Egan TD, Shafer SL. Target-controlled infusions for intravenous anesthetics: surfing USA not! *Anesthesiology*. 2003;99:1039-41.
18. Sani O, Shafer SL. MAC Attack? *Anesthesiology*. 2003;99:1249-50.
19. Shafer SL. Shock values. *Anesthesiology*. 2004;101:567-8.
20. Shafer SL. Safety of patients reason for FDA black box warning on droperidol. *Anesth Analg*. 2004;98:551-2.
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22. Eger EI 2nd, Shafer SL. Tutorial: context-sensitive decrement times for inhaled anesthetics. *Anesth Analg*. 2005;101:688-96.
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26. Shafer SL. Thank you, Ron Miller. *Anesth Analg*. 2006;102:982-983.
27. Shafer SL. Anesthesia & Analgesia's policy on off-label drug administration in clinical trials. *Anesth Analg* 2007;105:13-15
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29. Shafer SL. Occam's razor. *Anesth Analg*. 2007;104:1597-8.
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49. Shafer SL. Caveat Lector. *Anesth Analg* 2012;114:1160-2.
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3. Shafer SL. Administration des morphiniques en *bolus* ou en perfusion continue: mode d'utilisation spécifique de l'alfentanyl. in *Les Morphiniques*, pages 185-202, M. Chauvin ed. Paris, 1993
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5. Shafer SL. Pharmacokinetics and pharmacodynamics in the aged. *Geriatric Anesthesia*. Ed: C. McLeskey. Chapter 10, pp 123-142, 1996
6. Billard V, Shafer SL. Does the EEG measure therapeutic opioid drug effect? In *Control and Automation in Anaesthesia*. pp 79-95, H. Schwilden, H. Stoeckel, ed., 1995
7. Youngs E, Shafer SL. Basic pharmacokinetic and pharmacodynamic principles. Chapter 19, pp 319-331. In *Ambulatory Anesthesia and Medicine*. Ed: P. White. W.B. Saunders, 1997
8. Youngs E, Shafer SL. Basic pharmacokinetic and pharmacodynamic principles. Chapter 2, pp 10-26, in *Intravenous Anesthesia*. Ed: P. White. Williams and Wilkins, 1997
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12. Howell SH, and Shafer SL. Chapter 3, Basics of Pharmacokinetics and Pharmacodynamics. In *Atlas of Clinical Anesthesiology*, Ed. R Miller Current Medicine 1998
13. Shafer SL. Target controlled infusions: advance or gimmick? In *New Balanced Anesthesia*, Ed: K Mori et al, Elsevier, Amsterdam, 1998
14. Shafer SL. Clinical signs and drug concentrations: what really predicts depth of anesthesia? In *New Balanced Anesthesia*, Ed: K Mori et al, Elsevier, Amsterdam, 1998
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22. Schwinn DA, Shafer SL. Basic Principles of Pharmacology Related to Anesthesia. *Anesthesia*, 6<sup>th</sup> Edition. Ed: Ronald Miller. 2004
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29. Gelb AW, Leslie K, Stanski DR, Shafer SL. Measuring Depth of Anesthesia. *Anesthesia*, 7<sup>th</sup> Edition. Ed: Ronald Miller. 2009

## **Books**

1. Flood P, Rathmell J, Shafer SL. Eds. *Stoelting's Physiology and Pharmacology in Anesthesia Practice*, 5<sup>th</sup> Edition. 2015

**MISCELLANEOUS PUBLICATIONS**

1. Shafer S, Shafer A, Foxlee H, Prust R. Aesculapius: Implementation of a knowledge base on a microcomputer. Proceedings of the First Annual Medcomp Conference, Philadelphia, 1982.
2. Shafer S, Prust R, Foxlee H, Shafer A. Preliminary experience with Aesculapius. Proceedings of the First Annual AAMSI Conference, Washington D.C., 1982.
3. Shafer SL, Stanski DR. New Intravenous Hypnotics. ASA Refresher Course Book. 1990
4. Shafer SL, Kern S, Stanski DR. The Scientific Basis of Infusion Techniques in Anesthesia. CR. Bard, Inc., 1990
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6. McLeskey CH, Shafer SL. Current Insights: Transdermal Opioids. In Literature Scan: Anesthesiology 5:2-3, 1991
7. Shafer SL. New Intravenous Anesthetics: Remifentanyl. ASA Refresher Courses, Chapter 19, Lippincott Raven, 1996.
8. Billard V, Mavoungou P, Shafer SL. Bases pharmacocinétiques et pharmacodynamiques des perfusions à objectif de concentration. In Nouvelles Techniques en Anesthésie Générale, JEPU 1998 Proceedings, pp 15-52. CRI, 1998
9. Shafer SL. Anesthesia in the Future. In Nouvelles Techniques en Anesthésie Générale, JEPU 1998 Proceedings, pp 171-176. CRI, 1998
10. Shafer SL, Billard V. Repenser la médecine avec un sens critique. Les Aspects Économiques de l'Anesthésie. JEPU 19-25, 2000.
11. Shafer SL, Billard V. Pharmacologie des agents anesthésiques chez les patients âgés. L'anesthésie du Sujet Agé. JEPU 325-351, 2000

**DIGITAL PUBLICATIONS**

1. STANPUMP, a program to administer intravenous drugs to rapidly achieve and steady concentrations in the plasma and at the site of drug effect. STANPUMP is public domain software, available at <http://opentci.org/code/stanpump>. The STANPUMP code is the computational engine used in all commercially available TCI (“target controlled infusion”) drug delivery systems worldwide
2. stanpumpR (<https://steveshafer.shinyapps.io/stanpumpR/>)

**PATENTS**

1. Vally JM, Diamondstone LS, Hartlaub J, Lee GE, Shafer S. Systems and Methods for Performing Temporal Logic Queries. Patent 6,732,093, issued May 4, 2004
2. Shafer SL, Hung RO, Pliura DH. Opioid Delivery System. Patents 7,648,981, and 7,648,982, issued January 19, 2010

**GITHUB**

1. <https://github.com/StevenLShafer/stanpumpR>. Open-source software for pharmacokinetic / pharmacodynamic simulation.
2. <https://github.com/StevenLShafer/COVID19>. Open-source software for ongoing COVID-19 analysis, based on data from usafacts.org, Our World in Data, and the COVID-19 Data Repository by the Center for Systems Science and Engineering at Johns Hopkins University.

## **GRANTS**

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### **Current**

#### **Prevention of Neonatal Opioid Withdrawal Syndrome**

2R01HD070795-06 2019-2024, PI: Gary Peltz

Co Investigator, 15% FTE salary support

#### **Safety and Efficacy of TRP V1 Agonists**

Sponsor: Concentric Analgesics. 2019-2022, PI: Steven Shafer

15% FTE salary support

### **Pending**

Oxytocin: a pain disease-modifying agent in the nervous system after injury

NIH/NINDS PO-1

20% FTE

### **Prior (peer reviewed only)**

#### **Computer-Assisted Infusion of Drugs**

VA Merit Review (Three competitive renewals)

Award Period: April 1989 – March, 2000

PI: Steven L. Shafer, M.D.

#### **The EEG as a Predictor of Hemodynamic Responsiveness during General Anesthesia**

Starter Grant, American Society of Anesthesiologists

Award Date: November, 1987

PI: Steven L. Shafer, M.D.

#### **Molecular modeling, design, and evaluation of benzodiazepine ligands.**

R01 DA06304-08, P.I.: Loew GH. Molecular Research Institute

Co-Investigator, 5% effort:

#### **Novel Anesthetic Drug Delivery System**

1 R44 AG16168-01 (SBIR), P.I. Gargano, D, Harvard Clinical Technologies

Consultant (and author)

#### **Pharmacogenetic Analysis in Mice**

(1R01GM068885-01A1) PI: Gary Peltz

Consultant

#### **Sites and Mechanisms of Inhaled Anesthetic Actions**

5 P01 GM047818-15, PI: Ted Eger

Consultant

**Pediatric Off-Patent Drug Study Center for Sodium Nitroprusside**

RFP-NICHD-2003-09, PI: Gregory Hammer

Consultant

**SERVICE**

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**EDITORIAL SERVICE**

1996 – 1997	Editor, Clinical Pharmacokinetics
1998 – 1999	Associate Editor, Anesthesiology
2003 – 2005	Editor, Anesthesiology
1998 – 2008	Editor, Clinical Pharmacology and Therapeutics
2000 – 2006	Editor, Journal of Pharmacokinetics and Biopharmaceutics
2005 – 2006	Incoming Editor-in-Chief, Anesthesia and Analgesia
2006 – 2016	Editor-in-Chief, Anesthesia and Analgesia
2006 – Present	Editor, British Journal of Anaesthesia
2009 – Present	Advisory Board, Journal of Anesthesia (Japan Society of Anesthesiologists).
2015-Present	Editor, Journal of Pediatric Anesthesiology
1/2020 – Present	Editor-in-Chief, ASA Monitor

**SERVICE AS GRANT REVIEW**

1993 – 1997	Pharmacological Sciences Review Committee of the National Institute of General Medical Sciences
1994 – 1998	American Society of Anesthesiologists: Committee on Research
1995 – 1999	Department of Veterans Affairs Merit Review Committee for Alcoholism and Drug Dependence

**UNIVERSITY ADMINISTRATIVE SERVICE**

1990-2000	Undergraduate Advisor, Stanford University
1996-2007	Member, Committee on Research, Department of Anesthesia

1999, 2002-2006  
2012-Present

Member, Administrative Panel on Human Subjects in Medical Research

2016-present

Research Advisor, Multispecialty Group, Department of Anesthesiology, Perioperative and Pain Medicine

#### **SERVICE TO PROFESSIONAL ORGANIZATIONS**

1992 – 2006

American Society of Anesthesiologists: Committee on Drug Disposition, (Chair, 1997, 2000-2005)

1992 – 2016

Board of Directors, International Society of Anesthetic Pharmacology  
Program Chair, Annual Meeting, 1993, 2003, 2004  
Vice President, 1998, 2003  
President-Elect, 1999, 2004  
Ex-Officio – 2005 to 2016

2002 – 2006

Anesthetic & Life Support Advisory Committee, FDA

2004 – Present

Academy of Anesthesia Mentors

2007 – 2010

Vice President, World Society of Intravenous Anesthesia

2012 – Present

Expert Reviewer, Medical Board of California

2012 – 2013

Director, World Association of Medical Editors

2012 – 2013

Council Member, Committee on Publication Ethics

2015-present

Director, The Center for Scientific Integrity

2016-present

Member, Publications Committee, American Society of Anesthesiologists

2017-present

Board of Directors, Foundation for Anesthesia Education and Research

2017-present

Chair, Committee on Development, Foundation for Anesthesia Education and Research

2018-present

Steering committee, Gates Foundation Program for Neuroimaging in Childhood Development

**PRESENTATIONS (SELECTED)**

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**National**

- December 1987      Using computers to implement pharmacological concepts. Post Graduate Assembly. New York, NY.
- October 1989      Opioid selection in anesthesia, Annual Meeting of the American Society of Anesthesiologists, New Orleans, CA.
- December 1989      The clinical role of computer controlled infusion pumps, Post Graduate Assembly, New York, NY.
- March 1990        The new sedatives/hypnotics/tranquilizers: how safe are they? Annual Meeting of the California Medical Association. Anaheim, CA.
- May 1990          Targeting the effect site with computer controlled infusion. Biomedical Simulations Resource Workshop. Marina Del Rey, CA
- September 1990    "Reverse Nonlinear Regression:" Using nonlinear regression to design drug dosing regimens. Food and Drug Administration, Rockville, MD
- October 1990      New intravenous anesthetics. ASA Refresher Course. ASA Annual Meeting. Las Vegas, NV
- October 1990      Designing intravenous infusion regimens. ASA Annual Meeting. Las Vegas, NV
- July 1991          Implications of pharmacokinetic studies to tailoring opioid use. The Use of Fentanyl Series in Pain Management. New York, NY
- October 1991      Intravenous anesthesia, techniques and new drugs. ASA Refresher Course, San Francisco, CA
- May 1992          Application of semilinear canonical correlation to the measurement of opioid drug effect on the human EEG. International Pharmaco-EEG Society, Boca Raton, Florida.
- September 1992    Pharmacokinetic modeling is essential in drug development. Symposium in pharmacodynamic modeling, American College of Clinical Pharmacology, Washington DC
- February 1994      Introduction to Pharmacokinetics and Pharmacodynamics. Pharmacology 201. Harvard University, Boston, MA

- May 1994 Debate: NONMEM vs Pooled Data vs Two Stage modeling for pharmacokinetic parameter estimation. Symposium on Pharmacokinetics and Pharmacodynamics in Anesthesia. Chicago, IL
- October 1994 Debate: Does the EEG reflect the action of anesthetic drugs on the central nervous system. Society of Intravenous Anesthesia Annual Meeting, San Francisco, CA
- December 1994 The First and Last International Workshop on User-Hostile Pharmacokinetic Software. Palo Alto, CA
- March 1995 Advanced Pharmacokinetics Workshop. Annual Meeting of the American Society of Clinical Pharmacokinetics and Therapeutics. San Diego, CA
- March 1995 Analgesics Workshop. Annual Meeting of the American Society of Clinical Pharmacokinetics and Therapeutics. San Diego, CA
- May 1995 Control and Modeling in Anesthesia. Biomedical Simulations Resource Workshop. Marina del Rey, California
- May 1996 Measuring Depth of Anesthesia. Department of Laboratory Medicine, UCSF
- October 1996 How to Excel at Mixed Effects Modeling. Devices and Radiological Health Division, FDA, Shady Grove, MD.
- October 1996 Pharmacokinetics and pharmacodynamics in drug development, USUHS, Bethesda, MD
- May 1997 The pharmacokinetics of spinally administered drugs, Workshop on Spinal Drug Delivery, San Diego, CA
- June 1997 The use of high-resolution pharmacokinetic and pharmacodynamic studies in Phase I research to guide Phase II and Phase III research. Drug Development Workshop, Center for Drug Development Science, Palo Alto, CA
- August 1998 Overview of the clinical utility of surrogate markers and pharmacodynamics. Annual Meeting, American Association of Clinical Chemistry. Chicago
- September 1998 Remifentanyl – application of pharmacokinetics and pharmacodynamics to drug development. Annual Meeting, American Association of Pharmaceutical Scientists, Arlington, VA.

- May 2000 Panel on Health Care and Medicine in the Digital Age: Yielding Better Information, Smarter Systems, and Unparalleled Treatments for Disease. E-Health Forum, Stanford University, Stanford, CA
- October 2001 Visualization of Response Surfaces. International Society of Anesthetic Pharmacology. New Orleans, LA
- September 2004 NONMEM Workshop, Palo Alto, CA
- November 2004 Models of Drug Interaction, Food and Drug Administration, Rockville, MD
- November 2004 The Scientific and Clinical Basis of Target Controlled Drug Delivery, Food and Drug Administration, Rockville, MD
- January 2005 Intermediate Workshop in Pharmacokinetic and Pharmacodynamic Modeling with NONMEM, Princeton, NJ
- March 2005 The future of analgesic pharmacology. 79<sup>th</sup> Congress of the International Anesthesia Research Society, Honolulu, HI
- May 2005 Limitations of Awareness Monitoring. Pediatric Awareness Meeting, Boston, MA
- September 2005 Advanced Workshop in Pharmacokinetic and Pharmacodynamic Modeling with NONMEM. Newark, NJ
- January 2006 Advanced Workshop in Pharmacokinetic and Pharmacodynamic Modeling with NONMEM. San Francisco, CA
- March 2006 The Future of Anesthetic Drug Development, Emory University, Atlanta
- May 2006 Critical Thinking in Anesthesia, Society of Cardiovascular Anesthesiologists Keynote Lecture, San Diego
- September 2006 Advanced Workshop in Pharmacokinetic and Pharmacodynamic Modeling with NONMEM. Newark, NJ
- March 2007 The Future of Anesthetic Pharmacology, IARS Annual Meeting, Orlando, Florida
- May 2007 Pro: It is acceptable for patients to drive home after ambulatory surgery. SAMBA Annual Meeting, San Diego, California

- May 2007           Lecturer, Workshop Leader, 25<sup>th</sup> Rowland/Sheiner Course in Advanced Pharmacokinetic Methods. San Francisco, California
- June 2007           Did Our Brains Fall Out? Annual Research Retreat, Department of Anesthesia, Vanderbilt University
- June 2007           Advanced Workshop in Pharmacokinetic and Pharmacodynamic Modeling with NONMEM. San Francisco, California
- October 2007       Advanced Workshop in Pharmacokinetic and Pharmacodynamic Modeling with NONMEM. Bethesda, MD
- December 2007     Critical Thinking in Anesthesia. Post Graduate Assembly. New York, NY
- December 2007     Principles of Pharmacokinetic Modeling. Annual Meeting of the UK Society for Intravenous Anaesthesia. Cambridge, England
- January 2008       The Anesthetic Pipeline. Virginia Apgar Lecture, Columbia University. New York, NY.
- October 2008       Critical Thinking in Anesthesia. 8<sup>th</sup> honorary FAER lecture, Annual Meeting of the American Society of Anesthesiologists, Atlanta, GA
- February 2009     What Pharmacogenomics Can Teach the Anesthesiologist, Grand Rounds, Medical College of Wisconsin, Milwaukee, Wisconsin
- March 2009         Common Statistical Errors. 2009 IARS Congress, San Diego, CA
- March 2009         The Most Important Five Retracted Research Papers. 2009 IARS Congress, San Diego, CA
- May 2009           Steven J. Prevoznik Memorial Lecture, Critical Thinking in Anesthesia, Department of Anesthesiology, University of Pennsylvania, Philadelphia, PA
- May 2009           Inaugural Vladimir Nigrovic Memorial Lecture, Vladimir Nigrovic's Contributions to Clinical Pharmacology of Anesthetic Drugs: From Dose to TCI in 40 Years, University of Toledo, Toledo, OH
- December 2009     Ralph Waters Lecture, Comparative Opioid Pharmacology, Department of Anesthesiology, University of Wisconsin
- December 2009     Pharmacogenetics: Computational Approaches to the Murine Genome, Department of Anesthesiology, University of Wisconsin

- December 2009 R.W. Robertazzi Memorial Panel. Everything I Learned About Pharmacokinetics Was Wrong. Post Graduate Assembly, New York, NY
- December 2009 MU Receptor Antagonists, Fospropofol, Benzos: What's in the Pipeline? Post Graduate Assembly, New York, NY
- March 2010 Is Print Dead? Annual Congress of the International Anesthesia Research Society, Honolulu, Hawaii
- March 2010 Common Statistical Errors. Annual Congress of the International Anesthesia Research Society, Honolulu, Hawaii
- April 2010 Mentorship for Clinical Research. Annual Meeting of the Association of University Anesthesiologists. Denver, Colorado
- April 2010 11<sup>th</sup> Fisher / Shafer NONMEM/PLT Tools Workshop. San Francisco, California
- September 2010 Everything I learned about pharmacokinetics was wrong. Founders Day Lecture, Northwestern University
- September 2010 Critical Thinking in Anesthesia, Northwestern University
- September 2010 How quantitative methods can improve patient care: Mathematical Modeling in Analgesia Research. Leon Goldberg Lecture, University of Chicago
- September 2010 Cardinal Numbers: 50 years of Anesthesia Research at Stanford University. Stanford University
- October 2010 What I Learned from Don Stanski. Session on Mentorship, Society of Neuroscience in Anesthesiology and Critical Care. San Diego, California
- October 2010 What the APSF Contributed Via Its Research, and How Should It Proceed in the Future? Workshop on the Future of the Anesthesia Patient Safety Foundation. San Diego, California
- October 2010 Ethics in Publication, Part 1. ASA Annual Meeting, San Diego, California
- October 2010 Ethics in Publication, Part 2. ASA Annual Meeting, San Diego, California
- November 2010 12th Fisher/Shafer NONMEM Workshop with PLT Tools. Bethesda, Maryland
- March 2011 13th Fisher/Shafer NONMEM Workshop with PLT Tools. San Francisco,

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	California
May 2011	Critical Thinking in Anesthesia. University of Washington, Seattle, Washington
October 2011	Mentorship for Clinical Research. Plenary Lecture. International Society of Anesthetic Pharmacology, Chicago
November 2011	14th Fisher/Shافر NONMEM Workshop with PLT Tools. Bethesda, Maryland
December 2011	Improving Outcome with Computer Controlled Drug Delivery. Post Graduate Assembly, New York
December 2011	Academic Misconduct: The Role of the Editor-in-Chief. Post Graduate Assembly, New York
January 2012	The Role of Clinical Pharmacology in the Trial of Conrad Murray. University of Florida, Gainesville, Florida
January 2012	Plagiarism and Research Ethics. University of Florida, Gainesville, Florida
February 2012	The Michael Jackson Trial. Academy of Anesthesia, Santa Monica, California
April 2012	Razing Research Fraud – Where do we Stand? Society of Cardiovascular Anesthesiologists. Boston, Massachusetts
May 2012	The Use and Abuse of Anesthetic Drugs, IARS Annual Congress, Boston
June 2012	The Role of Clinical Pharmacology in the Trial of Conrad Murray. Marcus Reidenberg Lecture. Department of Pharmacology, Weill Cornell Medical College, New York, New York
June 2012	Academic Misconduct: Petty Plagiarism to Flagrant Fraud. Mount Sinai Medical Center, New York, New York.
March 2013	The Role of Clinical Pharmacology in the Michael Jackson Trial. Plenary Lecture, American Society of Clinical Pharmacology and Therapeutics, Indianapolis
December 2013	Propofol: Murder, Mayhem, and Mercy, Haugen Lecture, OHSU. Portland, Oregon
December 2013	Prescription Opioid Abuse: Old problem, New solutions. OHSU, Portland,

## Oregon

- January 2014 How do Successful Physician-Entrepreneurs Make it Happen? FAER Anesthesiology Conference on Innovation and Entrepreneurship. Orlando, Florida
- January 2014 R&D Relationships with the Medical Device Industry: Valuation, Validation and Commercialization. FAER Anesthesiology Conference on Innovation and Entrepreneurship. Orlando, Florida
- April 2014 The Clinical Consequences of Academic Misconduct. Annual meeting of the American Society of Regional Anesthesia Congress. Chicago, Illinois
- April 2014 COPE Panel on Academic Misconduct. Counsel of Scientific Editors. San Antonio, Texas
- May 2014 Workshop on Academic Misconduct. Annual Meeting of the Council of Scientific Editors. San Antonio, Texas.
- May 2014 Propofol: Murder, Mayhem, and Mercy. Harvard Anesthesia Update. Boston, MA
- May 2014 Publication Ethics. Harvard Anesthesia Update. Boston, MA
- September 2014 Michael Jackson: What Went Wrong? Pediatric Sedation outside the Operating Room. San Francisco
- October 2014 Propofol: Murder, Mayhem, and Mercy. Plenary Lecture, Society of Anesthesia and Sleep Medicine, New Orleans
- October 2014 Critical Thinking in Anesthesiology. Plenary Lecture, Outcomes Research Symposium. New Orleans.
- December 2014 Propofol: Murder, Mayhem, and Mercy. Joseph Priestley Lecture. Penn State / Milton S. Hershey Medical Center, Hershey, Pennsylvania
- June 2015 Fail Early, Fail Often, but Just Not Always. FAER Workshop on Innovation, Shaumburg, IL
- September 2015 Academic Misconduct. Washington University, St. Louis, MO
- October 2015 Let the Data Speak. Lewis Sheiner Lecture. International Society of Pharmacometrics. Washington, DC
- October 2015 Propofol: Murder, Mayham, and Mercy. Annual Meeting of Western

- Inspectors General for the Department of Veteran Affairs, Sacramento, CA
- October 2015 Open-loop vs. Closed-loop Anesthesia Control: Outside US Evidence from Target Controlled Infusion. FDA Physiological Closed Loop Control Workshop, Silver Springs, MD.
- October 2015 The Measures of a Man. Ty Smith Lecture. Society of Technology in Anesthesia. San Diego, California.
- October 2015 Cognitive Computing and Disruptive Technology. Severinghaus Lecture. Annual Meeting of the Society of Anesthesiologists. San Diego, CA
- May 2016 Chair, Reproducibility in Science Symposium, IARS Annual Congress, San Francisco
- May 2016 Reproducibility and Fraud, IARS Annual Congress, San Francisco
- June 2016 Cognitive Computing and Disruptive Technology. Outcomes Research Institute, Cleveland Clinic, Cleveland, Ohio
- September 2016 Engaging both hemispheres. 2016 Annual Meeting of the American Society of Anesthesiologists, Chicago
- April 2017 Basic Concepts of Clinical Pharmacology. Dannemiller Review Course, San Antonio, Texas
- April 2017 Opioids: Basic and Clinical Pharmacology, Dannemiller Review Course, San Antonio, Texas
- April 2017 Sedatives and Hypnotics: Basic and Clinical Pharmacology, Dannemiller Review Course, San Antonio, Texas
- May 2017 How Advances in Technology and Computing Will Transform Clinical Practice. Annual Congress, International Anesthesia Research Society, Washington, DC
- May 2017 Keynote Lecture: Reproducibility Crisis in Scientific Research. Annual Congress, International Anesthesia Research Society, Washington, DC
- May 2017 Propofol: Murder, Mayhem, and Mercy. Harvard Anesthesia Update. Boston, MA
- May 2017 Why Most Anesthesia Research is False. Harvard Anesthesia Update. Boston, MA

- September 2017 Medical Legal Issues of Sedation: Do We Really Need Informed Consent? Pediatric Sedation Outside of the Operating Room. San Francisco, California
- October 2017 Swimming with Sharks, 2017 FAER Entrepreneur Workshop, Annual Meeting of the American Society of Anesthesiologists, Boston
- October 2017 Death of Michael Jackson. National Association of Medical Examiners. Phoenix
- October 2017 Reproducibility in Science. MGH/Harvard Grand Rounds, Boston
- November 2017 Machine Learning in Clinical Research. Stanford-Kanagawa Symposium, Stanford
- December 2017 Reproducibility in Science. University of Chicago 31<sup>st</sup> Annual CME Conference, Chicago
- December 2017 Propofol: Murder, Mayhem, and Mercy. University of Chicago 31<sup>st</sup> Annual CME Conference, Chicago
- January 2018 How “can’t fail” fails. STA-FAER Entrepreneurial Symposium, Miami
- January 2018 Exposure-response and drug-drug interaction. Advanced Course in Drug Regulatory Science, University of California Washington Center, Washington DC
- January 2018 How a mediocre student became Ted Eger. Ted Eger Memorial Symposium. UCSF, San Francisco
- October 2018 Swimming with Sharks. ASA Annual Meeting, San Francisco
- October 2018 Debate on Randomized Controlled Trials. ASA Annual Meeting, San Francisco
- October 2018 Threats in Early Clinical Trials. ASA Annual Meeting, San Francisco
- October 2018 Machine Learning in PK/PD. Annual Meeting, International Society of Anesthetic Pharmacology, San Francisco
- October 2018 Big Innovations for Little Patients. Plenary Lecture. Society of Pediatric Anesthesiology. San Francisco
- November 2018 Cognitive Computing and Disruptive Innovation. CSA Fall Program. Hawaii

- November 2018      Exparel is no better than plain bupivacaine. CSA Fall Program. Hawaii
- November 2018      How to manage drug shortages. CSA Fall Program. Hawaii
- November 2018      Propofol: Murder, Mayhem, and Mercy, CSA Fall Program. Hawaii
- January 2019        Exposure-response and drug-drug interaction. Advanced Course in Drug Regulatory Science, University of California Washington Center, Washington DC

### **International**

- February 1992      Pharmacologie et informatique des infusions. Université Laval, Quebec, Canada
- March 1992        Quantification de l'action des morphiniques. Journées d'Enseignement Post-Universitaire, Paris, France
- March 1992        Alfentanil: Administration en bolus et par voie IV continue. Journées d'Enseignement Post-Universitaire, Paris, France
- June 1992         Appropriate study methodology for the assessment of predictive performance with particular reference to analgesic drugs. International Workshop on Target Control Titration in Anaesthesia, The Hague, Holland.
- April 1994         Individualization of Opioid Dosage in Anesthetic Practice. 2nd International Symposium on Measurements and Kinetics of *In Vivo* Drug Effects. Leiden, Holland.
- May 1994         Does the EEG reflect Anaesthetic Action? 2nd International Workshop on Automation and Control in Anaesthesia. Bonn, Germany
- April 1995         Propofol for maintenance of anesthesia and sedation. Guanzhou, Shanghai, and Beijing, China.
- May 1995         Anaesthesia in the year 2005. European Society of Anesthesiology, Paris, France
- September 1995    Target Controlled Drug Delivery in Research. Symposium on Target Controlled Infusions, Cambridge, England
- September 1995    Debate: Intravenous vs inhalational anesthesia. VII World Congress on Endocrine Response to Stress and Perioperative Pain Management. Cadiz,

## Spain

- April 1996 Pharmacokinetics and Pharmacodynamics in Support of Total Intravenous Anesthesia. World Congress of Anesthesiology. Sydney, Australia
- February 1997 Managing pharmacodynamic variability in anesthesia: integrating the EEG and effect site anesthetic concentrations with clinical measures of anesthetic depth. Second European Meeting on Population Methods, Geneva, Switzerland.
- November 1997 The role of newer opioids in geriatric anesthesia. Annual Meeting, Belgian Society of Anesthesia and Reanimation, Gent, Belgium
- February 1998 What predicts anesthetic depth? Clinical signs vs drug concentrations. AOSIVA Conference, Kyoto Japan
- March 1998 The pharmacokinetic and pharmacodynamic basis of target controlled infusions. JEPU Conference, Paris, France
- April 1998 Monitors of the anesthetic state: clinical measures, EEG measures, and utility of effect site anesthetic concentrations. European Society of Intravenous Anesthesia, Barcelona, Spain.
- August 1998 An examination of claims made for anesthetic drugs. Annual Meeting, New Zealand/Australian Societies of Anesthesia, Dunedin, New Zealand
- March, 1999 Response surface approaches to drug interactions. Workshop on Intravenous Anesthesia, Cambridge, England.
- March, 2000 Critical thinking in anesthesia. JEPU Meeting, Paris, France
- June 2000 Propofol: the possible role of EDTA improving survival in ICU patients. World Congress of Anesthesia, Montreal, Canada
- July 2000 New computer technologies for improving the quality of clinical trials and enhancing the rational use of drugs. VII World Congress on Clinical Pharmacology and Therapeutics, Florence, Italy
- April 2004 NONMEM Workshop, World Congress of Anesthesia, Paris, France
- October 2004 Models of drug behavior – The basis for computerized drug delivery. Joint ESCTAIC-SFIMAR Meeting, Toulouse, France
- April 2005 The role of covariates in target controlled and closed loop drug delivery. Advanced Modeling and Control in Anesthesia Meeting, Monte Verità,

- Switzerland
- April 2005 Models of drug behavior relevant to target controlled and closed loop drug delivery. Advanced Modeling and Control in Anesthesia Meeting, Monte Verità, Switzerland
- April 2005 The regulatory status of target controlled drug delivery in the United States. Advanced Modeling and Control in Anesthesia Meeting, Monte Verità, Switzerland
- September 2005 Target Controlled Infusion / Total Intravenous Anesthesia. 20th International Congress Of The Israel Society Of Anesthesiologists. Tel Aviv, Israel
- February 2006 Drug Interactions and Anesthetic Mechanisms. Royal Prince Alfred Hospital, Sydney, Australia
- March 2006 Models of Drug Behavior, Lessons Learnt from the COX-2 Story, and The Future of Analgesia Drug Development, Jobson Visiting Professor, Sydney, Australia.
- April 2006 Sheiner/Rowland Advanced Methods in PK/PD Analysis, Sils, Switzerland
- September 2006 TCI and Propofol. Chinese Society of Anesthesiology in Zhengzhou, China, (the first talk ever given by a western speaker to the Chinese Society of Anesthesiology).
- September 2006 Editor-in-Chief's address, Chinese Language Edition of Anesthesia & Analgesia, Zhengzhou, China
- March 2007 Advanced Workshop in Pharmacokinetic and Pharmacodynamic Modeling with NONMEM. Ghent, Belgium
- September 2007 How to publish your manuscript in Anesthesia & Analgesia. 115<sup>th</sup> Anniversary Celebration, First China Hospital, Chengdu, China
- September 2007 The use of propofol in total intravenous anesthesia using target controlled drug delivery. 115<sup>th</sup> Anniversary Celebration, First China Hospital, Chengdu, China
- September 2007 The future of intravenous anesthetics for total intravenous anesthesia. First Congress of the World Society of Intravenous Anesthesia – TCI. Venice, Italy

- September 2007      The pain of anesthesia: anesthetic choice makes a difference. First Congress of the World Society of Intravenous Anesthesia – TCI. Venice, Italy
- September 2007      Survey of remifentanyl use in total intravenous anesthesia. First Congress of the World Society of Intravenous Anesthesia – TCI. Venice, Italy
- September 2007      Target controlled drug delivery and the FDA. First Congress of the World Society of Intravenous Anesthesia – TCI. Venice, Italy
- November 2007      The Inside Story of COX-2 Inhibitors. Hong Kong Society of Anaesthesiology. Hong Kong
- November 2007      Safety Issues on Conscious Sedation. Hong Kong Society of Anaesthesiology. Hong Kong
- November 2007      The Future of Anesthetic Pharmacology. Hong Kong Society of Anesthesiology. Hong Kong
- December 2007      Principles of Pharmacokinetic Modeling. Annual Meeting of the UK Society for Intravenous Anaesthesia. Cambridge, England
- December 2007      TCI in the United States. Annual Meeting of the UK Society for Intravenous Anaesthesia. Cambridge, England
- February 2008      Advanced Workshop in Pharmacokinetic and Pharmacodynamic Modeling with NONMEM. Seoul, South Korea
- February 2008      Is There A Future in Anesthetic Pharmacology? ISAP Symposium, Stellenbosch, South Africa
- February 2008      Obesity and Pharmacokinetics, World Congress of Anaesthesia, Cape Town, South Africa
- April 2008      Important Questions for Anesthesia Research. Toggenburger Anästhesierepetitorium, Wildhaus, Switzerland
- May 2008      Critical Thinking in Anesthesia. Ellis Gillespie Lecture, Annual Scientific Meeting of the Australian and New Zealand College of Anesthetists. Sydney, Australia
- May 2008      What Anesthesiologists Can Learn from In Silico Pharmacogenomics, Annual Scientific Meeting of the Australian and New Zealand College of Anesthetists. Sydney, Australia

- May 2008 Evolution and the Mechanism of General Anesthetic Action. Annual Scientific Meeting of the Australian and New Zealand College of Anesthetists. Sydney, Australia
- May 2008 Academic Misconduct: Tales from the Archives of Anesthesia & Analgesia. Annual Scientific Meeting of the Australian and New Zealand College of Anesthetists. Sydney, Australia
- May 2008 The Practice of Anesthesia: Art or Science? (Debate) Annual Scientific Meeting of the Australian and New Zealand College of Anesthetists. Sydney, Australia
- May 2008 Comparative Pharmacology of Opioids. Grand Rounds, Hobart Hospital, Hobart (Tasmania), Australia
- August 2008 Combined Modeling of Continuous and Categorical Modeling of Drug Interactions (5 day course). Second Novartis/Roche Modeling and Simulation Workshop. Basal, Switzerland
- January 2009 Top Research Questions. Anesthesia Frontiers Meeting, Shanghai, China
- April 2009 Perioperative Genomics, World Society of Intravenous Anesthesia, Berlin, Germany
- April 2009 The Anesthetic Pipeline, World Society of Intravenous Anesthesia, Berlin, Germany
- April 2009 Pain and Volatile Anesthetics, World Society of Intravenous Anesthesia, Berlin, Germany
- April 2009 Drug Interaction Models, World Society of Intravenous Anesthesia, Berlin, Germany
- May 2009 Richard Arment Memorial Lecture, Critical Thinking in Anesthesia, Canadian-American Anesthesia Conference, Niagara Falls, Ontario, Canada
- July 2009 Don't Let Your Brains Fall Out, 16<sup>th</sup> ASEAN Congress of Anesthesiologists, Kota Kinabalu, Sabah, Malaysia
- July 2009 The Anesthetic Pipeline: a survey of drugs currently in development, 16<sup>th</sup> ASEAN Congress of Anesthesiologists, Kota Kinabalu, Sabah, Malaysia
- July 2009 How to get a paper published in Anesthesia & Analgesia, 16<sup>th</sup> ASEAN Congress of Anesthesiologists, Kota Kinabalu, Sabah, Malaysia

- September 2009 Critical Thinking in Anesthesiology. Plenary Lecture, 11<sup>th</sup> Capital City Conference of the German Society of Anesthesia and Intensive Care Medicine, Berlin, Germany
- September 2009 Critical Thinking in Anesthesiology. Plenary Lecture, Netherlands Society of Anesthesiology, Amsterdam, the Netherlands
- November 2009 Ten Papers in Anesthesiology: The Top Five Papers, and the Top Five Retracted Papers. Chile Congress in Anesthesiology, Coquimbo, Chile
- November 2009 Critical Thinking in Anesthesiology. Chile Congress in Anesthesiology, Coquimbo, Chile
- November 2009 New Analgesic Drugs. Chile Congress in Anesthesiology, Coquimbo, Chile
- November 2009 New Drugs in Anesthesia. Chile Congress in Anesthesiology, Coquimbo, Chile
- December 2009 Important Research Questions in Anesthesia (& Analgesia). Department of Anesthesia & Perioperative Medicine, London Health Sciences Centre, London, Ontario, Canada
- January 2010 New Insights into the Mechanism of Action of Inhaled Anesthetics. Refresher Course, Department of Anesthesiology, King Saud University, Riyadh, Saudi Arabia
- January 2010 Critical Thinking in Anesthesiology. Plenary Lecture, Third International Anesthesia Conference on Current Practice in Anesthesia and Pain Management. Riyadh, Saudi Arabia
- January 2010 Update on Anesthetic Pharmacology. Third International Anesthesia Conference on Current Practice in Anesthesia and Pain Management, Riyadh, Saudi Arabia
- January 2010 Comparative Pharmacology of Opioids. Third International Anesthesia Conference on Current Practice in Anesthesia and Pain Management, Riyadh, Saudi Arabia
- January 2010 Propofol for Sedation by Non-Anesthesiologists: Is it safe? Third International Anesthesia Conference on Current Practice in Anesthesia and Pain Management, Riyadh, Saudi Arabia
- January 2010 Ethics in Publishing: Cases from the Files of Anesthesia & Analgesia.

- Third International Anesthesia Conference on Current Practice in Anesthesia and Pain Management. Riyadh, Saudi Arabia
- May 2010 Confessions of an Academic Anesthesiologist. Annual Scientific Meeting of the Australia and New Zealand College of Anesthetists, Christchurch, New Zealand
- May 2010 TIVA at the Extremes of Age and Weight. Annual Scientific Meeting of the Australia and New Zealand College of Anesthetists, Christchurch, New Zealand
- May 2010 Unsolved Mysteries of Anesthesia. Annual Scientific Meeting of the Australia and New Zealand College of Anesthetists, Christchurch, New Zealand
- May 2010 The Last Lecture I Will Ever Give. Annual Scientific Meeting of the Australia and New Zealand College of Anesthetists, Christchurch, New Zealand
- June 2010 What can we infer about anesthetic mechanisms from the interaction between analgesics and hypnotics? MAC 2010, Toronto, Canada
- November 2010 Burnell Jose Visiting Professor, Adelaide, Australia  
New Insights into the Mechanism of Inhaled Anaesthetics  
Comparative Opioid Pharmacology  
Ethics of Publication: Scott Reuben and Joachim Boldt  
Important Research Questions and the Future of Anesthesia  
Unsolved Mysteries of Anaesthesia  
Critical Thinking in Anaesthesia  
TIVA at the Extremes of Age and Weight  
Propofol for Sedation by Non-Anaesthetists: Is It Safe?  
Ten Papers in Anaesthesiology: The Top Five Papers, and the Top Five Retracted Papers.  
Obesity and Pharmacokinetics  
Pain and Volatile Anaesthetics  
Inside the COX-2 Story  
Common Statistical Errors
- January 2011 The Rising Bar in Publication. China 2011 Anesthesia Summit. Chengdu, China
- May 2011 The Contributions of T. Cecil Gray to Modern Anesthesia. Inaugural British Journal of Anaesthesia / Royal College of Anaesthetists T. Cecil Gray Lecture, Liverpool, England

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| May 2011       | The Many Faces of Misconduct. Congress of the International Anesthesia Research Society, Vancouver, Canada  |
| May 2011       | Predictibilidad de los Modelos TCI, Chilean Congress of Anesthesiologists, Santiago, Chile  |
| May 2011       | Workshop in Mixed Effects Modeling, Chilean Congress of Anesthesiologists, Santiago, Chile  |
| June 2011      | The Rising Publication Bar. Association of Chairs of University Departments of Anesthesia, Toronto, Canada  |
| September 2011 | Critical Thinking in Anesthesia, Terry Davidson Plenary Lecture, International Congress of Israel Society of Anesthesiologists, Tel Aviv, Israel          |
| September 2011 | Pharmacokinetic Tools for Training. International Congress of Israel Society of Anesthesiologists, Tel Aviv, Israel                                       |
| November 2011  | Magic and Misconduct. University of Toronto Postgraduate CME Program, Toronto, Canada   |
| November 2011  | The Anesthetic Pipeline. University of Toronto Postgraduate CME Program, Toronto, Canada  |
| February 2012  | How to Teach Pharmacology to a Lay Jury. Novartis Corporation. Basel, Switzerland.  |
| May 2012       | The Michael Jackson Trial. Sir Ivan Magill Inaugural Lecture, Dublin, Ireland   |
| May 2012       | The role of pharmacokinetics and pharmacodynamics in drug development. Medicines Healthcare Regulatory Agency, London, UK                                 |
| November 2012  | Michael Jackson - the Clinical Pharmacology. United Kingdom Society for Intravenous Anaesthesia. Edinburgh, Scotland                                      |
| March 2013     | The Role of Clinical Pharmacology in the Michael Jackson Trial. Plenary Lecture, American Society of Clinical Pharmacology and Therapeutics, Indianapolis |
| November 2013  | Propofol: Murder, Mayhem, and Mercy. Keynote Lecture, Obstetric Anaesthetists Association, London, England  |
| February 2014  | The evolution of clinical pharmacology in anesthesia: what happened to  |

- the future? Medical Innovations and Technologies in Anaesthesiology and Intensive Care Medicine, Erlangen, Germany
- February 2014 The Role of Clinical Pharmacology in the Michael Jackson Trial. Medical Innovations and Technologies in Anaesthesiology and Intensive Care Medicine, Erlangen, Germany
- February 2014 Propofol: Murder, Mayhem, and Mercy. Asian Australasian Congress of Anesthesiologists. Auckland, New Zealand
- February 2014 Publication Ethics. Asian Australasian Congress of Anesthesiologists. Auckland, New Zealand
- March 2014 The Role of Clinical Pharmacology in the Michael Jackson Trial. Anesthesia and Beyond Symposium, Linz, Austria
- May 2014 A&A Reviewer Guidance Panel: How to Become a Good Reviewer. IARS Annual Congress. Montreal, Quebec
- May 2014 Statistics for Journal Editors. IARS Annual Congress. Montreal, Quebec
- June 2014 Journal Club, Primagravid Labor: A graphicostatistical analysis (Friedman 1955) vs. Reassessing the Labor Curve in Nulliparous Women (Zhang, 2002). No Pain Labor and Delivery. Shanghai, China
- June 2014 Local Anesthetic Pharmacology. Henan Maternal and Child Health Care Hospital. Zhengzhou, China
- June 2014 Comparative Opioid Pharmacology. Henan Maternal and Child Health Care Hospital. Zhengzhou, China
- September 2014 Future of anesthesia - Profession and practice. Ontario Anesthesia Meeting. Ontario, Canada
- June 2015 Remifentanil PCA for Labor Analgesia. Third International Obstetrics & Gynecology Summit. Shanghai, China
- June 2015 Local Anesthetic Pharmacology. Anesthesia for Obstetrical Care. Union Medical College. Wuhan, China
- March 2016 Cognitive Computing and Anesthesia, RCOA Jubilee Celebration, London, England
- May 2016 The Eisenach Guidelines for Neuraxial Drug Administration. European Society of Anaesthesiology Meeting, London, England

- August 2016 Why most published research findings are false. World Congress of Anaesthesiology, Hong Kong
- August 2016 Misrepresentation of new drugs and devices. World Congress of Anaesthesiology, Hong Kong
- August 2016 How Journals Manage Research Fraud. World Congress of Anaesthesiology, Hong Kong
- November 2016 Avoiding Misconduct in Journal Submissions. 36<sup>th</sup> Annual Meeting of the Japanese Society of Clinical Anesthesia. Kochi, Japan
- November 2016 Serial Misconduct. How big a problem? What are we doing about it? 36<sup>th</sup> Annual Meeting of the Japanese Society of Clinical Anesthesia. Kochi, Japan
- March 2017 Will Computers Replace Doctors? General Grand Rounds, Royal Children's Hospital, Melbourne
- March 2017 Statistical Methods for Fraud Detection. General Grand Rounds, Royal Children's Hospital, Melbourne
- March 2017 Innovation Pipeline: New Drugs. Tasmanian Combined ANZCA/ASA Annual Scientific meeting, Hobart, Tasmania, Australia
- March 2017 Innovation Pipeline: New Devices. Tasmanian Combined ANZCA/ASA Annual Scientific meeting, Hobart, Tasmania, Australia
- March 2017 Cognitive Computing in Anesthesia, Tasmanian Combined ANZCA/ASA Annual Scientific meeting, Hobart, Tasmania, Australia
- June 2017 Big Data and Cognitive Computing, Healthcare New Frontier Symposium, Yokohama, Japan
- June 2017 Basic Principles of Pharmacokinetics and Pharmacodynamics, PK/PD of Hypnotics, PK/PD of Opioids, Cognitive Computing and Disruptive Innovation, Hanoi, Vietnam
- June 2017 Basic Principles of Pharmacokinetics and Pharmacodynamics, PK/PD of Hypnotics, PK/PD of Opioids, Cognitive Computing and Disruptive Innovation, Baotou, China
- June 2017 From Michael Jackson to TensorFlow: Why PK/PD Models Matter. Department of Anesthesiology, University of Groningen, Groningen,

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	Netherlands
September 2017	Cognitive Computing in Medicine. <i>Advances in Internal Medicine</i> National Institute of Medical Sciences and Nutrition Salvador Zubiran, Mexico City, Mexico
November 2017	Advanced PK/PD Workshop. Society of Intravenous Anesthesia, London, England
November 2017	How Much Do Clinicians Need to Know About PK/PD. Society of Intravenous Anesthesia, London, England
November 2017	TRV 130. Society of Intravenous Anesthesia, London, England
March 2018	The Application of Artificial Intelligence to Drug Development. Astra- Zeneca Global Development, Gothenburg, Sweden
May 2018	Clinical Pharmacology: from Michael Jackson to TensorFlow. University of British Columbia, Vancouver, Canada
May 2018	Artificial Intelligence and Machine Learning in Drug Development, Yokohama, Japan
June 2018	How Inhaled Anesthetics Work. Hanoi Medical University, Hanoi, Vietnam
June 2018	Uptake and Distribution of Inhaled Anesthetics. Hanoi Medical University, Hanoi, Vietnam
June 2018	Academic Misconduct and Publication Ethics. Hanoi Medical University, Hanoi, Vietnam
June 2018	电脑及高科技技术的发展 将怎样会改变我们临床医学的应用 (How computer and high-tech development will change the application of our clinical medicine), First Affiliated Hospital, Harbin, China
June 2018	临床疗效研究在中国 (Clinical Effectiveness Research in China), Shijiazhuang Women's Hospital, Shijiazhuang, China
February 2019	异丙酚谋杀混乱和怜悯 (Propofol, Murder, Mayhem, and Mercy) Beijing Union Medical Center, Beijing, China

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May 2019	AI in Anesthesia. IARS Annual Meeting. Montreal, Canada
June 2019	Big Data, Big Results. ESA Annual Meeting, Vienna, Austria
October 2019	Swimming with Sharks. 2019 Annual Meeting of the American Society of Anesthesiologists. Orlando

### **VISITING PROFESSORSHIPS**

1988	Department of Anesthesiology, University of California at San Diego, San Diego, California
1992	Department of Anesthesiology, Duke University, Durham, North Carolina
1992	Department of Anaesthesia, Dalhousie University, Halifax, Nova Scotia, Canada
1992	Department of Anesthesia, University of Connecticut, Hartford, Connecticut
1993	Department of Anesthesiology, University of Alabama, Birmingham, Alabama
1993	Department of Anesthesiology, University of New Mexico, Albuquerque, New Mexico
1993	Department of Anesthesiology, Northwestern University, Chicago, Illinois
1993	Department of Anesthesiology, Emory University, Atlanta, Georgia
1993	Department of Anesthesiology, New England Medical Center, Boston, Massachusetts
1993	Department of Anesthesiology, State University of New York, New York, New York
1993	Departments of Anesthesia and Clinical Pharmacology, University of Chicago, Chicago, Illinois
1994	Departments of Anesthesia and Pharmacology, Massachusetts General Hospital, Harvard University, Boston, Massachusetts
1994	Department of Anesthesiology, U.S. Naval Hospital, Portsmouth, Virginia

- 1994 Department of Pharmaceutics, State University of New York at Buffalo, Buffalo, New York
- 1994 Department of Anaesthesia, Dalhousie University, Halifax, Canada
- 1995 Department of Anesthesiology, Bowman Gray School of Medicine, Winston-Salem, North Carolina
- 1995 Department of Anaesthesiology, Chinese University of Hong Kong, Hong Kong
- 1995 Department of Anesthesia, Brigham and Women's Hospital, Boston, Massachusetts
- 1996 Department of Anaesthesia, Stellenbosch University School of Medicine, Cape Town, South Africa.
- 1996 Department of Anaesthesia, University of Montréal, Montréal, Canada
- 1996 Department of Anaesthesia, McGill University, Montréal, Canada
- 1998 Department of Anesthesia, University of Washington, Seattle, Washington
- 1998 Department of Pharmaceutical Sciences, University of California, San Francisco
- 1998 Department of Anesthesia, Kyushu University, Fukuoka, Japan
- 1998 Department of Anaesthesia, University of Otago, Christchurch, New Zealand
- 1998 Department of Anesthesia, Indiana University, Indianapolis, Indiana
- 1999 Department of Anesthesia, University of Utah, Salt Lake City, Utah
- 1999 Department of Clinical Pharmacology, Huddinge Hospital, Karolinski Institute, Stockholm, Sweden
- 2000 Department of Anesthesiology, Medical College of Wisconsin, Milwaukee, Wisconsin
- 2003 Department of Anesthesiology, Johns Hopkins University, Baltimore, Maryland

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- 2004 Department of Anesthesia, Columbia University, New York, New York
- 2004 Department of Anesthesia, Medical University of South Carolina, Charlotte, South Carolina
- 2004 Department of Anesthesiology, SUNY Stony Brook, Stony Brook, New York
- 2004 Department of Anesthesiology, UCLA, Los Angeles, California
- 2005 Department of Anesthesiology, Washington University, Saint Louis, Missouri
- 2005 Department of Pharmacy, The Hebrew University of Jerusalem, Jerusalem, Israel
- 2005 Department of Anesthesiology, Brigham and Woman's Hospital, Boston, Massachusetts
- 2006 Department of Anesthetics, Royal Prince Alfred Hospital, Sydney, Australia
- 2006 Jobson Visiting Professor, Jobson Foundation, Sydney, Australia
- 2006 Crawford Long Visiting Professor, Emory University, Atlanta, Georgia
- 2006 Department of Anesthesiology, Massachusetts General Hospital, Boston, Massachusetts
- 2007 Department of Anesthesiology, Mount Sinai Medical Center, New York, NY
- 2007 Department of Anesthesiology, Vanderbilt University, Nashville, Tennessee
- 2007 West China Hospital, Chengdu, China
- 2007 Cambridge University, Cambridge, United Kingdom
- 2008 University of Plymouth, Plymouth, United Kingdom
- 2008 Oxford University, Oxford, United Kingdom
- 2009 Department of Anesthesia, Medical College of Wisconsin, Milwaukee, Wisconsin

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- 2009 Department of Anesthesiology, University of Pennsylvania, Philadelphia, Pennsylvania
- 2009 St. Vincent's Hospital, Manhattan, New York, New York
- 2009 Department of Anesthesiology, University of Wisconsin, Madison, Wisconsin
- 2010 Department of Anesthesiology, King Saud University, Riyadh, Saudi Arabia
- 2010 Department of Anesthesiology, Northwestern University, Chicago, Illinois
- 2010 Department of Medicine (Clinical Pharmacology), University of Chicago, Chicago, Illinois
- 2010 University of Adelaide, Adelaide, Australia
- 2011 Department of Anesthesiology, University of Washington, Seattle, Washington
- 2011 Department of Anesthesia, Dalhousie University, Halifax, Nova Scotia, Canada
- 2012 Department of Anesthesiology, University of Florida, Gainesville, Florida
- 2012 Department of Clinical Pharmacology, Cornell University, New York, NY
- 2012 Department of Anesthesiology, Mt. Sinai Medical Center, New York, NY
- 2013 Department of Anesthesiology, Oregon Health Sciences University, Portland, OR
- 2014 Department of Anesthesiology, University of Virginia, New York, NY
- 2014 Department of Anesthesiology, Cornell University, New York, NY
- 2014 Henan Maternal and Child Health Care Hospital, Zhengzhou, China
- 2014 First Affiliated Hospital of Zhengzhou University, Zhengzhou, China
- 2014 Department of Anesthesiology, Pennsylvania State University / Hershey Medical Center, Hershey, PA

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2015	Department of Anesthesiology, University of Texas Southwest, Dallas, TX
2015	Department of Anesthesiology, University of Washington, St. Louis, MO
2016	Department of Anesthesiology, Hospital for Special Surgery
2016	Outcomes Research Center, Cleveland Clinic
2017	Department of Anesthesiology, Royal Children's Hospital, Melbourne, Australia
2017	Department of Anesthesia, Hobart Hospital, Tasmania, Australia
2017	Department of Anesthesiology, University of Minnesota, Minneapolis, MN
2017	Department of Anesthesia, Third Steel Hospital, Baotou, China
2017	Department of Anesthesiology, Hanoi University, Hanoi, Vietnam
2017	Department of Anesthesiology, Medical University of Groningen, Groningen, Netherlands
2017	Department of Anesthesiology, University of Michigan, Ann Arbor, MI
2017	Department of Anesthesiology, University of Minnesota, Minneapolis, MN
2017	Department of Anesthesiology, Instituto Nacional de Nutricion Salvador Zubiran, Mexico City, Mexico
2017	Department of Anesthesiology, Ohio State University, Columbus, Ohio
2017	Department of Anesthesiology, Massachusetts General Hospital, Harvard University, Boston, MA
2018	Department of Anesthesiology and Clinical Pharmacology, University of British Columbia, Vancouver, BC
2018	Medical University of Hanoi, Hanoi, Vietnam
2018	First Affiliated Hospital, Harbin, China
2018	Second Affiliated Hospital, Harbin, China

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Peking Union Medical Center, Beijing, China

October 2019