

Bob Eisenberg

(more formally, Robert S. Eisenberg)

Ten Most Representative Publications

Reprints available on this hyperlink or by clicking [\[PDF\]](#)

Papers: Electrical Properties of Ionic Channels:

- (1) Schuss, Zeev, Nadler, Boaz, and Eisenberg, R.S. (2001) Derivation of PNP Equations in Bath and Channel from a Molecular Model, *Phys Rev E* 64: 036116 1-14. [\[PDF\]](#)
- (2) Nonner, Wolfgang, Peyser, Alexander, Gillespie, Dirk, and Bob Eisenberg. (2004) Relating microscopic charge movement to macroscopic currents: the Ramo-Shockley theorem applied to ion channels. *Biophysical Journal*, 87: 3716-22. [\[PDF\]](#)
- (3) Boda, Dezsó, Nonner, Wolfgang, Valisko, Mónika, Henderson, Douglas, Eisenberg, Bob, and Dirk Gillespie (2007) Steric Selectivity in Na Channels Arising from Protein Polarization and Mobile Side Chains. *Biophysical Journal* 93:1960-1980. [\[PDF\]](#)
- (4) Eisenberg, Bob, Hyon, YunKyong, and Chun Liu. (2010) Energy Variational Analysis EnVarA of Ions in Water and Channels: Field Theory for Primitive Models of Complex Ionic Fluids. *Journal of Chemical Physics*. 133, 104104 [\[PDF\]](#)

Reviews

- (5) Eisenberg, R.S. (1983) Impedance Measurement of the Electrical Structure of Skeletal Muscle. In: *Handbook of Physiology, Section 10: Skeletal Muscle*, Ed. L.D. Peachey American Physiological Society, pp 301-323. [\[PDF\]](#)
- (6) Eisenberg, R.S. Channels as Enzymes. *J. Memb. Biol.*, 115, 1-12 (1990). [\[PDF\]](#) Published August 1, 2008, posted on arXiv.org with Paper ID as [arXiv:0808.0130](#) [\[PDF\]](#)
- (7) Tang, J.M., Wang, J., and Eisenberg, R.S. (1992) Perfusing patch pipettes, easily and quietly. *in Ion Channels* (ed.'s B. Rudy and L.E. Iverson), 207: 176-180 *Methods in Enzymology*. [\[PDF\]](#)
- (8) Eisenberg, Bob. (2010). Crowded Charges in Ion Channels. *Advances in Chemical Physics* (Stuart Rice, Editor), *in the press*. Posted on arXiv.org with Paper ID [arXiv:1009.1786v1](#) September 9, 2010. [\[PDF\]](#)
- (9) Eisenberg, Bob (2011) Mass Action in Ionic Solutions. *Frontiers Article*, and cover of *Chemical Physics Letters*, 511 p. 1-6; DOI: [10.1016/j.cplett.2011.05.037](#). *Note misprint in address. should be Rush University.* [\[PDF\]](#)
- (10) Eisenberg, Bob (2006). The value of Einstein's mistakes. "Einstein should be allowed his mistakes ..." *Physics Today* (Letter to the Editor) 59 (4) p.12. [\[PDF\]](#)

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Publications since 2008

Reprints available on this hyperlink or by clicking [\[PDF\]](#)

Papers (23, since 2009: 17)

- (1) Boda, Dezső, Nonner, Wolfgang, Henderson, Douglas, Eisenberg, Bob, and Dirk Gillespie. (2008) Volume exclusion in calcium selective channels. *Biophys. J.*, 94: 3486–3496 BioFAST: January 16, 2008. doi:10.1529/biophysj.107.122796. [\[PDF\]](#)
- (2) Roth, Roland, Gillespie, Dirk, Nonner, Wolfgang, Eisenberg, Bob. (2008) Bubbles, gating and anesthetics in ion channels. *Biophysical Journal* Volume 94 4282–4298 published online as January 30, 2008 as BioFAST, doi:10.1529/biophysj.107.120493 [\[PDF\]](#) *note misprint in middle initial of RSE in print edition.*
- (3) Powell, Matthew; Sullivan, Michael; Vlassiouk, Ivan; Constantin, Dragos; Sudre, Olivier; Martens, Craig, Eisenberg, Robert; and Siwy, Zuzanna (2008) Nanoprecipitation Assisted Ion Current Oscillations. *Nature Nanotechnology* 3, 51 - 57 (01 Jan 2008), doi: 10.1038/nnano.2007.420. [\[PDF\]](#)
- (4) Eisenberg, Bob. (2008). Bubble Gating Currents in Ionic Channels. Posted on arXiv.org with Paper ID [arXiv:0802.0308v1](#). [\[PDF\]](#)
- (5) Singer, A. Gillespie, D., Norbury J., and Eisenberg, R.S. (2008) Singular perturbation analysis of the steady state Poisson-Nernst-Planck system: applications to ion channels. *European Journal of Applied Mathematics* vol. 19, pp. 541–560. [\[PDF\]](#)
- (6) Abaid, Nicole, Eisenberg, R.S., Liu, Weishi. (2008) Asymptotic expansions of I-V relations via a Poisson-Nernst-Planck system. *SIAM Journal of Applied Dynamical Systems*. 7 1507-1526. [\[PDF\]](#)
- (7) Boda, Dezső, Valisko, Monika, Henderson, Douglas, Eisenberg, Robert, Gilson, Michael. (2009) Ions and Inhibitors in the Binding Site of HIV-Protease: Comparison of Monte Carlo Simulations and the Linearized Poisson-Boltzmann Theory. *Biophysical Journal* 96 1293–1306. [\[PDF\]](#)
- (8) Boda, Dezső, Valisko, Monika, Henderson, Douglas, Eisenberg, Bob, Gillespie, Dirk, and Wolfgang Nonner. (2009) Ionic selectivity in L-type calcium channels by electrostatics and hard-core repulsion. Cover of *Journal of General Physiology* [\[COVER\]](#) and 133 p. 497-509. [\[PDF\]](#)
- (9) He, Yan, Gillespie, Dirk, Boda, Dezső, Vlassiouk Ivan, Eisenberg, Robert S., and Zuzanna S. Siwy. (2009) Tuning transport properties of nanofluidic diodes with local charge inversion *Journal of the American Chemical Society* 131 (14), pp 5194–5202. [\[PDF\]](#)
- (10) Bardhan, Jaydeep P., Eisenberg, Robert S., and Dirk Gillespie. (2009) Discretization of the Induced-Charge Boundary Integral Equation. *Physical Review E*. 80, 011906. [\[PDF\]](#)

- (11) Luchinsky, D. G., Tindjong, R., Kaufman, I., McClintock, P.V.E., and R.S. Eisenberg. (2009) Self-consistent analytic solution for the current and the access resistance in open ion channels. *Physical Review E* 80, 021925. [\[PDF\]](#)
- (12) Malasics, Attila, Gillespie, Dirk, Nonner, Wolfgang, Henderson, Douglas, Eisenberg, Bob, Boda, Dezső. (2009) Protein structure and ionic selectivity in calcium channels: Selectivity filter size, not shape, matters. *Biophysica and Biochimica Acta: Biomembranes Biochimica et Biophysica Acta* 1788, 2471–2480. [\[PDF\]](#)
- (13) Luchinsky, D. G., Tindjong, R., Kaufman, I., McClintock, P.V.E., and R.S. Eisenberg. (2009) Charge fluctuations and their effect on conduction in biological ion channels. *Journal of Statistical Mechanics: Theory and Experiment*. P01010. [doi:10.1088/1742-5468/2009/01/P01010](https://doi.org/10.1088/1742-5468/2009/01/P01010). [\[PDF\]](#)
- (14) Knepley, Matthew G., Karpeev, Dmitry A., Davidovits, Seth, Eisenberg, Robert S., and Dirk Gillespie. (2010) An efficient algorithm for classical density functional theory in three dimensions. *Journal of Chemical Physics* 132, 124101-1 to 124101-11. [\[PDF\]](#) Posted on arXiv.org with Paper ID [arXiv:0910.1531](https://arxiv.org/abs/0910.1531).
- (15) Zhang, Chao; Raugei, Simone, Eisenberg, Robert, and Paolo Carloni. (2010) Molecular Dynamics in Physiological Solutions: Force-fields, Alkali Metal Ions, and Ionic Strength. *Journal of Chemical Theory and Computation*. 6:2167-2175. [\[PDF\]](#)
- (16) Eisenberg, Bob, Hyon, YunKyong, and Chun Liu. (2010) Energy Variational Analysis EnVarA of Ions in Water and Channels: Field Theory for Primitive Models of Complex Ionic Fluids. *Journal of Chemical Physics*. 133, 104104 [\[PDF\]](#)
- (17) Hyon, YunKyong, Eisenberg, Bob and Chun Liu. (2010). A mathematical model of the hard sphere repulsion in ionic solutions. *Communications in Mathematical Sciences* **9**, pp. 459–475 [\[PDF\]](#)
- (18) Eisenberg, B., Multiple Scales in the Simulation of Ion Channels and Proteins. (2010) *The Journal of Physical Chemistry C*, 2010. **114** (48): p. 20719-20733. [\[PDF\]](#)
- (19) Giri, Janhavi, Fonseca, James. E., Boda, Dezső, Henderson, Douglas, and Eisenberg, Bob. (2011) Self-organized Models of Selectivity in Calcium Channels. *Physical Biology Phys. Biol.* **8** 026004 [\[PDF\]](#)
- (20) Boda, Dezső, Giri, Janhavi, Henderson, Douglas Eisenberg, Robert and Gillespie, Dirk. (2011) Analyzing the components of the free energy landscape in a calcium selective ion channel by Widom's particle insertion method. *Journal of Chemical Physics*. **134**, 055102 [\[PDF\]](#)
- (21) Krauss, Daniel, Eisenberg, Bob and Gillespie, Dirk. (2011) Selectivity sequences in a model calcium channel: Role of electrostatic field strength. *European Journal of Biophysics*, **40**(6): p. 775-782. [\[PDF\]](#)
- (22) Boda, Dezső, Henderson, Douglas, Eisenberg, Bob and Dirk Gillespie. (2011) A method for treating the passage of a charged hard sphere ion as it passes through a sharp dielectric boundary. *Journal of Chemical Physics*, 135(6): 64105. [\[PDF\]](#)

- (23) Mori, Yoichiro, Liu, Chun, and RS Eisenberg (2011) A Model of Electrodifffusion and Osmotic Water Flow and its Energetic Structure. *Physica D (in the press)*. [[PDF](#)] See early version [Everything Else, Mori]

Reviews (4, since 2009: 3)

- (1) Eisenberg, Bob. (2008) Ion channels allow atomic control of macroscopic transport. *Physica Status Solidi (c)* 5, 708–713 (2008) /DOI 10.1002/pssc.200777556. [[PDF](#)]
- (2) Eisenberg, Bob. (2010). Crowded Charges in Ion Channels. *Advances in Chemical Physics* (Stuart Rice, Editor), *in the press*. Posted on arXiv.org with Paper ID [arXiv:1009.1786v1](#) September 9, 2010. [[PDF](#)]
- (3) Eisenberg, Bob (2011). Life's Solutions are Not Ideal. Posted on arXiv.org with Paper ID [arXiv:1105.0184v1](#), May 3, 2011. [[PDF](#)]
- (4) Eisenberg, Bob (2011) Mass Action in Ionic Solutions. *Frontiers Article*, and cover of *Chemical Physics Letters*, 511 p. 1-6; DOI: [10.1016/j.cplett.2011.05.037](#). Note misprint in address. should be Rush University. [[PDF](#)]

Everything Else (12, since 2009: 7)

- (1) Eisenberg, Bob. (2008) Understanding Life with Molecular Dynamics and Thermodynamics: Comment on *Nature* 451, 240-243 (2008). Posted on arXiv.org with Paper ID [arXiv:0802.2244v2](#) [[PDF](#)]
- (2) Eisenberg, B. (2008) Engineering channels: Atomic biology *Proc. Natl. Acad. Sci. U. S. A.* 2008 105: p. 6211-6212. [[PDF](#)]
- (3) Eisenberg, B. (2008) Letter to the Editor. *New York Times*, May 15, p. A30. [[PDF](#)]
- (4) Luchinsky, D.G., Tindjong, R., Kaufman, I. McClintock, P.V.E., R.S. Eisenberg. (2008) Charge fluctuations and their effect on conduction in biological ion channels.[†] Posted on arXiv.org with Paper ID [arXiv.org:0807.0838v1](#) [[PDF](#)]
- (5) Eisenberg, B. (2008) Ionic Selectivity in Channels: complex biology created by the balance of simple physics. *Nanotechnology 501 Lecture Series: Purdue University*.: Nanohub Purdue University. <http://www.nanohub.org/resources/4726/> [[PDF](#)]
- (6) Eisenberg, B. (2009). Self organized model of selectivity. Available online from Institute for Mathematics and its Applications (IMA) University of Minnesota at [Self-Organizd IMA link](#) and posted on arXiv.org with Paper ID <http://arxiv.org/abs/0906.5173> [[PDF](#)]
- (7) Eisenberg, B. (2010). Ion Channels and Selectivity. Kavli Institute of Theoretical Physics. University of California Santa Barbara. Seminar Slides on-line at <http://online.kitp.ucsb.edu/online/evocell10/eisenberg>

- (8) Bardhan, Jaydeep P., Leaf, Gary K. and Bob Eisenberg. (2010) Reproducible Estimation of Osmotic Coefficients Using the Inverse Monte Carlo Method. Argonne National Laboratory Mathematics and Computer Science Preprint ANL-MCS P1764-0610 [[PDF](#)]
- (9) Eisenberg, Bob. (2010) CSO Deserves Immense Credit. Letter to the Editor, Chicago Tribune, June 4. [[PDF](#)]
- (10) Eisenberg, Bob, Hyon, YunKyong, and Chun Liu. (2010) Energy variational analysis EnVarA of ions in water and channels: Field theory for primitive models of complex ionic fluids, Preprint# 2317 of the reprint series of the Institute for Mathematics and its Applications (IMA, University of Minnesota, Minneapolis) <http://www.ima.umn.edu/preprints/jun2010/jun2010.html> [[PDF](#)] *Nearly identical to paper 146.*
- (11) Hyon, YunKyong, Eisenberg, Bob, and Chun Liu. (2010) A mathematical model for the hard sphere repulsion in ionic solutions Preprint# 2318 of the reprint series of the Institute for Mathematics and its Applications (IMA, University of Minnesota, Minneapolis) <http://www.ima.umn.edu/preprints/jun2010/jun2010.html> [[PDF](#)]
- (12) Mori, Yoichiro, Liu, Chun, and RS Eisenberg (2010) A Model of Electrodifffusion and Osmotic Water Flow and its Energetic Structure. Posted on arXiv.org with Paper ID <http://arxiv.org/abs/1101.5193v1> [[PDF](#)], See final version: Papers, No. Mori

Abstracts (28, since 2009:25)

- (1) Powell, Matthew R., Sullivan, Michael, Vlassioux, Ivan, Constantin, Dragos, Sudre, Olivier, Martens, Craig, Eisenberg, Robert S., and Siwy, Zuzanna. (2008) Ion Current Oscillations Caused by Femtoliter Volume Precipitation in a Nanopore. Biophysical Journal 94 p. 333a. Poster [[PDF](#)]
- (2) Boda, Dezső, Nonner, Wolfgang, Valisko, Monika, Henderson, Douglas, Eisenberg, Bob, and Gillespie, Dirk. (2008) Competition of Steric repulsion and Electrostatic Attraction in the Selectivity Filter of Model Calcium Channels. Biophysical Journal 94 p. 447a. Poster [[PDF](#)]
- (3) Eisenberg, Bob, Roth, Roland, Gillespie, Dirk, and Nonner, Wolfgang. (2008) Bubbles, Gating, and Anesthetics in Ion Channels. Biophysical Journal 94 p. 1040a. Abstract [[PDF](#)]
- (4) Eisenberg, Bob, Boda, Dezső, Giri, Janhavi, Fonseca, James, Gillespie, Dirk, Henderson, Doug, and Nonner, Wolfgang. (2009) Self-organized Models of Selectivity in Ca and Na Channels. Biophysical Journal, Volume 96, Issue 3, 253a. Abstract [[PDF](#)] and Poster [[PDF](#)] Other versions available at Institute of Mathematics and its Applications IMA, University of Minnesota, [Self-Organizd IMA link](#) and on the arXiv.org with Paper ID [arXiv:0906.5173](http://arxiv.org/abs/0906.5173) [[PDF](#)]

- (5) Knepley, Matthew G., Karpeev, Dmitry A., Eisenberg, Robert S., and Gillespie, Dirk. (2009) Energetics of Calcium Selectivity: A Three-Dimensional Classical Density Functional Theory Approach. *Biophysical Journal*, Volume 96, Issue 3, 661a. Abstract [[PDF](#)] and Poster [[PDF](#)]
- (6) Mori, Yoichiro, Liu, Chun, and RS Eisenberg (2010) A multidomain model for electrodiffusion and water flow Volume 98 pp. 96a Abstract [[PDF](#)] and Poster 511 [[PDF](#)]
- (7) Fonseca, James E. Boda, Dezső, Nonner, Wolfgang, and Bob Eisenberg (2010) Conductance and concentration relationship in a reduced model of the K⁺ channel. Volume 98 pp. 117a Abstract [[PDF](#)] and Poster 613 [[PDF](#)]
- (8) Zhang, Chao, Raugei, Simone, Eisenberg, Bob, and Paolo Carloni. (2010) On the domain of applicability of currently used force fields for the calculation of the activity of alkali ions at physiological ionic strength. *Biophysical Journal*. Volume 98 pp. 330a - 331a. Abstract [[PDF](#)] and Poster 1718 [[PDF](#)]
- (9) Giri, Janhavi, Eisenberg, Bob, Gillespie, Henderson, Douglas, and Dezső Boda. (2010) Monte Carlo simulation of free energy components. Energetics of selective binding in a reduced model of L-type Ca²⁺ channels. *Biophysical Journal*. Volume 98 pp. 514a – 515a Abstract [[PDF](#)] and Poster 2665 [[PDF](#)]
- (10) Eisenberg, Robert S., Hyon, YunKyong, and Chun Liu. (2010) Energetic Variational Analysis *EnVarA* of ions in calcium and sodium channels. *Biophysical Journal*. Volume 98 pp. 515a. Abstract [[PDF](#)] and Poster 2666 [[PDF](#)]
- (11) Mori, Y., C. Liu, and R.S. Eisenberg, (2011) Electrodiffusion and Osmotic Water Flow and its Variational Structure. *Biophysical Journal*. 100(3): p. 86a-87a. Abstract 466-Pos [[PDF](#)] and Poster Board B266 [[PDF](#)]
- (12) Berti, C., D. Gillespie, B. Eisenberg, S. Furini, and C. Fiegna, (2011) A novel Brownian-Dynamics Algorithm for the Simulation of Ion Conduction Through Membrane Pores. *Biophysical Journal*. 100(3): p. 158a. Abstract 867-Pos [[PDF](#)] and Poster Board B667 [[PDF](#)]
- (13) Ryham, R., R. Eisenberg, C. Liu, and F. Cohen, (2011) A Continuum Variational Approach to Vesicle Membrane Modeling. *Biophysical Journal*. Volume100(3): p. 187a. Abstract [[PDF](#)] and 1025-Plat [[PDF](#)]
- (14) Jimenez-Morales, D., J. Liang, and B. Eisenberg, (2011) Active Sites of Enzymes are Crowded with Charge. *Biophysical Journal*. 100(3): p. 218a. Abstract 1191-Pos [[PDF](#)] and Poster Board B101 [[PDF](#)]
- (15) Hyon, Y., J.E. Fonseca, B. Eisenberg, and C. Liu, (2011) A new Poisson-Nernst-Planck Equation (PNP-FS-IF) for charge inversion near walls. *Biophysical Journal*. 100(3): p. 578a. Abstract 3130-Pos [[PDF](#)] and Poster Board B235 [[PDF](#)]
- (16) 123. Giri, J., J.M. Tang, C. Wirth, C.M. Peneff, T. Schirmer, and B. Eisenberg, (2011) Single Channel Measurements of N-Acetylneuraminic Acid-Inducible Channel (NANC) in *E. coli*. *Biophysical Journal*. Volume 100(3): p. 579a. Abstract 3136-Pos [[PDF](#)] and Poster Board B241 [[PDF](#)]

- (17) Giri, J., J.M. Tang, C. Wirth, C.M. Peneff, T. Schirmer, and B. Eisenberg, (2011) Sialic Acid Transport in E. coli: Role of Outer Membrane Porin NanC. Biophysical Journal. 100(3): p. 577a. Abstract 3123-Pos [\[PDF\]](#) and Poster Board B228 [\[PDF\]](#)
- (18) Jimenez-Morales, D., J. Liang, and B. Eisenberg, (2011) Active Sites of Enzymes are Crowded with Charge. 6th Annual Midwest Conference on Protein Folding, Assembly, and Molecular Motions. University of Notre Dame. (*not published*) [\[PDF\]](#)