

Curriculum Vitae

Name: Jeffrey R. Balser
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Training

1984 B.S.E. in Biomedical Engineering from Tulane University, LA United States
1990 Ph.D. in Pharmacology from Vanderbilt University, TN United States
1990 M.D. in Medicine from Vanderbilt University, TN United States

Academic Appointments

10/1998 - 04/2001 Associate Professor of Anesthesiology, Vanderbilt University (Nashville, Tennessee)
04/2001 - Present Professor of Pharmacology, Vanderbilt University (Nashville, Tennessee)
04/2001 - 01/2010 James Tayloe Gwathmey Clinician-Scientist, Vanderbilt University (Nashville, Tennessee)
04/2001 - Present Professor of Anesthesiology, Vanderbilt University (Nashville, Tennessee)
09/2001 - 05/2004 Department Chair of Anesthesiology, Vanderbilt University (Nashville, Tennessee)
04/2006 - Present Professor of Medicine, Vanderbilt University (Nashville, Tennessee)
07/2008 - Present Dean of Vanderbilt University School of Medicine, Vanderbilt University (Nashville, Tennessee)
06/2009 - Present Vice Chancellor for Health Affairs, Vanderbilt University (Nashville, Tennessee)

Other Work Experience

01/1995 - 02/1998 Assistant Professor, The Johns Hopkins University School of Medicine
01/1995 - 10/1998 Attending Physician, The Johns Hopkins University School of Medicine
03/1998 - 10/1998 Associate Professor, The Johns Hopkins University School of Medicine
11/1998 - 06/2003 Associate Dean, Physician Scientist Chairman, Vanderbilt
11/1998 - 04/2001 Associate Professor, Vanderbilt
04/2001 - Present The James Tayloe Gwathmey Professor of Anesthesiology and Pharmacology, Vanderbilt
09/2001 - 07/2004 Chairman, Vanderbilt
01/2004 - Present Associate Vice-Chancellor for Research, Vanderbilt

Honors / Awards

1980 1980-1984 Tulane University Deans Honor Scholarship, Tau Beta Pi, Summa Cum Laude
1984 Vanderbilt University Medical Scientist Training Program
1990 Vanderbilt University Meade Haven Scholar, Albert Weinstein Prize
1994 1994-1996 Passano Clinician Scientist, The Johns Hopkins University School of Medicine
1996 Louis and Arnold Katz Basic Science Award, The American Heart Association
1999 Association of University Anesthesiologists (AUA)
1999 1999-2002 Established Investigator, The American Heart Association
2000 American Society of Anesthesiologists, National Refresher Course Lecturer
2000 Association of Cardiac Anesthesiologists (ACA)
2001 Fellow of the American Heart Assoc. (Basic Cardiovascular Sciences, FAHA)
2001 American Society for Clinical Investigation (ASCI)

Publications

Non-Peer Reviewed Publications

Research Articles

1. Cowin SC, Hart RT, **Balser JR**, Kohn DH. Functional adaptation in long bones: establishing in vivo values for surface remodeling rate coefficients. *Journal of Biomechanics* 1985; 18(9).
2. Roden, DM, Bennett, PB, Snyders, DJ, **Balser, JR**, Hondeghem, LM. Quinidine delays IK activation in guinea pig ventricular myocytes. *Circ Res* 1988; 62(5) PMID: 2452034.
3. Roden DM, Bennett PB, Snyders DJ, **Balser JR**, and Hondeghem LM. Quinidine delays IK activation in guinea pig ventricular myocytes. *Circulation Research* 1988; 62.
4. **Balser JR**, Roden DM, and Bennett PB. Single inward rectifier potassium channels in guinea pig ventricular myocytes: effects of quinidine. *Biophysical Journal* 1990; 59.
5. **Balser, JR**, Bennett, PB, Roden, DM. Time-dependent outward current in guinea pig ventricular myocytes. Gating kinetics of the delayed rectifier. *J Gen Physiol* 1990; 96(4) PMID: 2258717 PMCID: 2229010.
6. **Balser JR**, Bennett PB, Roden DM. Time-dependent outward current in guinea pig ventricular myocytes: gating kinetics of the delayed rectifier. *Journal of General Physiology* 1990; 96.
7. **Balser JR**, Roden DM, and Bennett PB. Global parameter optimization for cardiac potassium channel gating models. *Biophysical Journal* 1990; 57.
8. Wikswo JP, Wisialowski TA, Altemeier WA, **Balser JR**, Kopelman HA, Roden DM. Virtual cathode effects during stimulation of cardiac muscle: two-dimensional in vivo experiments. *Circulation Research* 1991; 68.
9. **Balser, JR**, Bennett, PB, Hondeghem, LM, Roden, DM. Suppression of time-dependent outward current in guinea pig ventricular myocytes. Actions of quinidine and amiodarone. *Circ Res* 1991; 69(2) PMID: 1860189.
10. **Balser, JR**, Roden, DM, Bennett, PB. Single inward rectifier potassium channels in guinea pig ventricular myocytes. Effects of quinidine. *Biophys J* 1991; 59(1) PMID: 2015380 PMCID: 1281127.
11. **Balser JR**, Bennett PB, Hondeghem LM, Roden DM. Suppression of time-dependent outward current in guinea pig ventricular myocytes: actions of quinidine and amiodarone. *Circulation Research* 1991; 69.
12. Tomaselli GF, Chiamvimonvat N, Nuss HB, **Balser JR**, Perez-Garcia, MT, Kluge K, Orias DW, Backx PH, Marban E. A Mutation in the pore of the sodium channel that alters gating. *Biophysical Journal* 1995; 68.
13. Lawrence, JH, Orias DW, **Balser JR**, Nuss HB, Tomaselli, GF, Marban E. Single-channel analysis of inactivation-defective rat skeletal muscle sodium channels containing the F1304Q mutation. *Biophysical Journal* 1996; 71.
14. Nuss HB, **Balser JR**, Orias DW, Lawrence JH, Tomaselli GF, Marban E. Coupling between fast and slow inactivation revealed by analysis of a point mutation (F1304Q) in $\square 1$ rat skeletal muscle sodium channels. *Journal of Physiology* 1996; 494.
15. Balser JR, Nuss HB, Romashko, DN, Marban E, Tomaselli, GF. Functional consequences of lidocaine binding to slow-inactivated sodium channels. *Journal of General Physiology* 1996; 107.
16. **Balser JR**, Nuss HB, Orias DW, Johns DC, Marban E, Tomaselli GF, Lawrence JH. Local anesthetics as effectors of allosteric gating: lidocaine effects on inactivation-deficient rat skeletal muscle Na channels. *Journal of Clinical Investigation* 1996; 98.
17. **Balser JR**, Nuss HB, Chiamvimonvat N, Perez-Garcia MT, Marban E, Tomaselli GF. External pore residue mediates slow inactivation in $\square 1$ rat skeletal muscle sodium channels. *Journal of Physiology* 1996; 494.
18. Benitah JP, **Balser JR**, Marban E, Tomaselli GF. Proton Inhibition of sodium channels: mechanism of gating shifts and reduced conductance. *Journal of Membrane Biology* 1997; 155.
19. Perez-Garcia MT, Chiamvimonvat N, Ranjan R, **Balser JR**, Tomaselli GF, Marban E. Mechanisms of sodium/calcium selectivity in sodium channels probed by cysteine mutagenesis and sulphydryl modification. *Biophysical Journal* 1997; 72.
20. Schultheis LW, **Balser JR**, Calkins H, Robertson S, Weiss JL, Sussman M, Stuart RS. High dose neostigmine treatment of sinus tachycardia. *PACE* 1997; 20.
21. **Balser JR**. The rational use of intravenous amiodarone in the perioperative period. *Anesthesiology* 1997; 86.
22. Perdue PW, **Balser JR**, Lipsett PA, Breslow MJ. "Renal-dose" dopamine in surgical patients: Dogma or science?. *Annals of Surgery* 1998; 227.
23. Kambouris N, Hastings L, Stepanovic S, Marban E, Tomaselli GF, **Balser JR**. Mechanistic link between local anaesthetic action and inactivation gating probed by outer pore mutations in the rat $\square 1$ sodium channel. *Journal of Physiology* 1998; 512.
24. Kambouris NG, Nuss HB, Johns DC, Tomaselli GF, Marban E, **Balser JR**. Phenotypic characterization of a novel long QT syndrome mutation in the cardiac sodium channel. *Circulation* 1998; 97.

25. Pu, J, **Balser JR**, Boyden PA. Lidocaine action on sodium currents in ventricular myocytes from the epicardial border zone of the infarcted heart. *Circulation Research* 1998; 83.
26. **Balser JR**, Martinez EA, Winters BD, Purdue PW, Clarke AW, Huang W, Tomaselli GF, Dorman T, Campbell K, Lipsett P, Breslow MJ, Rosenfeld BA. \square -adrenergic blockade accelerates conversion of postoperative supraventricular tachycardia. *Anesthesiology* 1998; 89.
27. **Balser, JR**. The molecular pharmacology of local anesthetic/antiarrhythmic agents. *Trends in Cardiovascular Medicine* 1998; 8.
28. Dorman T, Breslow MJ, Lipsett PA, Rosenberg JM, **Balser JR**, Almog Y, Rosenfeld BA. Radial artery pressure monitoring underestimates central arterial pressure during vasopressor therapy in critically ill surgical patients. *Critical Care Medicine* 1998; 10.
29. **Balser, JR**. Structure and function of the cardiac sodium channels. *Cardiovasc Res* 1999; 42(2) PMID: 10533571.
30. Benitah JP, Chen Z, **Balser JR**, Tomaselli GF and Marban E. Molecular dynamics of the sodium channel pore vary with gating: Interactions between P-segment motions and inactivation. *J Neurosci* 1999; 19(5).
31. **Balser JR**. . Structure and function of the cardiac sodium channels. *Cardiovascular Research* 1999; 42.
32. **Balser JR**. Sodium β channelopathies and sudden death: must you be so sensitive?. *Circulation Research* 1999; 85.
33. Johnson, JP, **Balser, JR**, Bennett, PB. Enhancement of HERG K(+) currents by Cd(2+) destabilization of the inactivated stat. *Biophys J* 1999; 77(5) PMID: 0010545354.
34. Johnson, JP, **Balser, JR**, Bennett, PB. Enhancement of HERG K(+) currents by Cd(2+) destabilization of the inactivated stat. *Biophys J* 1999; 77(5) PMID: 10545354 PMCID: 1300528.
35. Johnson JP, **Balser JR**, Bennett PB. Enhancement of HERG K currents by destabilization of the inactivated state. *Biophysical Journal* 1999; 77.
36. **Balser JR**. Structure and function of the cardiac sodium channels. *Cardiovasc Res* 1999; 42(2).
37. Benitah JP, Chen Z, **Balser JR**, Tomaselli GF, Marban E. Molecular dynamics of the sodium channel pore vary with gating: interactions between P-segment motions and inactivation. *Journal of Neuroscience* 1999; 19.
38. Ong, BH, Tomaselli, GF, **Balser, JR**. A structural rearrangement in the sodium channel pore linked to slow inactivation and use dependence. *J Gen Physiol* 2000; 116(5) PMID: 11055994 PMCID: 2229478.
39. Chen, Z, Ong, BH, Kambouris, NG, MarbÃin, E, Tomaselli, GF, **Balser, JR**. Lidocaine induces a slow inactivated state in rat skeletal muscle sodium channels. *J Physiol* 2000; 524 Pt 1: PMID: 10747182 PMCID: 2269847.
40. Chen Z, Ong BH, Kambouris NG, Marban E, Tomaselli GF and **Balser JR**. Lidocaine induces a slow inactivated state in rat skeletal muscle sodium channels. *J Physiol* 2000; 524.
41. Numaguchi, H, Mullins, FM, Johnson, JP, Johns, DC, Po, SS, Yang, IC, Tomaselli, GF, **Balser, JR**. Probing the interaction between inactivation gating and Dd-sotalol block of HERG. *Circ Res* 2000; 87(11) PMID: 11090546.
42. Numaguchi, H, Johnson, JP, Petersen, CI, **Balser, JR**. A sensitive mechanism for cation modulation of potassium current. *Nat Neurosci* 2000; 3(5) PMID: 10769379.
43. Dzhura I, Wu Y, Colbran RJ, **Balser JR** and Anderson ME. Calmodulin kinase determines calcium-dependent facilitation of L-type calcium channels. *Nat Cell Biol* 2000; 2(3).
44. Kambouris NG, Nuss HB, Johns DC, Marban E, Tomaselli GF and **Balser JR**. A revised view of cardiac sodium channel "blockade" in the long-QT syndrome. *J Clin Invest* 2000; 105(8).
45. Wang, DW, Makita, N, Kitabatake, A, **Balser, JR**, George, AL. Enhanced Na(+) channel intermediate inactivation in Brugada syndrome. *Circ Res* 2000; 87(8) PMID: 11029409.
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47. 2000.
48. Nuss HB, Marban E, Tomaselli GF, **Balser JR**. Isoform-Specific Lidocaine Block of Sodium Channels Rationalized by Differences in Gating. *Biophysical Journal* 2000; 78.
49. **Balser, JR**. The cardiac sodium channel: gating function and molecular pharmacology. *J Mol Cell Cardiol* 2001; 33(4) PMID: 11273715.
50. Johnson, JP, **Balser, JR**, Bennett, PB. A novel extracellular calcium sensing mechanism in voltage-gated potassium ion channels. *J Neurosci* 2001; 21(12) PMID: 11404399.
51. Dzhura, I, Wu, Y, Colbran, RJ, Corbin, JD, **Balser, JR**, Anderson, ME. Cytoskeletal disrupting agents prevent calmodulin kinase, IQ domain and voltage-dependent facilitation of L-type Ca²⁺ channels. *J Physiol* 2002; 545 (Pt 2) PMID: 12456820 PMCID: 2290681.
52. **Balser, JR**. Perioperative arrhythmias: incidence, risk assessment, evaluation, and management. *Card Electrophysiol Rev* 2002; 6(1-2) PMID: 11984026.
53. Wang, DW, Viswanathan, PC, **Balser, JR**, George, AL, Benson, DW. Clinical, genetic, and biophysical characterization of SCN5A mutations associated with atrioventricular conduction block. *Circulation* 2002; 105 (3) PMID: 11804990.
54. Kupershmidt, S, Yang, IC, Sutherland, M, Wells, KS, Yang, T, Yang, P, **Balser, JR**, Roden, DM. Cardiac-

- enriched LIM domain protein fhl2 is required to generate I(Ks) in a heterologous system. *Cardiovasc Res* 2002; 56(1) PMID: 12237170.
55. Tan, HL, Kupershmidt, S, Zhang, R, Stepanovic, S, Roden, DM, Wilde, AA, Anderson, ME, **Balser, JR**. A calcium sensor in the sodium channel modulates cardiac excitability. *Nature* 2002; 415(6870) PMID: 11807557.
 56. Mullins, FM, Stepanovic, SZ, Desai, RR, George, AL, **Balser, JR**. Extracellular sodium interacts with the HERG channel at an outer pore site. *J Gen Physiol* 2002; 120(4) PMID: 12356854 PMCID: 2229534.
 57. Roden, DM, **Balser, JR**, George, AL, Anderson, ME. Cardiac ion channels. *Annu Rev Physiol* 2002; 64: PMID: 11826275.
 58. Kupershmidt, S, Yang, IC, Hayashi, K, Wei, J, Chanthaphaychith, S, Petersen, CI, Johns, DC, George, AL, Roden, DM, **Balser, JR**. The IKr drug response is modulated by KCR1 in transfected cardiac and noncardiac cell lines. *FASEB J* 2003; 17(15) PMID: 14525949.
 59. Mullins, FM, Stepanovic, SZ, Gillani, NB, George, AL, **Balser, JR**. Functional interaction between extracellular sodium, potassium and inactivation gating in HERG channels. *J Physiol* 2004; 558(Pt 3) PMID: 15169846 PMCID: 1665011.
 60. Viswanathan, PC, **Balser, JR**. Inherited sodium channelopathies: a continuum of channel dysfunction. *Trends Cardiovasc Med* 2004; 14(1) PMID: 14720472.
 61. Petersen, CI, McFarland, TR, Stepanovic, SZ, Yang, P, Reiner, DJ, Hayashi, K, George, AL, Roden, DM, Thomas, JH, **Balser, JR**. In vivo identification of genes that modify ether-a-go-go-related gene activity in *Caenorhabditis elegans* may also affect human cardiac arrhythmia. *Proc Natl Acad Sci U S A* 2004; 101(32) PMID: 15280551 PMCID: 511051.
 62. Wingo, TL, Shah, VN, Anderson, ME, Lybrand, TP, Chazin, WJ, **Balser, JR**. An EF-hand in the sodium channel couples intracellular calcium to cardiac excitability. *Nat Struct Mol Biol* 2004; 11(3) PMID: 14981509.
 63. Thompson, A, **Balser, JR**. Perioperative cardiac arrhythmias. *Br J Anaesth* 2004; 93(1) PMID: 15145821.
 64. Fukuda, K, Davies, SS, Nakajima, T, Ong, BH, Kupershmidt, S, Fessel, J, Amarnath, V, Anderson, ME, Boyden, PA, Viswanathan, PC, Roberts, LJ, **Balser, JR**. Oxidative mediated lipid peroxidation recapitulates proarrhythmic effects on cardiac sodium channels. *Circ Res* 2005; 97(12) PMID: 16284182.
 65. Shah, VN, Wingo, TL, Weiss, KL, Williams, CK, **Balser, JR**, Chazin, WJ. Calcium-dependent regulation of the voltage-gated sodium channel hH1: intrinsic and extrinsic sensors use a common molecular switch. *Proc Natl Acad Sci U S A* 2006; 103(10) PMID: 16505387 PMCID: 1450128.
 66. Viswanathan, PC, **Balser, JR**. Molecular basis of isolated cardiac conduction disease. *Handb Exp Pharmacol* 2006; (171) PMID: 16610351.
 67. Nakajima, T, Hayashi, K, Viswanathan, PC, Kim, MY, Anghelescu, M, Barksdale, KA, Shuai, W, **Balser, JR**, Kupershmidt, S. HERG is protected from pharmacological block by alpha-1,2-glucosyltransferase function. *J Biol Chem* 2007; 282(8) PMID: 17189275.

Others

1. **Balser, J R**, Roden, D M, Bennett, P B. Global parameter optimization for cardiac potassium channel gating models. 1990; PMID: 2306494 PMCID: 1280738.
2. Wikswo, J P, Wisialowski, T A, Altemeier, W A, **Balser, J R**, Kopelman, H A, Roden, D M. Virtual cathode effects during stimulation of cardiac muscle. Two-dimensional in vivo experiments. 1991; PMID: 1991354.
3. **Balser, J R**. Inherited sodium channelopathies: novel therapeutic and proarrhythmic molecular mechanisms. 2001; PMID: 11673053.
4. Viswanathan, P C, Bezzina, C R, George, A L, Roden, D M, Wilde, A A, **Balser, J R**. Gating-dependent mechanisms for flecainide action in SCN5A-linked arrhythmia syndromes. 2001; PMID: 11535580.
5. Viswanathan, Prakash C, Benson, D Woodrow, **Balser, Jeffrey R**. A common SCN5A polymorphism modulates the biophysical effects of an SCN5A mutation. 2003; PMID: 12569159 PMCID: 151865.
6. Fukuda, Koji, Nakajima, Tadashi, Viswanathan, Prakash C, **Balser, Jeffrey R**. Compound-specific Na⁺ channel pore conformational changes induced by local anaesthetics. 2005; PMID: 15677685 PMCID: 1456037.