

# **Bob Eisenberg**

*aka Robert S. Eisenberg*

## *Curriculum Vitae*

*February 3, 2008*

### ***Work co-ordinates***

#### ***Address***

Department of Molecular Biophysics and Physiology  
Rush Medical College  
1750 West Harrison, Room 1291 Jelke  
Chicago IL 60612

#### ***Phone numbers***

Voice: (312)-942-6467  
Dept FAX: (312)-942-8711  
FAX to email: (801)-504-8665  
Skype Phone Number (708)-459-8089  
Email: [beisenbe@rush.edu](mailto:beisenbe@rush.edu)

### ***Short Biography***

Bob Eisenberg received his A.B. (summa cum laude) after three years of study at Harvard College with John Edsall as tutor. He started studying electrical properties of cells at that time, working under the direction of John Pappenheimer and Steve Kuffler. He went to University College London for his Ph.D. under Paul Fatt with Alan Hodgkin as his external examiner (and hero!), Bernard Katz as Chairman, and Andrew Huxley as mentor, for many years. Eisenberg's Ph.D. thesis and later work for a decade or two used engineering methods (impedance measurements) to determine the electrical structure of cells and tissues (skeletal muscle, cardiac muscle, lens of the eye), developing mathematical models to describe the anatomy of the tissue (with the help of Julian Cole and Victor Barcion), and to measure the structure with statistical sampling methods of stereology (helping Brenda Eisenberg). He served as Chairman of the Physiology Study Section of the NIH for several years, and Director of Research (etc) for the American Heart Association (Chicago Branch). After single channel recording was discovered, he was the inventor and senior designer of the AxoPatch patch clamp amplifier (working with Rick Levis, Jim Rae, and Alan Finkel) which is used by most workers in the field to this day.

Bob has spent many years on multi-scale analysis of ion channels, seeking to predict the current through the channel, in a range of solutions of different composition, over a range of voltages. Working with Zeev Schuss, he showed how the flux over a potential barrier of arbitrary shape could be evaluated analytically, starting from a description of the stochastic trajectories of diffusion. "Eyring models" of transition state theory arise as a special case, hardly easier to compute than the general formulas. Eisenberg (with Wolfgang Nonner and Dirk Gillespie, et al) has shown how the properties of concentrated bulk solutions (as summarized in the Density Functional Theory of the Liquid State) can account for the selectivity of L-type calcium channels and voltage activated  $\text{Na}^+$  channels (of nerve membranes for example originally described by

Hodgkin, Huxley and Katz) without invoking specific binding sites or quantum mechanical effects. Recently, he (helping Zeev Schuss and Boaz Nadler) have shown how mean field models can be derived from a model of the stochastic trajectories of ions in solution, using the techniques of probability theory and one easily justified physical assumption. He has recently (1) designed selective channels using nonselective bacterial channels (ompF porin) as the ‘substrate’ (with Hank Miedema, et al, from Groningen), (2) designed abiotic ionic channels (which Zuzanna Siwy builds), (3) helped Weishi Liu apply geometric perturbation theory to ion channels, and (4) used the mathematics of inverse problems to design the selectivity and permanent charge of channels, assisting Heinz Engl and Martin Burger.

Along the way, he helped Amit Singer (working with Zeev Schuss) show why perturbations in the charge distribution of table salt (NaCl) do not produce sparks and electrocute those who touch it. Safety in salt is a consequence of probability theory alone and does not depend on physics, as users of salt should be glad to know.

## ***Internet Coordinates***

### ***Web Sites***

Departmental Site: <http://www.rushu.rush.edu/molbio/>  
with a ‘Chairman’s Message’ at <http://www2.phys.rush.edu/physiomsg.html>  
leading to Personal Site <http://www2.phys.rush.edu/RSEisenberg/physioeis.html>

*PNP* Online <http://www.pnponline.org/> Interactive software for running Poisson Nernst Planck theory, with Brice Burgess.

### ***FTP Sites***

- 1) [Reprints](#) available on this [hyperlink](#)  
or by anonymous ftp from <ftp.rush.edu>.  
(*sign on as anonymous;*, for password: use your email address)  
Migrate to [/MoleBio/Bob\\_Eisenberg/Reprints](#)  
or just click on this hyperlink
- 2) *PNP* is available in various flavors,
  - a. *PNP*online is at <http://www.pnponline.org/> thanks to Brice Burgess
  - b. from <ftp.rush.edu> at  
[/pub/Eisenberg/PNP](#); [/pub/Eisenberg/Hollerbach](#); [/pub/Eisenberg/Nonner](#), thanks to Duan Chen, Uwe Hollerbach, Wolfgang Nonner and See-Wing Chiu.
- 3) Files of single channel currents with noise are in [/pub/Eisenberg/Noise](#), written in collaboration with Rick Levis (*deceased, 2005*).

## ***Education***

Elementary School: New Rochelle, New York

High School, 1956-59. Horace Mann School, Riverdale, New York City, graduated in three years with honors and awards in Biology, Chemistry, Physics, Mathematics, Latin, English and History.

Undergraduate, 1959-62. Entered Harvard College with Advanced Placement as a sophomore, concentrated in Biochemical Sciences, Prof. J.T. Edsall tutor and mentor; advisor in Physiology Prof. J.R. Pappenheimer; graduated in three years A.B., *summa cum laude*.

Summer work, 1960-61. Nerve Muscle Program at Marine Biological Laboratory directed by Prof. S.W. Kuffler.

Doctoral work: University College London 1962-65 (Ph.D. in Biophysics: B. Katz, Chairman); Supervisor, P. Fatt; External Examiner, A.L. Hodgkin. Mentor (over several decades): A.F. Huxley.

## ***Personal***

### *Home co-ordinates:*

Address: 7320 Lake Street, Unit 5, River Forest IL 60305

Phone: (708)-366-6332

Personal FAX: (801)-504-8665 and also (775)-256-9463

Born in Brooklyn, New York, April 25, 1942: Citizen of the United States.

Social Security Number 075-xx-xxxx.

Married Ardyth Eisenberg, 1991.

Children (mother, Brenda Russell):

Benjamin Russell Eisenberg, born March 17, 1969.

*Grandchild, mother Angelle Moutoussamy*

Crystal Lynn Moutoussamy, born March 19, 1994

Emily Ruth Eisenberg, born February 8, 1973. Husband, Benjamin Taylor

Jill Anna Trowbridge (formerly Eisenberg), born November 7, 1974.

*Grandchildren, father John Trowbridge*

James Louis Trowbridge, born August 15, 1997.

Holly Sophia Trowbridge, born July 11, 2000.

Henry Samuel Trowbridge, born January 15, 2004.

Alastair Solomon Trowbridge, born January 10, 2006

Sally Lynn Eisenberg, born June 20, 1979.

## ***Academic Positions***

### *Main Positions*

Rush Medical College, Chicago IL. Rush Employee ID 010207

1995- .... Chairman of Molecular Biophysics and Physiology

1976 -.... Endowed Chair "The Francis and Catherine Bard Professor"

1976-1995 Chairman of Physiology

University of California at Los Angeles

1975-1976 Professor of Biomathematics and Physiology,  
Chairmen: Carol Newton, W. Mommaerts

1970-1975 Associate Professor, Dept of Physiology

1968-1970 Assistant Professor, Dept of Physiology,

Duke University, Durham NC

Associate, 1965-1968. Department of Physiology, Duke University,  
Chairman: D. Tosteson. Post-doctoral fellow of P. Horowicz, along with  
P. Gage, C. Armstrong, etc.

### *Secondary Positions*

Adjunct Professor, Department of Bioengineering, University of Illinois Chicago 2007- ...  
Senior Scientist, Argonne National Laboratory (Mathematics and Computer Science  
Division, 2005 - ...

Schlumberger Visiting Professor, University of Cambridge (UK) 2002

Visiting Fellow, Corpus Christi College, University of Cambridge (UK) 2002

Visiting Professor, 2000-2003 Computational Electronics, Beckman Institute, University of  
Illinois, Urbana Champaign

Visiting Scientist, 1991-1995. Department of Physics, Brookhaven National Laboratory,  
Upton, Long Island, NY.

### *Honors*

Editorial Board, Journal of General Physiology, 1970-1991

Editorial Board, Journal of Computational Electronics, 2001-...

Associate Editor, Comments on Theoretical Biology, 1987- ..

Associate Editor, News in Physiological Sciences, 1988-1992

Harvard College Scholarship

A.B. received *summa cum laude*

Phi Beta Kappa: member of "Senior Sixteen"

L.J. Henderson award for thesis in Biochemical Sciences

Senior Common Room Award for "Most Promising Scholar"

Schlumberger Visiting Professor, University of Cambridge (UK)

Visiting Fellow, Corpus Christi College, University of Cambridge (UK)

Schlumberger Medal, Physical Chemistry

Plenary Lecture at European Mathematics Society/AMAM 2003

Member Executive Board, American Physical Society (2002-2004)

Fellow, American Physical Society (Division of Biological Physics)

Argonne National Laboratory: Director's Seminar

Fellow, Senior, and Life Member of the IEEE

Institute of Medicine of Chicago

### *Grant Support*

Continuous Grant Support (without interruption) thanks to a combination of NSF, NIH, and  
DARPA from approximately 1970 to present. Miscellaneous additional grants from AHA,  
MDA, Chicago Heart, etc.

### *Scientific Administration*

AMERICAN PHYSICAL SOCIETY

Councilor (First term: 2000-2004)

Councilor (Second term: 2005-2009)  
 Member of Executive Board (2002-2004)  
 Member, Committee on Committees (2003- 2006)  
 Member, Audit Committee (2004 - 2007), Chair Audit Committee (2005 – 2006)  
 Division of Biological Physics  
 Executive Board (2001- ...)

#### BIOPHYSICAL SOCIETY

Member of U.S. National Committee International Union of Pure and Applied  
 Biophysics (1978-1983)  
 Member of Council (1983-1986).  
 Member of Executive Board (1983-1986).  
 Member of Program Committee (1984).  
 Chairman of Nominating Committee (1985).  
 Chairman of Science Public Policy Committee (1985-1987).

#### CHICAGO CHAPTER OF SOCIETY FOR NEUROSCIENCE

Member of Council (1981-1984), Meeting Organizer, then President.

#### CHICAGO HEART ASSOCIATION

Member, Vice Chairman, then Chairman of the Research Council (1982-1986).  
 Member, Vice Chairman, then Chairman of Research Review Committee (1976-1986;  
 1989).

#### NATIONAL INSTITUTES OF HEALTH

Member (1979-1981), then Chairman (1981-1983) of Physiology Study Section.  
 Member *ad hoc* (2004) Modeling and Analysis of Biological Systems (MABS) Study  
 Section.

#### NATIONAL SCIENCE FOUNDATION

Member, Steering Committee on Biology and Mathematics (1989, 1996).

#### PENNSYLVANIA MUSCLE INSTITUTE

Member (1980-1982; 1989-1990), then Chairman (1982-1987; 1989-1990) of the External  
 Advisory Board, University of Pennsylvania, Director: A. Somlyo (1980-1987);  
 Y. Goldman (1989-1990).

#### SOCIETY OF GENERAL PHYSIOLOGISTS

Councilor; Chairman, Membership Committee.

#### UNIVERSITY OF MIAMI

External review of Graduate Program, Department of Physiology (1988).

### ***Invited Lectures***

Albert Einstein College of Medicine  
 American Chemical Society, Division of Physical Chemistry  
 American Heart Association  
 AMA Institute (1966)  
 American Physical Society (Division of Biological Physics) March Meeting, 2000  
 American Physical Society (Division of Biological Physics) March Meeting, 2006

American Chemical Society Meeting, San Francisco, 2000  
 American Physiological Society Meeting: 1978, 1979, 1983  
 Argonne National Laboratory: Director's Seminar  
 Association of Chairmen of Departments of Physiology  
 Australian National University (Canberra)  
 Baylor University  
 Biological Chemists of the Federal Republic of Germany  
 Biophysical Society, 1991: in Symposium on Ion Channels in Intracellular Membranes  
 Biophysical Society, 2007: in Symposium on Modeling as a Tool in Biophysics; Sponsor  
 American Physical Society (Division of Biological Physics)  
 Biozentrum (Basel, Switzerland): Minicourse on Electrophysiology  
 Biozentrum (Basel, Switzerland): Selectivity in Channels (Seminar in Structural Biology)  
 Boston University (Department of Mathematics)  
 Brandeis University (Biochemistry)  
 Brigham Young University (Zoology)  
 Brookhaven National Laboratory (Department of Physics)  
 California Institute of Technology (Biology)  
 California Institute of Technology (Applied Mathematics)  
 Cambridge University (England) Physiology: Foster Club  
 Cambridge University (England) Chemistry, in the "Lennard Jones Lecture Series"  
 Cambridge University (England) Pharmacology  
 Cambridge (England): Schlumberger Lecture, 2002  
 Cambridge University (England) Centre for Computational Chemistry  
 CCNY, Dept of Physics, Mike Lubell Chairman  
 CECAM: Ionic Transport: from Nanopores to Biological Channels (Organizers Mounir  
     Tarek and Mark Sansom, Lyon (2007))  
 Centro de Investigacion y de Estudios del Avanzados (Mexico City)  
 Chicago Heart Association Cardiovascular Research Forum  
 Chicago Medical School  
 City of Hope, Duarte, California  
 K.S. Cole Symposium (FASEB, 1974)  
 Colorado State University (Fort Collins: Dept. of Chemistry)  
 Columbia University, Dept of Chemical Engineering  
 Conference on Fluctuations, Escape, and Optimal Control Traverse City MI  
 Conference of N.Y. Academy of Science, 1977  
 Cornell University Medical School: Department of Physiology  
 Cornell University: Dept of Chemistry  
 Courant Institute (NYU) Seminar "Mostly Biomathematics" (2004)  
 DARPA (Defense Advanced Research Projects Agency)  
     Many workshops.  
     Director's Seminar, 2001  
 DSRC (Defense Sciences Research Council) Workshop on Biosensors  
 DuPont Experimental Station  
 European Mathematics Society: Plenary Lecture at AMAM 2003 (Applied Math ...)  
 Participant (not speaker) at EMBO Meeting in honor of retirement of Max Perutz  
     at Kings College, Cambridge, 1980  
 Emory University

Fine Structure Society (Rosemont IL 1995)  
 Florida State University: Inaugural Workshop for Computational Science, 2000  
 FOCUS 2000, DARPA workshop, Session Leader, Speaker, Plenary Session  
 Gordon Conference on Smooth Muscle, 1973  
 Gordon Conference on Skeletal Muscle, 1980  
 Gordon Conference on Skeletal Muscle, 1983  
 Gordon Conference on Skeletal Muscle, 1985  
 Gordon Conference on Solid State Ionics, 1990  
 Gordon Conference on Ion Channels, 1998  
 Gordon Conference on Ion Channels, 2000  
 Grinnel College, Department of Biology  
 Harvard University (Neurobiology)  
 Hebrew University, Jerusalem: Fritz Haber Lecturer in Physical Chemistry  
 Hebrew University, Jerusalem: Bat Sheva (de Rothschild) Seminar  
 Hebrew University, Jerusalem: Protein Dynamics and thermodynamics, participant and session chair.  
 Henderson Symposium (Basic and Applied Statistical Mechanics of Condensed Matter, Brigham Young University, 2004)  
 HRL (formerly Hughes Research Lab) Malibu: Physics Colloquium, 1999.  
 HRL (formerly Hughes Research Lab) Malibu: Colloquium, 2005.  
 ICIAM 6<sup>th</sup> International Congress on Industrial & Applied Mathematics Zurich 2007, Co-organizer, two minisymposia: Direct and inverse problems in channels and membranes. Organizer Martin Burger, Co-organizer Heinz Engl.  
 IEEE International Conference on Pattern Recognition (1994), presented by Amir Averbuch and Moshe Israeli  
 Intel Workshop on Early Disease Detection (Sept 2002)  
 Institute for Pure and Applied Mathematics, IPAM, UCLA, Ion Channels (2002)  
 Institute for Pure and Applied Mathematics, IPAM, UCLA, Inverse Problems, Lecture and Workshop (2003)  
 Institute for Pure and Applied Mathematics, IPAM, Lake Arrowhead UCLA Conference: Inverse Problems Reunion (2005)  
 Institute for Pure and Applied Mathematics, IPAM, Lake Arrowhead UCLA Conference: Inverse Problems Reunion (2006)  
 Institute for Theoretical Physics, University of California, Santa Barbara, Conference on Electrostatic Effects in Complex Fluids and Biophysics, 1998  
 International Conference on Circuit/System Theory, Sydney, Australia (1970)  
 International Conference on Computational Nanoscience  
 International Conference on Unsolved Problems of Noise and fluctuations in physics, biology, and high technology, Bethesda, 2002  
 International Filter Symposium, Santa Monica, CA, 1972  
 International Workshop on Computational Electronics: IWCE-5, 1997, Notre Dame.  
 International Workshop on Computational Electronics, IWCE-6, 1998, Osaka  
 International Workshop on Computational Electronics, IWCE-8, 2001, UIUC  
 International Workshop on Computational Electronics, IWCE-9, 2003, Roma, Italia  
 International Workshop on Computational Electronics, IWCE-11, 2006, Vienna, Austria  
 Johns Hopkins (Department of Biology)  
 Johns Hopkins (Department of Biomedical Engineering)

Kansas University (Mathematics, 2005, 2007)  
Laboratory of Molecular Biology, MRC, Cambridge England  
Lancaster University (Dept of Physics)  
Liblice Conference (5<sup>th</sup>) on Statistical Mechanics of Liquids  
Los Alamos National Laboratory (Center for Nonlinear Studies)  
Loyola University, Dept of Physiology, Maywood, Illinois  
Marquette University: Department of Biology  
Marquette University: Department of Mathematics  
Marine Biological Laboratory, Woods Hole  
Max Planck Institute (Goettingen: Erwin Neher. Am Fessberg series) 2007  
Max Planck Institute (Heidelberg: Ken Holmes, Bert Sakmann)  
Mayo Clinic  
McMaster University: Dept. of Physics (Hamilton, Ontario)  
Medical College of Virginia  
Medical College of Wisconsin  
Medical Research Council, Mill Hill, England  
Merck, Sharpe, and Dhome  
Mesilla Conference on Physical Chemistry (2001), Las Cruces New Mexico  
MIT Bio-Informatics Seminar (with the Whitehead Institute)  
Monash University, Australia: Electrical Engineering  
Monash University, Australia: Department of Physiology  
NASA Ames: Biomolecular Systems  
National Science Foundation (first MOBS Seminar: Modeling of Biological Systems)  
New York University Medical School (Physiology)  
New York University (Biology: Tamar Schlick's Group)  
NATO Advanced Research Workshop. Ionic Soft Matter, Lviv, Ukraine  
NIH NINCDS  
NIH Arthritis Institute  
NIH GMS  
NISTI-NIGMS Digital Biology Speaker (2003)  
NIST Physical and Chemical Properties Division  
Northwestern University: Evanston, Applied Mathematics  
Northwestern Univ Evanston, Mathematics "Conversations in Mathematics & Biology"  
Northwestern University: Evanston, Neurosciences  
Northwestern University Evanston, Physics and Engineering Sciences  
Northwestern University: Chicago, Physiology  
Notre Dame, Dept. of Electrical Engineering  
Notre Dame, Dept of Chemistry and Biochemistry  
Novartis Foundation Symposium: Gramicidin and Related Peptides, 1998  
Novartis Foundation Meeting: Physical Models of Ion Permeation, 2000  
Oregon Health Sciences University (Vollum Institute)  
Oxford University (England) Physiology  
Oxford University Biochemical Society (England)  
Oxford University Seminar in Physical and Theoretical Chemistry (England)  
Oxford University Seminar in Chemistry (Hagan Bayley)  
Oxford University OCIAM Mathematics in Medicine 5<sup>th</sup> Study Group (Oct, 2005)  
Oxford University OCIAM Mathematics in Medicine: Ion Channels (March, 2006)



PacifiChem (meeting of American Chemical Society, 2000)  
 PacifiChem (meeting of American Chemical Society, 2005)  
 Polytechnic University (NY) Dept of Chemical Engineering  
 Purdue University: Dept. of Biology  
 Purdue University: Dept. of Electrical Engineering: Solid State Physics  
 Radon Institute (RICAM) EMS (European Mathematics Society) Linz, Austria, 2006  
     Minicourse (3 days) Lectures on Ion Channels  
 Radon Institute (RICAM), Linz, Austria, Special Semester on Quantitative Biology (2007)  
     Ionic Channels  
 Rensselaer Polytechnic Institute Dept. of Mathematics  
 Rowland Institute (Cambridge MA)  
 Sandia National Laboratory (Laura Frink/Grant Heffelfinger)  
 Sandia National Laboratory Biophysical Discussion (Susan Rempé)  
 Satellite Meeting (Debrecen) of International Physiological Congress, 1980  
 Schlumberger Cambridge Research  
 Simon Fraser University (Vancouver) Department of Physics  
 Society of General Physiologists Meeting, Woods Hole  
 Society of Industrial and Applied Mathematics:  
     Invited lecture, Conference on Applied Probability in Science & Engineering Society  
         of Industrial and Applied Mathematics  
     Invited lecture, symposium on “Ionic Channels in Biological Membranes”. Annual  
         meeting, 1993  
     Invited lecture, Symposium on Ionic Channels, 2001, Annual meeting  
     Invited lecture, Symposium Electrodifussion: Modeling, Analysis, Simulation, and  
         Applications, 2005, Annual Meeting  
     Invited lecture, Symposium Multiscale Modeling of Electrochemical Systems, 2006,  
         Annual Meeting  
     Invited Lecture, Symposium, Multiscale Nonlinear Problems in Biology, 2007,  
         Conference on Dynamical Systems  
 SPIE Annual Meeting (1994) *in* Symposium “Mathematical Imaging: Wavelet  
     Applications” (presented by Amir Averbuch and Moshe Israeli)  
 Stanford University (Department of Electrical Engineering)  
 State University of New York (Albany)  
 State University of New York (Stony Brook)  
 Taft School Centennial Symposium  
 Technical University of Vienna (Mathematics)  
 Telluride Science Research Center Symposium on Biological Ion Channels (2003)  
 Telluride Science Research Center Symposium on Biophysical and Biochemical Properties  
     of Ion Channels in Epithelia (2004)  
 Telluride Science Research Center Symposium Biological Ion channels: Structure and  
     Function (2005)  
 Texas Instrument Corporation (1966)  
 Thomas Jefferson University: Daniel Baugh Institute  
 TIDS12 Transport in Disordered Systems 12<sup>th</sup> Annual Meeting, Marburg, 2007  
 TMR Meeting on Kinetics, Goteborg Sweden, 2000, Plenary Speaker  
 Tulane University (1967)  
 UCLA: Biology Department (1968)

UCLA: Jerry Lewis Muscle Disease Center  
 UCLA: Physiology Department  
 UCLA: Molecular Biology Institute  
 UCLA: Department of Anesthesiology  
 UCLA School of Engineering, Mechanics and Structures  
 UCLA Dept of Bioengineering  
 University College (London): Biophysics  
 University College (London): Physiology  
 University of Buffalo (SUNY) Dept of Physiology and Biophysics  
 University of Buffalo (SUNY) Dept of Electrical Engineering  
 University of California (Berkeley) Chemical Engineering, Chakraborty Group  
 University of California (Berkeley) Colloquium in Physics Dept (Marvin Cohen)  
 University of California (Irvine) Miledi Group  
 University of California (Irvine) Colloquium in Physics  
 University of California (San Francisco, Biochemistry, ~1970)  
 University of California (San Francisco, Biochemistry, 2007)  
 University of Chicago: Department of Biophysics  
 University of Chicago: Department of Physiology  
 University of Chicago: Department of Chemistry  
 University of Chicago: Applied Mathematics  
 University of Colorado (Boulder): Applied Mathematics  
 University of Colorado (Denver): Physiology  
 University of Florida Dept. of Chemistry, Charles Martin's Nanogroup  
 University of Gröningen, Netherlands (Department of Chemistry)  
 University of Hawaii (von Bekesy Laboratory)  
 University of Heidelberg Bioquant-Vorlesung Seminar, 2007  
 University of Heidelberg - Bioms – Bioquant Lecture in the  
 Workshop on Transport, Signaling and Structure Formation in Cellular Systems:  
 Mathematics Meets Experiments  
 University of Illinois (Chicago): Department of Chemistry  
 University of Illinois (Chicago): Department of Physics  
 University of Illinois Medical School (Chicago): Department of Biochemistry  
 University of Illinois Medical School (Chicago): Department of Ophthalmology  
 University of Illinois Medical School (Chicago): Department of Physiology  
 University of Illinois (Champaign-Urbana): Physiology  
 University of Illinois (Champaign-Urbana): Biological Physics  
 University of Illinois (Champaign-Urbana): Physics, Beckman Institute  
 University of Illinois (Champaign-Urbana): Computational Electronics  
 University of Linz, Oesterreich (Austria). Johan Radon Institute of Applied Mathematics.  
 University of Maryland (Baltimore): Physiology  
 University of Maryland (Baltimore): Biochemistry  
 University of Maryland (College Park): Electrical Engineering, Electrophysics Series  
 University of Maryland (College Park): Institute for Physical Science and Technology  
 University of Maryland (College Park): CSCAMM  
 University of Massachusetts (Amherst) Department of Chemistry  
 University of Miami: Biophysics and Physiology  
 University of Michigan: Michigan Interdisciplinary Mathematics Meeting.

University of Michigan: Seminar in Applied and Interdisciplinary Mathematics  
 University of Münster, Westfälischen Wilhelms-Universität Germany,  
     Department of Applied Mathematics  
 University of New South Wales, Australia  
 University of Notre Dame (Dept. of Electrical Engineering)  
 University of Oklahoma  
 University of Pennsylvania  
 University of Rochester (Physiology)  
 University of Rochester (Neurology)  
 University of Rochester (Neuromuscular Center)  
 University of Sydney, Australia  
 University of Texas (Austin), Texas Institute for Computational and Applied Mathematics  
 University of Texas (Austin), Physics and Mathematics Seminar  
 University of Texas (Austin), Colloquium in Physics (host: Harry Swinney)  
 University of Texas (Austin) ICES/Computational Life Sciences and Biology Seminar:  
     “Ionic Selectivity: A Physical Analysis of Vital Chemistry” (host: Ron Elber)  
 University of Texas (Austin) Center for Nonlinear Dynamics (Harry Swinney)  
 University of Texas (Galveston)  
 University of Texas (Southwestern: Dallas)  
 University of Tokyo (Neuroscience)  
 University of Utah  
 University of Vermont  
 University of Vienna, Department of Mathematics  
 University of Washington  
 University of Wisconsin Madison (Electrical Engineering)  
 University of Wisconsin Madison (Contemporary Biochemistry)  
 University of Wisconsin Milwaukee  
 USA-Japan Seminar Excitation-Contraction Coupling, Tokyo 1971  
 Vanderbilt University Colloquium on Physics  
 Washington University, St. Louis, Physiology  
 Washington University, St. Louis, Center for Computational Chemistry  
 Weizmann Institute, Rehovot: Bat Sheva (de Rothschild) Seminar.  
 Weizmann Institute, Rehovot: Chemistry Dept  
 Western Nerve Net (San Diego)  
 Workshop on Wavelets: 16<sup>th</sup> International Conference of the IEEE Engineering in Biology  
     and Medicine Society.  
 World Congress on Medical Physics and Biomedical Engineering, 1994.  
 Yale University (Department of Physiology)  
 Yale University (Section of Neuroscience)  
 Yale University (Dept of Mathematics and Computational Science)  
 Yangtze Conference on Fluids and Interfaces

### ***Symposia Organized***

Chairman, Mini-symposium on **The Lens as a Syncytium**, Biophysical Society Meeting, 1980.

Co-Chairman, with Brian Salzberg, **Symposium on Fine Processing in the Fine Processes**

- of the Nervous System**, Biophysical Society Meeting, 1984.
- Chairman of Symposium and Luncheon **Calcium Signals in Muscle**, Biophysical Society Meeting, 1985
- Chairman of Symposium. **Nerve Impulse: From Conduction to Channels by way of Conductance** at the 100<sup>th</sup> Anniversary Meeting of the American Physiological Society, 1987.
- Chairman of Symposium. **Skeletal Muscle Physiology: an Update** at the 100<sup>th</sup> Anniversary Meeting of the American Physiological Society, 1987.
- Chairman of Minisymposium. **Moving through (Biological) Channels**, Society of Industrial and Applied Mathematics Conference on Applied Probability in Science and Engineering, New Orleans, 1990.
- Chairman of Minisymposium. **Ionic Movement through Biological Channels**. Society of Industrial and Applied Mathematics, Annual Meeting. Chicago, 1990.
- Organizer of Workshop: **From Structure to Permeation in Open Ionic Channels**. Biophysical Society Annual Meeting, Washington D.C., 1993
- Chairman of Symposium: **Ionic Channels: Natural Nanotubes**. American Physical Society Annual Meeting, 2000.
- Chairman and Organizer of **Novartis Foundation Meeting: Physical Models of Ion Permeation**, 2000
- Chairman and Organizer of **Symposium at International Conference on Computational Nanoscience, 2001: Nanostructure Simulation from thin oxides to biological ion channels**.
- Co-organizer of **Yangtze Conference on Fluids and Interfaces** (Chief Organizers Kwong-Yu Chan and D Henderson). Chairman, Ion Channels Session, 2001. see *J Colloid Interface Sci.* 2002 Vol. 246, p.222.
- Organizer and Chairman of **Nanostructures: biological ion channels to thin oxides**. Nanotech 2003, San Francisco.
- Co-organizer and Chairman (with Dirk Gillespie) of **Physical Models of Ion/Protein Interactions**, American Physical Society (Div of Biological Physics) March, 2003. Austin, TX.
- Chairman (Organizer Maria Kurnikova) **Physics of Ion Interactions with Proteins**, March, 2004, American Physical Society, Montreal Quebec Canada.
- Member, Organizing Committee, NATO Advanced Research Workshop. **Ionic Soft Matter** Lviv Ukraine, 2004.
- Helper to Andrij Trokhymchuk and David Busath, **Festschrift for Doug Henderson**, Brigham Young University, 2004.
- Co-organizer, with Heinz Engl, **RICAM Seminar on Ion Channels**, Johan Radon Institute of Applied Mathematics, University of Linz (Austria), 2004.
- Organizer and Chair, **Multiscale Analysis in Biology: Computation**, American Physical

Society, March, 2005, Los Angeles.

Organizer and Chair: **MultiScale Analysis of Ions in Solutions, Proteins, and Channels: Analysis**, American Physical Society, March, 2005, Los Angeles.

Problem Presenter: **Mathematics in Medicine Study Group**, Mathematics Institute, Oxford University, Sept. 2005, March 2006

Organizer and Chair: **Physical Models of Ion Channels**, American Physical Society, March 2006, Baltimore.

Helper to Chris Breward: Oxford University OCIAM **Mathematics in Medicine: Ion Channels**, March, 2006.

Member, Organizing Committee for **Special Semester on Quantitative Biology analyzed by Mathematical Methods**: RICAM (Radon Institute for Computational and Applied Math); (Oct 2007- Jan 2008: Johannes Kepler Univ of Linz, Austria) <http://www.ricam.oeaw.ac.at/ssqbm/>  
Co-organizer (with Martin Burger, Peter Pohl, Heinz Engl) of Workshop on Ion Channels, Oct 8-12, 2007

Co-organizer, with Martin Bazant of Symposium, **Multiscale Modeling of Electrochemical Systems** SIAM (Society of Industrial and Applied Mathematics), 2006.

Organizer of ARO Sponsored Meeting, **Calibrating Simulations**, at Rush University Medical Center, January 2007.

Facilitator of Annual Reciprocal Symposia between Biophysical Society and Division of Biological Physics of the American Physical Society, commencing 2007. Planned to be the first in a continuing series.

Organizer of Symposium (Sponsored by American Physical Society Division of Biological Physics) **Modeling as a Tool in Biophysics**, at Biophysical Society Annual Meeting, 2007. Planned to be the first in a continuing series.

Co-organizer: **Direct and inverse problems in channels and membranes**, ICIAM 6<sup>th</sup> International Congress on Industrial & Applied Mathematics Zurich 2007, Organizer Heinz Engl; co-organizer Martin Burger, pair of minisymposiar.

### ***Equipment and Software Designed***

Wide band amplifiers for microelectrode recording (with several collaborators, see publications 3, 9, 11, 16, 22, and 24).

Software for computing and analyzing impedance measurements with wide band amplifiers (*ibid.*)

**Axopatch Amplifier** for patch clamp recording, with R. Levis, J. Rae, and A. Finkel, sold by Axon Instruments, Burlingame CA, now part of Molecular Devices Sunnyvale CA.

**Perfusing Pipettes**, a hardware kit available from ALA Scientific, for perfusing patch pipettes.

**PNP Online** <http://www.pnponline.org/> Interactive software for running Poisson Nernst Planck theory, with Brice Burgess

**Patent Application**, PCT/NL2003/000013 Liquid Based Electronic Device (from BioMade, Groningen, Netherlands.)

**Patent Application**, Mathematical Design of Ion Channel Selectivity via Inverse Problems Technology (with Heinz Engl and Martin Burger, from Rush University Medical Center.)

### ***Professional Societies***

American Association for Advancement of Science  
American Mathematical Society  
American Physiological Society  
American Physical Society, Fellow  
American Society of Cell Biologists  
Biophysical Society  
Institute of Electrical and Electronic Engineering, Senior Member  
Mathematical Association of America  
New York Academy of Sciences  
Physiological Society, England (Associate Member)  
Royal Society of Chemistry (UK)  
Society of General Physiologists  
Society for Industrial and Applied Mathematics  
Society of Neuroscience  
Institute for Strategic Studies (London: 1963-1992)

### ***Research Interests***

#### **1960's-1980's:**

Electrical properties of cells and tissues. The relationship between the structure of biological tissues and the pathways for current flow: measurements of linear electrical properties to determine equivalent circuits of skeletal and cardiac muscle, nerve, the lens of the eye, and epithelia.

The modeling of tissues of complex geometry and the solution—in physically meaningful form—of the differential (or difference) equations which describe such tissues. Thus, models of the three dimensional spread of current in spherical and cylindrical cells; models of the spread of current in the random network of transverse tubules in skeletal muscle; models of current flow in the clefts of cardiac muscle; models of current flow in epithelia; models of current flow in dendritic trees.

The use of advanced mathematical techniques (ranging from singular perturbation theory to—when all else fails—brute force numerical simulation) to provide insight into the physical meaning of complex theory.

**1960's-1990's:**

Excitation-contraction coupling in skeletal and cardiac muscle; particularly, the junction between the tubular system and the sarcoplasmic reticulum and the mechanism of calcium release from the sarcoplasmic reticulum.

The electrical properties of the sarcoplasmic reticulum and its ionic channels as seen in patch clamp measurements from skinned muscle fibers.

**1980's – 2000's -... :**

Analysis of ionic channels, experimental and theoretical: properties of single channels in epithelia, particularly “pressure activated” channels. Single channels in sarcoplasmic reticulum of skinned muscle fibers.

Design of patch clamp amplifiers, headstage, holders with “zero excess” noise.

Optimal detection of single channel events using signal detection theory.

Measurement of open channel noise.

Theoretical analysis of ion movement through channels using an hierarchy of models from molecular dynamics to continuum electrostatics.

Simulations of the molecular dynamics of channel proteins.

Stochastic analysis of flux over barriers: first passage times, concentration boundary conditions and ionic fluxes.

PNP model of the open channel. Poisson-Nernst-Planck model of open channels, in which the potential distribution through the channel is calculated not assumed. PH model of the open channel, the Poisson Hydrodynamic model including temperature changes.

Coupling of fluxes, active transport, gating, and gating currents in a permanently open channel of one conformation as predicted by the PNP model in complex geometries and the PH model.

The stochastic generalization of the PNP model.

Simulations of the molecular dynamics of the entry process models of gramicidin.

**2000's -... :**

Design and construction of ion channels as useful devices.

Thus, building design tools for understanding current flow in bulk solution, ion channels, and proteins in general.

Computation of macroscopic properties of ionic solutions and channels from higher resolution models, using Langevin-Poisson, Monte Carlo Poisson, or Molecular Dynamics Poisson methods.

Mathematical analysis of macroscopic properties of ionic solutions and channels starting from higher resolution models, using Langevin-Poisson, Monte Carlo Poisson, or Molecular Dynamics Poisson methods.

Simulations and theories of gating and conformational change.

Construction of nonequilibrium statistical mechanics starting from the properties of

chaotic trajectories computed with Poisson and molecular dynamics. Statistical mechanics as stochastic processes.

Crowded Charge model of protein function, specifically, ion selectivity and permeation in ion channels.

## ***Administrative Work***

### **UCLA**

Member of Committee for Graduate Students.

First Year Advisor for Graduate Students.

Member of numerous review committees for promotions: received commendation from Vice Chancellor Saxon for work on review committees.

Member of Advisory Committee for the Jerry Lewis Muscular Dystrophy Center.

### **Rush University**

**Chairman**, Department of Physiology, then Department of Molecular Biophysics and Physiology. Recipient and first holder of “The Francis and Catherine Bard Chair of Physiology”

Department has approximately 10 tenure track faculty since 1976 and approximately 7,000 sq ft of usable research space. All faculty with research space (i.e., 4 laboratories) have had NIH or equivalent funding without interruption, thanks to their significant personal productivity. Key members (alphabetical order) in research: Fred Cohen (viral fusion); Tom DeCoursey (H<sup>+</sup> ion channels); Mike Fill (Ryanodine Receptor); Dirk Gillespie (selectivity); Josefina Ramos-Franco (IP<sub>3</sub> receptor); Eduardo Rios (Ca<sup>++</sup> movement); in Medical School Teaching, Joel Michael, Tom Shannon, and Dirk Gillespie; in Nursing Teaching Joe Zbilut.

### **Academic Administration.**

Member of College Councils.

Chairman of Promotions and Appointments Committee.

Member, Vice Chair, then Chair of Search Committee for Microbiology Chair.

Vice Chairman of Search Committee for Dean of the Medical College.

Member, Search Committee for Dean of the Graduate College.

Member, Search Committee for Pediatrics Chair.

Member, Search Committee for Microbiology Chair

## ***Teaching***

General responsibility for all teaching activities of the Department at Rush, including course and curriculum reorganization. Physiology Lectures for medical and nursing students.

### **Graduate students:**

J. Leung, R. Mathias, E. Engel, R. Levis, R. Milton (with R. Mathias), J. Tang, P. Gates, J. Wang, A. Hainsworth (with R. Levis), P. Dull (summer student), Dirk Gillespie, Amy Del



Medico (summer student), Boaz Nadler (in significant part: Zeev Schuss, supervisor); Amit Singer (in significant part: Zeev Schuss, supervisor), Janhavi Giri (Bioengineering, University of Illinois, Circle Campus).

**Post-doctoral fellows:**

J. Howell, P. Vaughan, B. Mobley, A. Peskoff, R. Mathias, E. Engel, R. Levis, J. Bell, R. Milton (with Rick Mathias), K. Cooper, D.P. Chen, J. Tang, D.Rojewska; D.Gillespie; Z. Kuang, T. van der Straaten (with Umberto Ravaioli), S. Wigger-Aboud (with Marco Saraniti).

***Community Activity***

AVENUE BANK OF OAK PARK: Director, Member, then Chairman of Audit Committee, Executive Committee, and Marketing Committee (1987-1992).

AMERICAN HEART ASSOCIATION OF METROPOLITAN CHICAGO: Member, Board of Governors, Executive Committee, and President's Cabinet (1984-1986). Member Research Council (1989-1990) and Chairman, Committee on Human Experimentation.

TAFT SCHOOL (Connecticut): Speaker at Centennial Symposium, and Seminar/Discussion Group.

PRESIDENT 7320 Condo Association. (1997– 2003; 2007)

TOWN TALK Telluride Science Research Center (part of Pinhead Lecture Series) 2003.

ARMY RESEARCH OFFICE talk to North Carolina Ventures Program for High Schools 2005

## ROBERT S. EISENBERG

### PUBLICATIONS

[Reprints](#) available on this [hyperlink](#)

(Last update: February 3, 2008)

[\[Laboratory of Robert S. Eisenberg\]](#)

#### *Electrical properties of tissues, mostly experimental:*

1. Eisenberg, R.S. and Hamilton, D. Action of  $\gamma$ -aminobutyric acid on *Cancer borealis* muscle. Nature 198: 1002-1003 (1963). [\[PDF\]](#)
2. Eisenberg, R.S. Impedance of single crab muscle fibers. Ph.D. Thesis, University of London (1965).
3. Eisenberg, R.S. Equivalent circuit of single crab muscle fibers as determined by impedance measurement with intracellular electrodes. J. Gen. Physiol. 50: 1785-1806 (1967). [\[PDF\]](#)
4. Eisenberg, R.S. and Gage, P.W. Frog skeletal muscle fibers: change in the electrical properties of frog skeletal muscle fibers after disruption of the transverse tubular system. Science 158: 1700-1701 (1967). [\[PDF\]](#)
5. Gage, P.W. and Eisenberg, R.S. Action potentials without contraction in frog skeletal muscle fibers with disrupted transverse tubules. Science 158: 1702-1703 (1967). [\[PDF\]](#)
6. Horowicz, P., Gage, P.W. and Eisenberg, R.S. The role of the electrochemical gradient in determining potassium fluxes in frog striated muscle. J. Gen. Physiol. 51: 193s-203s (1968). [\[PDF\]](#)
7. Eisenberg, B. and Eisenberg, R.S. The transverse tubular system in glycerol treated muscle. Science 160: 1243-1244 (1968). [\[PDF\]](#)
8. Eisenberg, B. and Eisenberg, R.S. Selective disruption of the sarcotubular muscle: A quantitative study with exogenous peroxidase as a marker. J. Cell Biol. 39: 451-467 (1968). [\[PDF\]](#)
9. Gage, P.W. and Eisenberg, R.S. Capacitance of the surface and transverse tubular membrane of frog sartorius muscle fibers. J. Gen. Physiol. 53: 265-278 (1969). [\[PDF\]](#)
10. Eisenberg, R.S. and Gage, P.W. Ionic conductance of the surface and transverse tubular membrane of frog sartorius fibers. J. Gen. Physiol. 53: 279-297 (1969). [\[PDF\]](#)
11. Gage, P.W. and Eisenberg, R.S. Action potentials, after potentials, and excitation-contraction coupling in frog sartorius fibers without transverse tubules. J. Gen. Physiol. 53: 298-310 (1969). [\[PDF\]](#)
12. Eisenberg, R.S., Howell, J. and Vaughan, P. The maintenance of resting potentials in glycerol treated muscle fibers. J. Physiol. 215: 95-102 (1971). [\[PDF\]](#)
13. Vaughan, P., Howell, J. and Eisenberg, R.S. The capacitance of skeletal muscle fibers in solutions of low ionic strength. J. Gen. Physiol. 59: 347-359 (1972). [\[PDF\]](#)

14. Eisenberg, R.S., Vaughan, P. and Howell, J. A theoretical analysis of the capacitance of muscle fibers using a distributed model of the tubular system. *J. Gen. Physiol.* 59: 360-373 (1972). [[PDF](#)]
15. Leung, J. and Eisenberg, R.S. The effects of the antibiotics gramicidin-A, amphotericin-B, and nystatin on the electrical properties of frog skeletal muscle. *Biochem. Biophys. Acta. Amsterdam* 298: 718-723 (1973). [[PDF](#)]
16. Valdiosera, R., Clausen, C. and Eisenberg, R.S. Measurement of the impedance of frog skeletal muscle fibers. *Biophys. J.* 14: 295-315 (1974). [[PDF](#)]
17. Valdiosera, R., Clausen, C. and Eisenberg, R.S. Circuit models of the passive electrical properties of frog skeletal muscle fibers. *J. Gen. Physiol.* 63: 432-459 (1974). [[PDF](#)]
18. Valdiosera, R., Clausen, C. and Eisenberg, R.S. Impedance of frog skeletal muscle fibers in various solutions. *J. Gen. Physiol.* 63: 460-491 (1974). [[PDF](#)]
19. Mobley, B.A., Leung, J. and Eisenberg, R.S. Longitudinal impedance of skinned frog muscle fibers. *J. Gen. Physiol.* 63: 615-637 (1974). [[PDF](#)]
20. Mobley, B.A., Leung, J. and Eisenberg, R.S. Longitudinal impedance of single frog muscle fibers. *J. Gen. Physiol.* 65: 97-113 (1975). [[PDF](#)]
21. Eisenberg, R.S. and Rae, J.L. Current-voltage relationships in the crystalline lens. *J. Physiol.* 262: 285-300 (1976). [[PDF](#)]
22. Mathias, R.T., Eisenberg, R.S. and Valdiosera, R. Electrical properties of frog skeletal muscle fibers interpreted with a mesh model of the tubular system. *Biophys. J.* 17: 57-93 (1977). [[PDF](#)]
23. Eisenberg, R.S., Mathias, R.T. and Rae, J.L. Measurement, modeling and analysis of the linear electrical properties of cells. *Ann. N.Y. Acad. Sci.* 303: 343-354 (1977). [[PDF](#)]
24. Mathias, R.T., Rae, J.L. and Eisenberg, R.S. Electrical properties of structural components of the crystalline lens. *Biophys. J.* 25: 181-201 (1979). [[PDF](#)]
25. Rae, J.L., Eisenberg, R.S. and Mathias, R.T. The lens as a spherical syncytium. Ed. Satish K. Srivastava. Elsevier North Holland Inc. **Red Blood Cell and Lens Metabolism**. pp. 277-292 (1980). [[PDF](#)]
26. Mathias, R.T., Rae, J.L. and Eisenberg, R.S. The lens as a nonuniform spherical syncytium. *Biophys. J.* 34: 61-85 (1981). [[PDF](#)]
27. Eisenberg, B. and Eisenberg, R.S. The *T-SR* junction in contracting single skeletal muscle fibers. *J. Gen. Physiol.* 79: 1-20 (1982). [[PDF](#)]
28. Rae, J.L., Thomson, R.D. and Eisenberg, R.S. The effect of 2-4 dinitrophenol on cell to cell communication in the frog lens. *Exp. Eye Res.* 35: 597-610 (1982). [[PDF](#)]
29. Rae, J.L., Mathias, R.T. and Eisenberg, R.S. Physiological role of the membranes and extracellular space within the ocular lens. *Exp. Eye Res.* 35: 471-490 (1982). [[PDF](#)]
30. Eisenberg, R.S., McCarthy, R.T., and Milton, R.L. Paralysis of frog skeletal muscle fibres by the calcium antagonist D-600. *J. Physiol.* 341: 495-505 (1983). [[PDF](#)]

31. Levis, R.A., Mathias, R.T., and Eisenberg, R.S. Electrical properties of sheep Purkinje strands. Electrical and chemical potentials in the clefts. *Biophys. J.* 44: 225-248 (1983). [[PDF](#)]
32. Hui, C.S., Milton, R.L. and Eisenberg, R.S. Charge movement in skeletal muscle fibers paralyzed by the calcium entry blocker D600. *Proc. Natl. Acad. Sci.* 81: 2582-2585 (1984). [[PDF](#)]
33. Curtis, B.A. and Eisenberg, R.S. Calcium influx in contracting and paralyzed frog twitch muscle fibers. *J. Gen. Physiol.* 85: 383-408 (1985). [[PDF](#)]
34. Milton, R.L., Mathias, R.T., and Eisenberg, R.S. Electrical properties of the myotendon region of frog twitch muscle fibers measured in the frequency domain. *Biophys. J.* 48: 253-267 (1985). [[PDF](#)]
35. Eisenberg, R.S. Membranes, calcium, and coupling. *Can. J. Physiol. and Pharmacol.* 65: 686-690 (1987). [[PDF](#)]

#### ***Theoretical Analysis and Modeling of Spread of Current:***

36. Eisenberg, R.S. and Johnson, E.A. Three dimensional electrical field problem in physiology. *Prog. Biophys. Mol. Biol.* 20: 1-65 (1970). [[PDF](#)]
37. Eisenberg, R.S. and Engel, E. The spatial variation of membrane potential near a small source of current in a spherical cell. *J. Gen. Physiol.* 55: 736-757 (1970). [[PDF](#)]
38. Barcion, V., Cole, J. and Eisenberg, R.S. A singular perturbation analysis of induced electric fields in nerve cells. *SIAM J. Appl. Math.* 21: No. 2, 339-354 (1971). [[PDF](#)]
39. Eisenberg, R.S. and Costantin, L.L. The radial variation of potential in the transverse tubular system of skeletal muscle. *J. Gen. Physiol.* 58:700-701 (1971). [[PDF](#)]
40. Engel, E., Barcion, V. and Eisenberg, R.S. The interpretation of current-voltage relationships from a spherical cell recorded with a single microelectrode. *Biophys. J.* 12: 384-403 (1972). [[PDF](#)]
41. Peskoff, A., Eisenberg, R.S. and Cole, J.D. Potential induced by a point source of current in the interior of a spherical cell. UCLA Engineering Report #7259, 62pp. (1972). [[PDF](#)]
42. Peskoff, A., Eisenberg, R.S. and Cole, J.D. Potential induced by a point source of current inside an infinite cylindrical cell. UCLA Engineering Report #7303, 70pp. (1973). [[PDF](#)]
43. Peskoff, A. and Eisenberg, R.S. Interpretation of some microelectrode measurements of electrical properties of cells. *Ann. Rev. Biophysics. and Bioeng.* 2: 65-79 (1973). [[PDF](#)]
44. Peskoff, A. and Eisenberg, R.S. A point source in a cylindrical cell: potential for a step-function of current inside an infinite cylindrical cell in a medium of finite conductivity. UCLA Engineering Report #7421, 73pp. (1974). [[PDF](#)]

45. Peskoff, A. and Eisenberg, R.S. The time-dependent potential in a spherical cell using matched asymptotic expansions. *Journal of Math. Biol.* 2: 277-300 (1975). [[PDF](#)]
46. Peskoff, A., Eisenberg, R.S. and Cole, J.D. Matched asymptotic expansions of the Green's function for the electric potential in an infinite cylindrical cell. *SIAM J. Appl. Math.* 30: 222-239, No. 2 (1976). [[PDF](#)]
47. Eisenberg, R.S., Barcilon, V., and Mathias, R.T. Electrical properties of spherical syncytia. *Biophys. J.* 25: 151-180 (1979). [[PDF](#)]
48. Mathias, R.T., Levis, R.A. and Eisenberg, R.S. Electrical models of excitation contraction coupling and charge movement in skeletal muscle. *J. Gen. Physiol.* 76: 1-31, (1980). [[PDF](#)]

### ***Electrical Properties of Ionic Channels:***

49. K.E. Cooper, Tang, J.M., Rae, J.L., and Eisenberg, R.S. A Cation Channel in Frog Lens Epithelia Responsive to pressure and Calcium. *J. Membrane Biology.* 93: 259-269 (1986). [[PDF](#)]
50. K.E. Cooper, P.Y. Gates, and Eisenberg, R.S. Surmounting barriers in ionic channels. *Quart. Rev. Biophysics.* 21: 331-364 (1988). [[PDF](#)]
51. K.E. Cooper, P.Y. Gates, and Eisenberg, R.S. Diffusion theory and discrete rate constants in ion permeation. *J. Membrane Biol.* 106: 95-105 (1988). [[PDF](#)]
52. J.M. Tang, J. Wang, and Eisenberg, R.S.  $K^+$  selective channel from sarcoplasmic reticulum of split lobster muscle fibers. *J. Gen. Physiol.* 94:261-278 (1989). [[PDF](#)]
53. P.Y. Gates, K.E. Cooper, J. Rae, and Eisenberg, R.S. Predictions of diffusion models for one ion membrane channels. in *Progress in Biophysics and Molecular Biology.* 53: 153-196 (1989). [[PDF](#)]
54. P.Y. Gates, K.E. Cooper, and Eisenberg, R.S. Analytical diffusion models for membrane channels. in **Ion Channels, Volume 2** (editor. T. Narahashi), Plenum Press (1990). [[PDF](#)]
55. D. Junge and R.S. Eisenberg. Uniqueness and interconvertibility among membrane potassium channels. *Comments on Theoret. Biology.* 11: 45-55 (1990). [[PDF](#)]
56. Tang, J.M., Wang, J., F.N. Quandt, and R.S. Eisenberg. Perfusing pipettes. *Pflügers Arch.* 416:347-350 (1990). [[PDF](#)]
57. Chen, D.P., Barcilon, V., and R.S. Eisenberg. Constant fields and constant gradients in open ionic channels. *Biophysical J.* 61:1372-1393 (1992). [[PDF](#)]
58. Barcilon, V., D.P. Chen, and R.S. Eisenberg. Ion flow through narrow membrane channels. Part II. *SIAM Journal of Applied Mathematics* 52:1405-1425 (1992). [[PDF](#)]
59. Wang, J., Tang, J.M., and R.S. Eisenberg. A calcium conducting channel akin to a calcium pump. *J. Membrane Biology* 130:163-181 (1992). [[PDF](#)]

60. Barcilon, V., D.P. Chen, R. Eisenberg, and M. Ratner. Barrier crossing with concentration boundary conditions in biological channels and chemical reactions. *J. Chem. Phys.* 98(2) 1193-1211 (1993). [[PDF](#)]
61. Chen, D.P. and R.S. Eisenberg. Charges, currents, and potentials in ionic channels of one conformation. *Biophysical Journal*. 64:1405-1421 (1993a). [[PDF](#)]
62. Chen, D.P. and R.S. Eisenberg. Flux, coupling, and selectivity in ionic channels of one conformation. *Biophysical Journal* 65:727-746 (1993b). [[PDF](#)]
63. Hainsworth, A.H., Levis, R.A., and R.S. Eisenberg. Origins of open-channel noise in the large potassium channel of sarcoplasmic reticulum. *J. Gen. Physiol.* 104:857-884 (1994). [[PDF](#)]
64. Eisenberg, R.S., Klosek, M.M., and Schuss, Z. Diffusion as a chemical reaction: stochastic trajectories between fixed concentrations. *J. Chem. Phys.*, 102(4): 1767-1780 (1995). [[PDF](#)]
65. Elber, R., Chen, D., Rojewski, D., and Eisenberg, R.S. Sodium in gramicidin: an example of a permion. *Biophysical Journal*, 68: 906-924, (1995). [[PDF](#)]
66. Chen, D., Eisenberg, R., Jerome, J., and Shu, C. Hydrodynamic model of temperature change in open ionic channels. *Biophysical J.* 69: 2304-2322. (1995). [[PDF](#)]
67. Barkai, E., Eisenberg, R.S., and Schuss, Z. (1996). A bidirectional shot noise in a singly occupied channel. (*Physical Review E*(2), 54 1161-1175). [[PDF](#)]
68. Chen, D., Lear, J., and Eisenberg, Bob. (1997) Permeation through an Open channel. Poisson-Nernst-Planck Theory of a Synthetic Ionic Channel. (*Biophysical Journal*, 72 97-116). [[PDF](#)]
69. Barcilon, V., Chen, D.-P., Eisenberg, R.S., and J.W. Jerome. (1997) Qualitative properties of steady-state Poisson-Nernst-Planck systems: perturbation and simulation study. *SIAM J. Appl. Math.* 57(3) 631-648. [[PDF](#)]
70. Chen, D.; Xu, L.; Tripathy, A.; Meissner, G.; Eisenberg, B. (1997) Permeation through the Calcium Release Channel of Cardiac Muscle. *with an appendix Rate Constants in Channology.* *Biophys. J.* 73(3) 1337-1354. [[PDF](#)]
71. Nonner, W.; Chen, D.; Eisenberg, B. (1998) Anomalous Mole Fraction Effect, Electrostatics, and Binding. *Biophys. J.* 74 2327-2334. [[PDF](#)]
72. Nonner, W. and Eisenberg, B. (1998) Ion Permeation and Glutamate Residues Linked by Poisson-Nernst-Planck Theory in L-type Calcium Channels. *Biophys. J.* 75:1287-1305. [[PDF](#)]
73. Chen, D.; Xu, L.; Tripathy, A.; Meissner, G.; and Eisenberg, B. (1999) Selectivity and Permeation in Calcium Release Channel of Cardiac Muscle: Alkali Metal Ions. *Biophysical Journal* 76:1346-1366. [[PDF](#)]
74. Hollerbach, U., Chen, D.P., Busath, D. D., and Eisenberg, B. (2000) Predicting function from structure using the Poisson-Nernst-Planck equations: sodium current in the gramicidin A channel. *Langmuir* 16:5509-5514. [[PDF](#)]

75. Gardner, C., Jerome, J. and R.S. Eisenberg (2000) Electrodifffusion Model of Rectangular Current Pulses in Ionic Channels of Cellular Membranes. *SIAM J Applied Math* 61 792-802. [[PDF](#)]
76. Nonner, W., L. Catacuzzeno, and Eisenberg, B. (2000). Binding and Selectivity in L-type Ca Channels: a Mean Spherical Approximation. *Biophysical Journal* 79: 1976-1992. [[PDF](#)]
77. Hollerbach, U., Chen, D.P., and Eisenberg, B. (2001) Two and Three Dimensional Poisson-Nernst-Planck Simulations of Current Through Gramicidin-A. *J. Scientific Computing* 16 (4) 373-409. [[PDF](#)]
78. Gillespie, D. and Eisenberg, R.S. (2001) Modified Donnan potentials for ion transport through biological ion channels. *Phys Rev E*, 63 061902 1-8. [[PDF](#)]
79. Nonner, W., Gillespie, D., Henderson, D., and Eisenberg, Bob. (2001) Ion accumulation in a biological calcium channel: effects of solvent and confining pressure. *J Physical Chemistry B* 105: 6427-6436. [[PDF](#)]
80. 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](#)]
81. Hess, K., Ravaioli, U., Gupta, M., Aluru, N., van der Straaten, T., and R.S. Eisenberg (2001) Simulation of Biological Ionic Channels by Technology Computer-Aided Design. *VLSI Design* 13: pp.179-187. [[PDF](#)]
82. Gillespie, Dirk, Nonner, W., Henderson, Douglas and Eisenberg, Robert S. (2002) A physical mechanism for large-ion selectivity of ion channels. *Physical Chemistry Chemical Physics*. 4, 4763-4769. [[PDF](#)]
83. Gillespie, Dirk, and Eisenberg, Robert S. (2002). Physical descriptions of experimental selectivity measurements in ion channels. *European Biophysics Journal* 31: 454-466). [[PDF](#)]
84. Gillespie, Dirk, Nonner, W., and Eisenberg, Robert S. (2002) Coupling Poisson-Nernst-Planck and Density Functional Theory to Calculate Ion Flux. *Journal of Physics (Condensed Matter)* 14: 12129–12145. [[PDF](#)]
85. Gardner, Carl L., Jerome, Joseph W., and Eisenberg. R.S. (2002) Electrodifffusion Model Simulation of Rectangular Current Pulses in a Voltage Biased Biological Channel. *Journal of Theoretical Biology* 219 291-299. [[PDF](#)]
86. Gardner, Carl L., Jerome, Joseph W., and Eisenberg. R.S. (2002) Electrodifffusion Model Simulation of Rectangular Current Pulses in a Biological Channel. *J Computational Electronics*, 1 347-351. [[PDF](#)]
87. van der Straaten, T.A., Tang, J., Eisenberg, R.S., Ravaioli, U., and Aluru, N.R. (2002) Three-dimensional continuum simulations of ion transport through biological ion channels: effects of charge distribution in the constriction region of porin. *J. Computational Electronics* 1 335-340 [[PDF](#)]

88. Boda, D., Busath, D., Eisenberg, B., Henderson, D., and Nonner, W. (2002) Monte Carlo Simulations of ion selectivity in a biological Na channel: charge-space competition. *Physical Chemistry Chemical Physics* 4 5154-5160. [[PDF](#)]
89. Hollerbach, Uwe and Robert Eisenberg. (2002) Concentration-Dependent Shielding of Electrostatic Potentials Inside the Gramicidin A Channel. *Langmuir* 18 3262-3631. [[PDF](#)]
90. Gillespie, D., Nonner, W. and RS Eisenberg. (2003) Crowded Charge in Biological Ion Channels *Nanotech* 3: 435-438. [[PDF](#)]
91. Nadler, B., Schuss, Z., Singer, A., Eisenberg, B. (2003) Diffusion through protein channels: from molecular description to continuum equations. *Nanotech* 3: 439-442. [[PDF](#)]
92. Wigger-Aboud, S., Saraniti, M. and R. Eisenberg. (2003) Self-consistent particle based simulations of three dimensional ionic solutions. *Nanotech* 3: 443-446. [[PDF](#)]
93. Aboud, S., Saraniti, M. and R. Eisenberg. (2003) Computational issues in modeling ion transport in biological channels: Self-consistent particle-based simulations. *Journal of Computational Electronics* 2: 239-243. [[PDF](#)]
94. van der Straaten, T., Kathawala, G., Kuang, Z., Boda, D., Chen, D.P., Ravaioli, U., Eisenberg, R.S., and Henderson, D. (2003) Equilibrium structure of electrolyte calculated using equilibrium Monte Carlo, Molecular Dynamics, and Transport Monte Carlo simulation. *Nanotech* 3: 447-451. [[PDF](#)]
95. Chen, D.; Xu, L.; Eisenberg, B; and Meissner, G. (2003) Calcium Ion Permeation through the Calcium Release Channel (Ryanodine Receptor) of Cardiac Muscle. *J Phys Chem* 107 9139-9145. [[PDF](#)]
96. Nadler, Boaz, Hollerbach, Uwe, Eisenberg, Bob. (2003) The Dielectric Boundary Force and its Crucial Role in Gramicidin. *Phys. Rev. E* 68 021905 p1-9. [[PDF](#)]
97. Gillespie, Dirk, Nonner, Wolfgang, and Eisenberg, Robert S. (2003) Density functional theory of charged, hard-sphere fluids. *Phys Rev E* 68 0313503 1-10. [[PDF](#)]
98. van der Straaten, T. A., Tang, J. M., Ravaioli, U., Eisenberg, R. S. and Aluru, N. (2003) Simulating Ion Permeation Through the OmpF Porin Ion channel Using Three-Dimensional Drift-Diffusion Theory. *Journal of Computational Electronics* 2: 29-47. [[PDF](#)]
99. Boda, Dezso, Varga, Tibor, Henderson, Douglas, Busath, David, Nonner, Wolfgang, Gillespie, Dirk, and Bob Eisenberg. (2004) Monte Carlo simulation study of a system with a dielectric boundary: application to calcium channel selectivity. *Molecular Simulation* 30: 89-96. [[PDF](#)]
100. Gardner, Carl, Nonner, Wolfgang, and Eisenberg, Robert S. (2004) Electrodiffusion Model Simulation of Ionic Channels: 1D Simulations *Journal of Computational Electronics* 3: 25-31. [[PDF](#)]
101. Boda, Dezso, Gillespie, Dirk, Nonner, Wolfgang, Henderson, Douglas and Bob Eisenberg. (2004) Computing induced charges in inhomogeneous dielectric media: application



- in a Monte Carlo simulation of complex ionic systems Phys Rev E 69, 046702. [\[PDF\]](#)
102. Goryll, M., Wilk, S., Laws, G. M., Thornton, T. J., Goodnick, S. M., Saraniti, M., Tang, J. M. and R. S. Eisenberg (2003) Silicon-based ion channel sensor Superlattices & Microstructures 34(3-6), 451-457. [\[PDF\]](#)
  103. Goryll, M., Wilk, S., Laws, G.M., Thornton, T. J., Goodnick, S. M., Saraniti, M., Tang, J. M. and R. S. Eisenberg (2004) Ion Channel Sensor on a Silicon Support Mat. Res. Soc. Symp. Proc. Vol. 820, O7.2.1-5. Proceedings Title: Nanoengineered Assemblies and Advanced Micro/Nanosystems Editors (Symposium O): Jun Liu, Jeffrey T. Borenstein, Piotr Grodzinski, Luke P. Lee, Zhong Lin Wang. [\[PDF\]](#)
  104. Nadler, Boaz, Schuss, Zeev, Singer, Amit, and RS Eisenberg. (2004) Ionic diffusion through confined geometries: from Langevin equations to partial differential equations. J. Physics: Condensed Matter 16: S2153-S2165. [\[PDF\]](#)
  105. Schuss, Zeev, B. Nadler, A. Singer, and R.S. Eisenberg, Models of boundary behavior of particles diffusing between two concentrations in *Fluctuations and Noise in Biological, Biophysical, and Biomedical Systems II* editors: D. Abbot, S. M. Bezrukov, A. Der, A. Sanchez, 26-28 May 2004 Maspalomas, Gran Canaria, Spain, Spie proceedings series Volume 5467, pp. 345-358. [\[PDF\]](#)
  106. Miedema, Henk, Anita Meter-Arkema, Jenny Wierenga, John Tang, Bob Eisenberg, Wolfgang Nonner, Hans Hektor, Dirk Gillespie and Wim Meijberg (2004) Permeation properties of an engineered bacterial OmpF porin containing the EEEE-lopus of Ca<sup>2+</sup> channels. Biophysical Journal Volume 87 3137–3147. [\[PDF\]](#)
  107. Aboud, S., Marreiro, D., Saraniti, M., and R. Eisenberg. (2004) A Poisson P3M Force Field Scheme for Particle-Based Simulations of Ionic Liquids. J. Computational Electronics, 3: 117–133. [\[PDF\]](#)
  108. Wilk, Seth, Goryll, Michael, Laws, Gerard M., Goodnick, Stephen M., Thornton, Trevor J., Saraniti, Marco, Tang, John M. and Eisenberg, Robert S. (2004) Teflon coated silicon aperture for lipid bilayer attachment Applied Physics Letters, 85, 3307-3309 [\[PDF\]](#)
  109. Nadler, Boaz, Schuss, Zeev, Hollerbach, Uwe, R.S. Eisenberg. (2004) Saturation of conductance in single ion channels: the blocking effect of the near reaction field Phys Rev E 70, 051912. [\[PDF\]](#)
  110. 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. [\[PDF\]](#)
  111. Singer, A., Schuss, Z., Nadler, B., and RS Eisenberg (2004) Memoryless control of boundary concentrations of diffusing particles Phys Rev E 70, 061106. [\[PDF\]](#)
  112. van der Straaten, Trudy A., Kathawala, G. Trellakis, A., Eisenberg, R.S., Ravaioli, U. (2005) BioMOCA — a Boltzmann transport Monte Carlo model for ion channel simulation. Molecular Simulation, 31: 151-171. [\[PDF\]](#)

113. Aguilera-Arzo, Marcel, Aguilera, Vicente and R. S. Eisenberg (2005) Computing numerically the access resistance of a pore European Biophysics Journal, 34: 314-322. [[PDF](#)]
114. Singer, Amit, Schuss, Zeev, and R. S. Eisenberg. (2005) Attenuation of the electric potential and field in disordered systems J. Stat. Phys. 119 (5/6) 1397-1418. [[PDF](#)]
115. Boda, D., Gillespie, D., Eisenberg, B., Nonner, W., Henderson, D. (2005) Induced Charge Computation Method: Application in Monte Carlo simulations of inhomogeneous dielectric systems p. 19–43.in D. Henderson et al. (eds.), Ionic Soft Matter: Modern Trends in Theory and Applications, Springer NY. [[PDF](#)]
116. Singer, Amit, Schuss, Zeev, Holcman, David and R. S. Eisenberg. (2006) Narrow Escape. Part I, J. Stat. Phys. 122, 437-463. [[PDF](#)]
117. Siwy, Zuzanna, Powell, Matthew R., Kalman, Eric, Astumian, R. Dean, Eisenberg, Robert S. (2006) Negative Incremental Resistance Induced by Calcium in Asymmetric Nanopores. Nano Letters 6, 473-477. [[PDF](#)]
118. Miedema, Henk, Vrouwenraets, Maarten, Wierenga, Jenny, Eisenberg, Bob, Schirmer, Tilman, Baslé, Arnaud and Wim Meijberg. (2006) Conductance and selectivity fluctuations in D127 mutants of the bacterial porin OmpF. European Journal of Biophysics, 36 13-22. [[PDF](#)]
119. Siwy, Zuzanna, Powell, Matthew R., Petrov, Alexander, Kalman, Eric, Trautmann, Christina, and Eisenberg, Robert S. (2006) Calcium-Induced Voltage Gating in Single Conical Nanopores. Nano Letters 6, 1729 -1734. [[PDF](#)]
120. Boda, Dezso, Valisko, Monika, Eisenberg, Bob, Nonner, Wolfgang, Henderson, Douglas, and Dirk Gillespie (2006) The Effect of Protein Dielectric Coefficient on the Ionic Selectivity of a Calcium Channel. Journal of Chemical Physics 125, 034901 1-11. [[PDF](#)]
121. Miedema, Henk, Vrouwenraets, Maarten, Wierenga, Jenny, Gillespie, Dirk, Eisenberg, Bob, Meijberg, Wim and Wolfgang Nonner. (2006)  $\text{Ca}^{2+}$  selectivity of a chemically modified OmpF with reduced pore volume. Biophysical J. 91 4392-4400. [[PDF](#)]
122. Eisenberg, Bob, Nonner, Wolfgang (2007) Shockley-Ramo Theorem Measures Conformation Changes of Ion Channels and Proteins. J Computational Electronics 6:363-345. [[PDF](#)]
123. Eisenberg, Bob, Liu, Weishi (2007) Poisson-Nernst-Planck systems for ion channels with permanent charges. SIAM Journal on Mathematical Analysis 38, No. 6, pp. 1932–1966 [[PDF](#)]
124. Burger, Martin, Eisenberg, Robert S. and Heinz Engl (2007) Inverse Problems Related to Ion Channel Selectivity. SIAM J Applied Math Vol. 67, No. 4, pp. 960–989 [[PDF](#)]
125. Boda, Dezso, Valisko, Monika, Eisenberg, Bob, Nonner, Wolfgang, Henderson, Douglas, and Dirk Gillespie (2007). The combined effect of pore radius and protein dielectric coefficient on the selectivity of a calcium channel. Phys Rev. Letters 98 168102 p.1-4 [[PDF](#)]

126. Boda, Dezsó, Nonner, Wolfgang, Valisko, Mónica, 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](#)]
127. Wilk, S.J., Petrossian, L., Goryll M., Thornton, T.J., Goodnick, S.M., Tang, J.M., Eisenberg R.S. (2007) Integrated Electrodes on a Silicon Based Ion Channel Measurement Platform. *Biosensors and Bioelectronics* Available online 8 April 2007. [doi:10.1016/j.bios.2007.03.030](https://doi.org/10.1016/j.bios.2007.03.030) [[PDF](#)]
128. Miedema, Henk Vrouenraets, Maarten Wierenga, Jenny Meijberg, Wim, Robillard, George and Bob Eisenberg (2007) A biological porin engineered into a molecular, nanofluidic diode. *Nanoletters* 7: 2886-2891. [[PDF](#)]
129. Boda, Dezsó, Nonner, Wolfgang, Henderson, Douglas, Eisenberg, Bob, and Dirk Gillespie. (2008) Volume exclusion in calcium selective channels. *Biophys. J.*, BioFAST: First Published January 16, 2008. [doi:10.1529/biophysj.107.122796](https://doi.org/10.1529/biophysj.107.122796) [[PDF](#)]
130. Roth, Roland, Gillespie, Dirk, Nonner, Wolfgang, Eisenberg, Bob. (2008) Bubbles, gating and anesthetics in ion channels. *Biophys. J.*, BioFAST, published on January 30, 2008 as [doi:10.1529/biophysj.107.120493](https://doi.org/10.1529/biophysj.107.120493) [[PDF](#)]
131. Powell, Matthew; Sullivan, Michael; Vlassioun, Ivan; Constantin, Dragos; Sudre, Olivier; Martens, Craig, Eisenberg, Robert; and Siwy, Zuzanna (2007) Nanoprecipitation Assisted Ion Current Oscillations. *Nature Nanotechnology* published on line 23 December 2007; [doi:10.1038/nnano.2007.420](https://doi.org/10.1038/nnano.2007.420). [[PDF](#)]
132. Abaid, Nicole, Eisenberg, R.S., Liu, W. (2007) Asymptotic expansions of I-V relations via a Poisson-Nernst-Planck system. *SIAM Journal of Applied Dynamical Systems*. (*submitted*).
133. Singer, A. Gillespie, D., Norbury J., and Eisenberg, R.S. (2007) Singular perturbation analysis of the steady state Poisson-Nernst-Planck system: applications to ion channels. (*submitted*).

**Reviews, mostly invited:**

1. †Eisenberg, R.S. The equivalent circuit of frog skeletal muscle. (1971) In: *Contractility of Muscle Cells* (Ed. R. Podolsky) Prentice Hall, p. 73-88. [[PDF](#)]
2. †Eisenberg, R.S. and Mathias, R.T. (1980) Structural analysis of electrical properties. *Critical Reviews in Bioengineering* 4: 203-232. [[PDF](#)]
3. Eisenberg, R.S. Structural Complexity, Circuit Models, and Ion Accumulation. (1980) *Fed. Proc.* 39: 1540-1543. [[PDF](#)]
4. Mathias, R.T., R.A. Levis, and R.S. Eisenberg. (1981) An alternative interpretation of charge movement in muscle. In: **The Regulation of Muscle Contraction: Excitation-Contraction Coupling**. Ed. A. D. Grinnell & M.A.B. Brazier, Academic Press, New York, pp 39-52. [[PDF](#)]

---

† Contains original research material, not published elsewhere.

5. †Eisenberg, R.S. (1984) Membranes and Channels. Physiology and Molecular Biology, pp. 235-283. *In: Membranes, Channels, and Noise*, Eds. R.S. Eisenberg, M. Frank, and C.F. Stevens, Plenum Press, NY. [\[PDF\]](#)
6. Eisenberg, R.S. (1986) Electrical field problems in muscle and their meaning to mathematicians, physiologists, and muscle. *in: Some Mathematical Questions in Biology - Muscle Physiology. Lectures on Mathematics in the Life Sciences, Vol. 16.* Ed., Robert M. Miura, American Mathematical Society, Providence, Rhode Island, 16: 223-234. [\[PDF\]](#)
7. †Eisenberg, R.S. (1987) Impedance measurements as estimators of the properties of the extracellular space. *Ann. NY Acad. Sci.* 481: 116-122. [\[PDF\]](#)
8. †Rae, J.L., Levis, R.A., and Eisenberg, R.S. (1988) Ionic channels in ocular epithelia. Ch. 8, p. 283-327 *in Ion Channels* (ed. T. Narahashi), Plenum Press. [\[PDF\]](#)
9. †Eisenberg, R.S. Channels as Enzymes. *J. Memb. Biol.*, 115, 1-12 (1990). [\[PDF\]](#)
10. †Tang, J.M., Wang, J., and Eisenberg, R.S. (1992) Studies on intact sarcoplasmic reticulum: patch clamp recording and tension measurement in lobster split muscle fibers. *in Ion Channels* (ed.'s B. Rudy and L.E. Iverson), a volume of **Methods in Enzymology**. [\[PDF\]](#)
11. †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**. [\[PDF\]](#)
12. †Tang, J.M., F.N. Quandt, and R.S. Eisenberg. Perfusion of Patch Pipettes. (1995) *in Patch Clamp Techniques and Protocols*. (p.123-140) ed.'s: A.A. Boulton, hG.B. Baker, and W. Walz. Humana Press. [\[PDF\]](#)
13. †Eisenberg, R.S. (1996a) Atomic Biology, Electrostatics and Ionic Channels. Ch. 5, p. 269-357, in: *New Developments and Theoretical Studies of Proteins*. Edited by Ron Elber in the *Advanced Series in Physical Chemistry*, Vol. 7. World Scientific, Philadelphia. [\[PDF\]](#)
14. Eisenberg, R.S. (1996b). Computing the field in proteins and channels. *J. Membrane Biol.* 150:1-25. [\[PDF\]](#)
15. Eisenberg, Bob (1998). Ionic channels in biological membranes. Natural nanotubes. *Accounts of Chemical Research* 31:117-125. [\[PDF\]](#)
16. Eisenberg, Bob (1998). Ionic Channels in Biological Membranes: Natural Nanotubes described by the Drift-Diffusion Equations. (Invited by and accepted by VLSI Design) *Proceedings of the Fifth International Workshop on Computational Electronics*. 8:75-78. [\[PDF\]](#)
17. Eisenberg, Bob (1998). Ionic channels in biological membranes. Electrostatic analysis of a natural nanotube. *Contemporary Physics*, 39 (6) 447-466. [\[PDF\]](#)

---

† Contains original material.

18. Nonner, Wolfgang, Chen, Duan, and Bob Eisenberg. (1999). Progress and prospects in permeation. *Journal of General Physiology* 113: 773-782. [[PDF](#)]
19. Eisenberg, R.S. (1999). From Structure to Function in Open Ionic Channels. *Journal of Membrane Biology* 171 1-24. [[PDF](#)]
20. Nonner, Wolfgang, and Bob Eisenberg. (2000) Electrodiffusion in Ionic Channels of Biological Membranes. *Journal of Molecular Fluids* 87:149-162. [[PDF](#)]
21. Eisenberg, Bob. (2000). Permeation as a Diffusion Process. Chapter 4 in **Biophysics Textbook On Line “Channels, Receptors, and Transporters”** Louis J. DeFelice, Volume Editor. Updated on November 18, 2005 [[PDF](#)]
22. Eisenberg, R. (2000) Ionic channels: natural nanotubes described by the drift diffusion equations. *Superlattices and Microstructures*. 27 (5/6) 545-549. [[PDF](#)]
23. Eisenberg, Bob (2003) Proteins, Channels, and Crowded Ions *Biophysical Chemistry* 100: 507 - 517. [Edsall Memorial Volume] [[PDF](#)]
- 23a. Eisenberg, Bob (2003) Erratum to “Proteins, channels and crowded ions”, *Biophysical Chemistry* 106 p.93. [*N.B., note misprint in title of Erratum in initial, i.e., left quotation marks!*] [[PDF](#)]
24. Schuss, Zeev, Nadler, Boaz, Singer, Amit, and Eisenberg, Robert S. Eisenberg. (2002) A PDE formulation of non-equilibrium statistical mechanics for ionic permeation, AIP Conference Proceedings 665, Washington, DC, 3-6 September 2002: *Unsolved Problems Of Noise And Fluctuations*, UPoN 2002, 3rd International Conference on Unsolved Problems of Noise and Fluctuations in Physics, Biology, and High Technology (S.M. Bezrukov, ed.), p.312, Washington, DC. [[PDF](#)]
25. Eisenberg, Bob. (2002) Ionic channels as natural nanodevices. *J. Computational Electronics* 1 331-334. [[PDF](#)]
26. Eisenberg, Bob (2003) Ion channels as devices. *J. Computational Electronics* 2 245-249. [[PDF](#)]
27. Eisenberg, Bob (2005) Living Transistors: a Physicist’s View of Ion Channels. Posted on <http://arxiv.org/> with PaperID [arXiv:q-bio/0506016v2](http://arxiv.org/abs/q-bio/0506016v2) [q-bio.BM], June 14, 2005. version 2 aug 25, 2005, posted Feb 3 2008 [[PDF](#)]
28. Saraniti, Marco, Aboud, Shela, and Robert Eisenberg (2006). The Simulation of Ionic Charge Transport in Biological Ion Channels: an Introduction to Numerical Methods. *Reviews in Computational Chemistry* Vol 22, pp 229-294. [[PDF](#)]
29. Eisenberg, Bob. (2008) Ion channels allow atomic control of macroscopic transport. *Physica Status Solidi (in the press)*.

**Everything Else:**

1. Eisenberg, R.S. (1975) Electrophysiology. A review of **Electric Current Flow in Excitable Cells**. J.B. Jack, D. Noble and R.W. Tsien. Clarendon (Oxford University Press), New York, 1975, xvi, 502pp. *Science*, 190, p. 1087.
2. Eisenberg, R.S. (1973) Studies of Biomembranes. Book review of **Perspective in Membranes. A Tribute to Kenneth S. Cole**, D.P. Agin (Ed.) Gordon & Breach, New York 319 pp. 1972, *Science* 181: 539. [[PDF](#)]
3. Eisenberg, R.S. (1982) Book review of **The Biophysical Approach to Excitable Systems**. Eds. W.J. Adelman, Jr. and D.E. Goldman, Plenum, New York, *Science*, 46: 1102-1103.
4. Eisenberg, R.S. (1987) Gating Current. **Encyclopedia of Neuroscience**, Birkhauser, Boston, MA, p. 449-450.
5. Eisenberg, R.S. (1987) Ionic Channels in Membranes. **Encyclopedia of Neurosciences**. Birkhauser, Boston, MA p. 627-628.
6. Eisenberg, R.S. (1987) Structural Complexity in Nerve Cells. **Encyclopedia of Neuroscience**, Birkhauser, Boston, MA, p. 741-742.
7. †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](#)]
8. Eisenberg, R.S. (1987) Volumes apart. *Nature. Scientific Correspondence* on a paper of Zimmerberg and Parsegian. 325: 114. [[PDF](#)]
9. Eisenberg, R.S. (1990) Complexities in solution. *Trends in Biochemical Sciences*, 15:51, A Letter concerning a paper of Payne and Rudnick. [[PDF](#)]
10. Eisenberg, RS. (1992) A unified theory of membrane transport. *in Harvard Class of 1962. Thirtieth Anniversary Report*. Harvard University: Office of the University Publisher, Cambridge, MA. [[PDF](#)]
11. Eisenberg, R.S. (1993) Popper, Wolpert, and Critics. *Nature* 361 292. [[PDF](#)]
12. Bertl, A., Blumwald, E., Coronado, R., Eisenberg, R., Findlay, G., Gradmann, D., Hille, B., Köhler, K., Kolb, H., MacRobbie, E., Meissner, G., Miller, C. Neher, E., Palade, P. Pantoja, O., Sanders, D., Schroeder, J., Slayman, C., Spanswick, R., Walker, A., and Williams, A. (1992) Electrical measurements on endomembranes. *Science* 258: 873-874. [[PDF](#)]
13. Chen, D.; Xu, L.; Tripathy, A.; Meissner, G.; Eisenberg, B. (1997) *with an Appendix* Rate Constants in Channology. in *Permeation through the Calcium Release Channel of Cardiac Muscle*. *Biophys. J.* 73 1337-1354. [original paper is also cited in this CV]
14. Eisenberg, Bob (2000) Vignette Applications of Physical Chemistry, a Biological Example. in Berry, Rice, and Ross **Physical Chemistry** (2<sup>nd</sup> Edition, Oxford University Press, p. 1011-1017). [[PDF](#)]

15. Eisenberg, Bob (2003) Why can't protons move through ion channels? *Biophysical Journal* 85 3427-3428. [[PDF](#)]
16. Tindjong, R., Applegate, A., Eisenberg, R.S. Kaufman, I., Luchinski, D.G., and PVE McClintock. (2004) Ionic current through an open channel: a low-dimensional model of coupling with vibrations of the wall. In D Abbott, SM Bezrukov, A Der, and A Sanchez, Eds. *Fluctuations and Noise in biological, Biophysical, and Biomedical systems II Proc of SPIE 5467*, 2004 338-344. (Proceedings of Conference in Maspalomas, May 2004). [[PDF](#)]
17. Tindjong, R, Eisenberg, R.S. Kaufman, I., Luchinski, D.G., and PVE McClintock. (2005). Brownian dynamics simulation of ionic current through an open channel. In T Gonzalez, J. Mateo, and D. Pardo, Eds *Proc of AIP Conference 780* p. 563-566. (Proceedings of the 18<sup>th</sup> International Conference on Noise and Fluctuations Salamanca, Spain Sept, 2005). [[PDF](#)]
18. Eisenberg, Bob (2005). Validating the need to validate code. *Physics Today (Letter to the Editor)* 58 (8) p. 13. [[PDF](#)]
19. 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](#)]
20. Eisenberg, Bob (2007). New and Notable: Mechanical Spikes from Nerve Terminals. *Biophysical Journal* 92 p. 2983. [[PDF](#)]
21. Eisenberg, R.S. (2007) Look at biological systems through an engineer's eyes. *Nature* Vol 447, p. 376. [[PDF](#)]
22. Eisenberg, Bob. (2008). Bubble Gating Currents in Ionic Channels. [arXiv:0802.0308v1](https://arxiv.org/abs/0802.0308v1) [q-bio.BM] [[PDF](#)]

### **Books:**

1. Eisenberg, R.S., M. Frank, and C.F. Stevens (eds.) (1984) **Membranes, Channels, and Noise.** Plenum Press, NY, pp. 1-54.

### **Abstracts:**

1. Eisenberg, R.S. and Gage, P.W. (1968) Electrical properties of frog skeletal muscle fibers with disrupted transverse tubules. *Biophys. J.* 8: A-188.
2. Eisenberg, R.S. and Eisenberg, B. (1968) The extent of disruption of the transverse tubular system in glycerol treated skeletal muscle. *Federation Proceedings* 27: 247.
3. Eisenberg, R.S. and Gage, P.W. (1968) The surface and tubular membranes of frog sartorius muscle fibers. *J. Cell Biol.* 39: 39a .
4. Eisenberg, R.S. and Gage, P.W. (1969) The conductance of the surface and tubular membranes of frog sartorius muscle. *Biophys. J.* 9: A99.

5. Eisenberg, R.S. and Johnson, E.A. (1969) The interpretation of potentials recorded with double-barrel microelectrodes or with a single electrode bridge. *Federation Proceedings* 28: 397.
6. Howell, J., Vaughan, P. and Eisenberg, R.S. (1970) Maintenance of resting potentials in glycerol treated muscle fibers. *Biophys. J.* 10: 75a.
7. Howell, J., Vaughan, P. and Eisenberg, R.S. (1970) Changes in the capacitance of frog skeletal muscle. *Federation Proceedings* 29: 656.
8. Eisenberg, R.S. (1972) The electrical properties of the internal membrane structures of skeletal muscle. *J. Physiol. Soc. Japan.* 34:90.
9. Valdiosera, R., Clausen, C. and Eisenberg, R.S. Impedance of frog skeletal muscle fibers. (1973) *Biophys. Soc. Abst.* 195a.
10. Mobley, B.A., Leung, J. and Eisenberg, R.S. (1974) Longitudinal Impedance of skinned frog muscle fibers. *Federation Proceedings* 33: 401.
11. Peskoff, A. and Eisenberg, R.S. (1974) Influence of extracellular resistance on membrane potential of cells. *Federation Proceeding* 33: 1266.
12. Mathias, R.T., Clausen, C. and Eisenberg, R.S. (1975) Mesh model of the electrical properties of the tubular system of skeletal muscle. *The Physiologist*, 18: August.
13. Clausen, C., Lewis, S.A., Diamond, J.M. and Eisenberg, R.S. (1976) Electrical circuit analysis of tight epithelia by alternating current techniques. *Biophys. J.* 16: 131a.
14. Eisenberg, R.S., Barcion, V. and Mathias, R.T. (1978) Electrical properties of a spherical syncytium. *Biophys. J.* 21: 48a.
15. Mathias, R.T., Rae, J. and Eisenberg, R.S. (1978) Linear electrical properties of the lens of the eye. *Biophys. J.* 21: 48a.
16. Eisenberg, B.R. and Eisenberg, R.S. (1980) *T-SR* Junction in activated muscle. *J. Cell. Biol.* 87: 264a.
17. Eisenberg, R.S. Structural analysis of electrical properties. (1981) *Biophys. J.* 33: 267a.
18. Eisenberg, R.S., Mathias, R.T., and J.L. Rae. (1982) Series resistance measured by integrals of transients. *Biophys. J.* 37: 63a.
19. Milton, R.L., Mathias, R.T. and R.S. Eisenberg. (1982) Impedance measurements at the pelvic end of frog sartorius muscle fibers. *Biophys. J.* 37: 356a.
20. Hui, C.S., Milton, R.L., and Eisenberg, R.S. (1983) Elimination of charge movement in skeletal muscle by a calcium antagonist. *Biophys. J.* 41: 178a.
21. McCarthy, R.T., Milton, R.L., and Eisenberg, R.S. (1983) Paralysis of skeletal muscle fibers by a calcium antagonist. *Biophys. J.* 41: 178a.
22. Levis, R.A., Mathias, R.T. and Eisenberg, R.S. (1983) Electrical properties of sheep Purkinje strands: Impedance measurements and voltage clamp simulations including electrodiffusion. *Biophys. J.* 41: 308a.



23. Curtis, B.A. and Eisenberg, R.S. A delayed calcium influx related to contraction in frog twitch fibers. (1984) *J. Gen. Physiol.* 84: 36a.
24. Cooper, K.E., McCarthy, R.T., Milton, R.L. and Eisenberg, R.S. (1984) Calcium antagonists modify contraction of skeletal muscle fibers. *Biophys. J.* 45: 232a.
25. Eisenberg, R.S., Curtis, B.A. and McCarthy, R.T. (1984) Calcium uptake and  $K^+$  contractures in paralyzed and contracting muscle fibers. *Biophys. J.* 45: 234a.
26. Eisenberg, R.S. Structural analysis of neuronal integration. (1984) *Biophys. J.* 45: 153a.
27. Curtis, B.A. and Eisenberg, R.S. (1984) A delayed influx related to contraction in frog twitch fibers. *J. Gen. Physiol.* 84: 36a.
28. Curtis, B.A. and Eisenberg, R.S. (1985) Calcium entry and the repriming period of frog twitch fibers. *Biophys. J.* 47: 132a.
29. Eisenberg, R.S. Calcium Signals in Muscle. (1985) *Biophys. J.* 47: 194a.
30. Curtis, B.A. and Eisenberg, R.S. (1985) Calcium ions: The link between t depolarization and *SR* Ca release. *Biophys. J.* 47: 195a.
31. Cooper, K.E., J.M. Tang, J.L. Rae and R.S. Eisenberg. (1985) Cation selective channel in the epithelium of frog lens. *Biophys. J.* 86: 9a.
32. Cooper, K.E., J.M. Tang, J.L. Rae and R.S. Eisenberg. (1985) Cation-selective channel in the epithelium of frog lens. *J. Gen. Physiol.* 86: 9a-10a.
33. Cooper, K.E., J.M. Tang, J.L. Rae and R.S. Eisenberg. (1986) A cation-selective channel from frog lens epithelium. *Biophys. J.* 49: 6a.
34. Cooper, K.E., Gates, P.Y., and R.S. Eisenberg. (1987) Rate constants for ionic diffusion over barriers. *Biophys. J.* 51: 48a.
35. Gates, P.Y., Cooper, K.E., and R.S. Eisenberg. (1987) Diffusive flux through ionic channels. *Biophys. J.* 51: 48a.
36. Tang, J. M., Wang, J., and R.S. Eisenberg. (1987) Patch clamp of sarcoplasmic reticulum within muscle fibers. *Biophys. J.* 51: 106a.
37. Eisenberg, R.S., Hainsworth, A.H., and R.A. Levis. (1987). Open-channel noise in a cation channel of the frog lens epithelium. *J. Physiol. (London)* 396: 84P.
38. Hainsworth, A., Tang, J.M., Wang, J., Levis, R.A., and R.S. Eisenberg. (1988) Open channel noise in the  $K^+$  channel of the sarcoplasmic reticulum. *Biophys. J.* 53: 151a.
39. Cooper, K.E., Gates, P.Y., and R.S. Eisenberg. (1988) Diffusion theory and discrete rate constants in ion permeation. *Biophys. J.* 152a.
40. Moghaddamjoo, A., Levis, R.A., and R.S. Eisenberg. (1988). Automatic detection of channel currents. *Biophys. J.* 153a.
41. R.S. Eisenberg. Channels as Enzymes (*title only*). (1988) *Medical Physics* 15: No. 4, p. 440.
42. J. Wang, J.M. Tang, and R.S. Eisenberg. (1989)  $Ca^{++}$  channels in the sarcoplasmic reticulum (*SR*) of skinned lobster muscle fibers: patch clamp measurements. *J. Cell Biology* 107:144a.

43. R.S. Eisenberg, A.H. Hainsworth, and R.A. Levis. Open-channel noise in the potassium channel of lobster sarcoplasmic reticulum. (1988) *J. Physiol. (Cambridge Meeting, July: 107P)*.
44. J. Wang, J.M. Tang, and R.S. Eisenberg.  $\text{Ca}^{++}$  channels from sarcoplasmic reticulum of split lobster muscle fibers. (1989) *Biophysical J. 55: 207a*.
45. A. Hainsworth, R.A. Levis, and R.S. Eisenberg. (1989) Excess open-channel noise in the SR  $\text{K}^{+}$  channel. *Biophysical J. 55: 200a*.
46. R.S. Eisenberg, A.H. Hainsworth, R.A. Levis. (1989) The effect of temperature on open-channel noise in the potassium channel of the lobster sarcoplasmic reticulum. *J. Physiol. 410: 18P*.
47. J.M. Tang, J. Wang, F.N. Quandt, and Eisenberg, R.S. (1990) Perfusing patch pipettes quietly and easily. *Biophys. J. 57: 171a*.
48. J.M. Tang, J. Wang, T. Lea and Eisenberg, R.S. (1990) Contractures and reloading in skinned lobster muscle fibers. *Biophys. J. 57: 171a*.
49. R.S. Eisenberg, J.M. Tang, and J. Wang. (1991) Ionic channels of the sarcoplasmic reticulum of lobster remotor muscle. *Biophys. J. 59: 177a*.
50. D.P. Chen and R.S. Eisenberg. (1991) Constant fields and constant gradients in open ionic channels. *Biophys. J. 59: 404a*.
51. R.S. Eisenberg, D.P. Chen, and V. Barcion. (1991) Constant fields and constant gradients in open ionic channels. *Physiologist. 34: 102*.
52. Wang, J., Tang, J.M., and RS Eisenberg. (1992) Calcium conducting channel in SR: calcium pump without occlusion? *Biophys. J. 61. A433*.
53. Chen, DP, Barcion, V. and RS Eisenberg. (1992) Induced and permanent charge in open ionic channels. *Biophys. J. 61. A11*.
54. Chen, DP, and R Eisenberg. (1992) Exchange diffusion, single filing, and gating in macroscopic channels of one conformation. *J. Gen. Physiol. 100: 9a*.
55. Eisenberg, Robert From Structure to Permeation in Open Ionic Channels. (1993) *Biophys. J. 64:A22*.
56. Eisenberg, Robert and Duanpin Chen. (1993) Poisson-Nernst-Planck (**PNP**) theory of an open ionic channel. *Biophys. J. 64:A22*.
57. Chen, Duanpin and Robert Eisenberg. (1993) Poisson-Nernst-Planck (**PNP**) theory of open ionic channels. *Biophys. J. 64:A22*.
58. Chen, Duan P. and Robert S. Eisenberg. (1994) Divalent effects on mono-valent cation channels, an extension of Poisson-Nernst-Planck theory. *Biophys. J. 66(2) A292*.
59. Elber, Ron, Duan Chen, Danuta Rojewska, and Bob Eisenberg. (1994)  $\text{Na}^{+}$  in Gramicidin: the prototype permion. *Biophys. J. 66(2) A354*.
60. Eisenberg, Bob, Malgorzata Klosek, and Zeev Schuss. (1994) Stochastic theory of the open channel. *Biophys. J. 66(2) A354*.

61. Chen, Duan, Paul Kienker, Jim Lear and Bob Eisenberg. (1995) PNP Theory fits current-voltage (*IV*) relations of a synthetic channel in 7 solutions. *Biophys. J.* 68:A370.
62. Chen, Duan, Wolfgang Nonner, and Bob Eisenberg. PNP (1995) Theory fits current-voltage (*IV*) relations of a neuronal anion channel in 13 solutions. *Biophys. J.* 68:A370
63. Chen, D., Eisenberg, R., Jerome, J., and Shu, C. (1995) PH (Poisson-Hydrodynamic) Theory of an open channel. *Biophys. J.*, 68:A371.
64. Tang, John, Rick Levis, Kelvin Lynn, and Bob Eisenberg. (1995) Opening and closing transitions of a large mitochondrial channel with microsecond time resolution. *Biophys. J.*, 68:A145, 1995.
65. Janovic, Slobidan, Kelvin Lynn, Xaioye Wu, Bob Eisenberg, and Rick Levis. (1995) Real-time analysis of single channel currents. *Biophys. J.*, 68:A42.
66. Eisenberg, Robert S., Chen, P. Solutions to Fields in Biological Channels. (1996) American Chemical Society, Division of Physical Chemistry, 212<sup>th</sup> Meeting. *Printed but perhaps not published Abstract.*
67. Chen, D., Xu, L., Tripathy, A., Meissner, G., and R. Eisenberg (1997) Permeation through the calcium release channel (CRC) of cardiac muscle. *Biophys. J.*, 72:A108.
68. Tang, J., Chen, D., Saint, N., Rosenbusch, J., and R. Eisenberg (1997). Permeation through porin and its mutant G119D. *Biophys. J.*, 72:A108, 1997.
69. Tang, J., Saint, N., Rosenbusch, J., and R. Eisenberg (1997). Currents through single channels of maltoporin. *Biophys. J.*, 72:A108, 1997.
70. Gardner, Carl, Eisenberg, B., and Joe Jerome. (1998) Numerical simulation of rectangular channel currents. *Biophys. J.*, 74 A342.
71. Schuss, Zeev and Eisenberg, B. (1998) Stochastic and continuum models of unidirectional fluxes in open ionic channels. *Biophys. J.*, 74 A342.
72. Elber, R. and Eisenberg, B. (1998) Molecular dynamics simulations of solvated ions between a membrane and metal electrodes at various electric potentials. *Biophys. J.*, 74 A342.
73. Chen, D., Tripathy, A., Xu, L., Meissner, G. and Bob Eisenberg. (1998) Permeation in the calcium release channel (CRC) of skeletal muscle. *Biophys. J.*, 74 A342.
74. Chen, D., Tripathy, A., Xu, L., Meissner, G. and Bob Eisenberg. (1998) Selectivity of calcium release channel (CRC) of cardiac muscle. *Biophys. J.*, 74 A342.
75. Nonner, W., Chen, D. and Bob Eisenberg. (1998) Anomalous mole fraction effects: an electrostatic interpretation. *Biophys. J.*, 74 A342.
76. Nonner, W. and Bob Eisenberg. (1998) Calcium channel permeability and glutamate residues linked by PNP Theory. *Biophys. J.*, 74 A342.
77. Catacuzzeno, L., W. Nonner, and B. Eisenberg. (1999) PNP2 Links Crystallographic Structure and Conduction in K Channels. *Biophysical Journal.* 76:A79.
78. Gillespie, D, and Bob Eisenberg. (1999) An analytic formula for the reversal potential derived from *PNP* theory. . *Biophysical Journal.* 76:A192

79. Hollerbach, U., Chen, D., Nonner, W., and Bob Eisenberg. (1999) Three-dimensional Poisson-Nernst-Planck Theory of Open Channels. *Biophysical J.* 76:A205.
80. Catacuzzeno, L., W. Nonner, L. Blum, and B. Eisenberg. Ca Selectivity in the 'EEEE' Locus of L-type Ca Channels. (1999) *Biophysical Journal.* 76:A259.
81. Nonner, W, L. Catacuzzeno, and B. Eisenberg. (2000) Ionic selectivity in K channels. *Biophysical Journal.* 78:A96.
82. Nonner, W, L. Catacuzzeno, and B. Eisenberg. (2000) Ionic selectivity in calcium channels. *Biophysical Journal.* 78:A455.
83. Chen, Duan, Le Xu, Bob Eisenberg, and Gerhard Meissner. (2000) Calcium and potassium ion selectivity of skeletal muscle ryanodine receptor. *Biophysical Journal.* 78:A462.
84. van der Straaten, T.A., RS Eisenberg, JM Tang, U Ravaioli, and N Aluru. (2001) Three dimensional Poisson Nernst Planck Simulation of ompF porin. *Biophysical Journal.* 80: 115a
85. Chen, Duan, L Xu, B Eisenberg, and G Meissner. (2001) Ca ion permeation through the calcium release channel (ryanodine receptor) of cardiac muscle *Biophysical Journal.* 50: 115a.
84. Nonner, W., B Eisenberg, and D Henderson (2001) Ca channel selectivity: the role of solvent *Biophysical Journal.* 80:453a.
85. Nonner, W., Gillespie, D., and B Eisenberg. (2002) Flux and selectivity in the Ca channel: a density functional approach. *Biophysical Journal.* 82: 340a.
86. Gillespie, D. and RS Eisenberg. (2002) Measurements of selectivity: physical interpretation. *Biophysical Journal.* 82:206a.
87. Van der Straaten, T.A., Tang, J.M., Eisenberg, RS, Ravaioli, U., Aluru, N., Varma, S., and E. Jakobsson. (2002) A study of mutations of ompf porin using Poisson-Nernst-Planck theory. *Biophys. J.* 82: 207a.
88. Chiu, See-Wing, Varma, S., Jakobsson, E., Tang, J.M., van der Straaten, T., Eisenberg, R.S. (2002) Molecular dynamics of permeation in porin and its mutant G119D. *Biophysical Journal.* 82:208a.
89. Gillespie, D., Nonner, W., and Bob Eisenberg. (2002) Physical model of selectivity and flux in Na channels. *Biophysical Journal* 84 (Number 2) p. 67a.
90. Nonner, Wolfgang, Gillsepsie, Dirk, Eisenberg, Bob, and Douglas Henderson. (2002) A physical basis for large-ion selectivity. *Biophysical Journal* 84 (Number 2) 93a.
91. Chen, Duan, Kuang, Zhifeng, Boda, Deszo, Eisenberg, Bob, Busath, David and Douglas Henderson. (2003) Ion channel permeation simulated by non-equilibrium molecular dynamics calibrated by equilibrium Monte Carlo. *Biophysical Journal* 84 (Number 2) 94a.

92. Boda, Dezso, Gillespie, Dirk, Nonner, Wolfgang, Henderson, Douglas, Busath, David, and Bob Eisenberg. (2004) Effects of dielectrics on selectivity: computing induced charge in Monte Carlo simulations. *Biophysical Journal* 86 6a.
93. Mediema, Henk, Meter-Arkema, Anita, Wierenga, Jenny, Hektor, Hans, Tang, John, Bob Eisenberg, Bob and Wim Meijberg. (2004) Permeation properties of an engineered OmpF containing the EEEE locus of Ca-channels. *Biophysical Journal* 86 260a.
94. Nonner, Wolfgang, Gillespie, Dirk, and Bob Eisenberg. (2004) Moving gating charges: comparing electrostatic energetics of the S4 motion of different models. *Biophysical Journal* 86 436a.
95. Aguilera-Arzo, Marcel, Garcia-Celma, Juan, Aguilera, Vicente, and Robert Eisenberg. (2004) Computing numerically access resistance of a channel. *Biophysical Journal* 86 629a.
96. Peyser, Alexander, Nonner, Wolfgang R., Gillespie, Dirk, Eisenberg Bob. (2005) Electrostrictive Forces in S4 Models. *Biophysical Journal* 88 458a.
97. Henderson, D., Boda, D., Valisko, M., Gillespie, D, Eisenberg, B., Nonner, W. (2005) New constant voltage method of simulating ions in a dielectric near a metallic electrode *PacificChem 2005*, Honolulu HI.
98. Eisenberg, R. S. (2005) Ions in channels: Life's transistors *PacificChem 2005*, Honolulu HI.
99. Wilk, S.J., Petrossian, L., Goryll, M., Thornton, T.J., Goodnick, S.M., Tang, J.M., Eisenberg, R.S. (2005) Integrated Platform for Ion Channel Sensing. *IEEE SENSORS 2005: the 4th IEEE conference on sensors*.
100. Siwy, Z, Powell, M., Kalman, E., Heins, E., Martin, C.R., R.S. Eisenberg. (2006). Pores in plastic can be calcium sensitive and gate. *Biophysical Journal* 90 314a.
101. Boda, Dezso, Valisko, Monika, Gillespie, Dirk, Nonner, Wolfgang, Henderson, Douglas and Bob Eisenberg. (2006) Dielectrics Enhance the Selectivity of Calcium Channels. *Biophysical Journal* 90 404a.
102. Nonner, Wolfgang, Gillespie, Dirk, Eisenberg, Bob. (2006) How Do Long Pores Make Better K Channels? *Biophysical Journal* 90 239a.
103. Eisenberg, Bob. (2007) . How can a channel tell  $\text{Ca}^{2+}$  from  $\text{Na}^{+}$  ? *Biophysical Journal* 92 342a; Symposium 14: Modeling as a Tool in Biophysics
104. Siwy, Zuzanna S., Powell, Matthew R., Kalman, Eric, Eisenberg Robert S. (2007) Gating, Modulation, and Rectification in a Large Diameter Abiotic Nanopore. *Biophysical Journal* 92 342a Symposium 14: Modeling as a Tool in Biophysics
105. Boda, Dezso, Valisko, Monika, Eisenberg, Bob, Nonner, Wolfgang, Henderson, Douglas, Gillespie, Dirk. (2007) The effect of the protein dielectric coefficient and pore radius on the Na affinity of a model sodium channel *Biophysical Journal* 92 p. 609a [[PDF](#)] and [[PPT](#)]
106. Powell, Matthew R., Sullivan, Michael, Siwy, Zuzanna S., Eisenberg. Robert S. (2007) Stochastic Sensing of Analytes by a Synthetic Nanopore with Adaptor *Biophysical Journal* 92 p. 649a

107. Arning, Katrin, Burger Martin, Engl, Heinz, Eisenberg, Robert, He, Lin, and Marie Wolfram. (2007) Simulation of ion transport through nanopores. International Conference on Simulation of Semiconductor Processes and Devices (SISPAD)
108. Powell, Matthew R., Sullivan, Michael, Vlassiuk, Ivan, Constantin, Dragos, Sudre, Olivier, Martens, Craig, Eisenberg, Robert S., Siwy, Zuzanna. (2008) Ion Current Oscillations Caused by Femtoliter Volume Precipitation in a Nanopore *Biophysical Journal* 94 p. 333a. [[PDF](#)] and [[PPT](#)]
109. Boda, Dezsó, Nonner, Wolfgang, Valisko, Monika, Henderson, Douglas, Eisenberg, Bob, Gillespie, Dirk. (2008) Competition of Steric repulsion and Electrostatic Attraction in the Selectivity Filter of Model Calcium Channels *Biophysical Journal* 94 p. 447a. [[PDF](#)] and [[PPT](#)]
110. Eisenberg, Bob, Roth, Roland, Gillespie, Dirk, Nonner, Wolfgang. Bubbles, Gating, and Anesthetics in Ion Channels. (2008) *Biophysical Journal* 94 p. 622a

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