

## Zachary Alan Levine, PhD

Associate Research Scientist

Department of Pathology

Email: [Zachary.Levine\[at\]yale\[dot\]edu](mailto:Zachary.Levine[at]yale[dot]edu)

Web: [https://medicine.yale.edu/people/search/zachary\\_levine.profile](https://medicine.yale.edu/people/search/zachary_levine.profile)

Yale School of Medicine  
310 Cedar Street LH 108  
PO Box 208023  
New Haven, CT 06520-8023

## Education

PhD Physics, University of Southern California	2013
MS Computer Science, University of Southern California	2012
MA Physics, University of Southern California	2008
BS Physics, San Francisco State University	2006

## Experience

Associate Research Scientist / Research Faculty <i>Department of Pathology, Yale School of Medicine</i>	2017–present
Postdoctoral Researcher <i>Department of Physics, Department of Chemistry &amp; Biochemistry, UC Santa Barbara</i>	2013–2017
Graduate Research/Teaching Assistant <i>Department of Physics, Information Sciences Institute, USC</i>	2008–2013
Undergraduate Research Assistant <i>Department of Physics, San Francisco State University</i>	2003–2006

## Peer-Reviewed Publications (23)

1. Seo S, Lee DW, Ahn JS, Cunha K, Filippidi E, Ju SW, Shin E, Kim BS, **Levine ZA**, Lins RD, Israelachvili JN, Waite JH, Valentine MT, Shea JE, Ahn BK. 2017. Significant Performance Enhancement of Polymer Resins by Bioinspired Dynamic Bonding. *Advanced Materials*. 1703026, 1-9. DOI: 10.1002/adma.201703026
2. Sözer EB, **Levine ZA**, and Vernier PT. 2017. Quantitative Limits on Small Molecule Transport via the Electropermeome – Measuring and Modeling Single Nanosecond Perturbations. *Scientific Reports*. 7 (57), 1-13. DOI:10.1038/s41598-017-00092-0
3. **Levine ZA**, Shea JE. 2017. Simulations of Disordered Proteins and Systems with Conformational Heterogeneity. *Current Opinion in Structural Biology*. 43, 95-103. DOI: 10.1016/j.sbi.2016.11.006
4. Das S, Lee BH, Linstadt RTH, Cunha K, Li Y, **Levine ZA**, Lipshutz BH, Lins RD, Shea JE, Israelachvili JN, Heeger AJ, and Ahn BK. 2016. Molecularly Smooth Self-Assembled Monolayer for High-Mobility Organic Field-Effect Transistors. *Nano Letters*. 16 (10), 6709–6715. DOI: 10.1021/acs.nanolett.6b03860
5. **Levine ZA**, Rapp MV, Wei W, Mullen RG, Wu C, Zerze GH, Mittal J, Israelachvili JN, Waite JH, Shea JE. 2016. Surface Force Measurements and Simulations of Mussel-Derived Peptide Adhesives on Wet Organic Surfaces. *Proceedings of the National Academy of Sciences of the United States of America*. 113 (16), 4332-4337. DOI: 10.1073/pnas.1603065113
6. **Levine ZA**, DeNardis NI, Vernier PT. 2016. Molecular Dynamics Interactions of Phospholipids and Hydrocarbons Between Silicon Electrodes. *Langmuir*. 32 (11), 2808-2819. DOI: 10.1021/acs.langmuir.5b04090
7. Vernier PT, **Levine ZA**. 2016. Biological Responses. *Bioelectrics*. Edited by Akiyama H and Heller R. ISBN: 978-4-431-56095-1. Springer. DOI: 10.1007/978-4-431-56095-1.
8. **Levine ZA**, Larini L, LaPointe NE, Feinstein SC, Shea JE. 2015. Regulation and Aggregation of Intrinsically Disordered Peptides. *Proceedings of the National Academy of Sciences of the United States of America*. 112 (9), 2758-2763. DOI: 10.1073/pnas.1418155112
9. Zerze GH, Mullen RG, **Levine ZA**, Shea JE, Mittal J. 2015. To what extent does surface hydrophobicity dictate peptide folding and stability near surfaces? *Langmuir*. 31 (44), 12223-12230. DOI: 10.1021/acs.langmuir.5b03814 (**GHZ, RGM, and ZAL share first-authorship**)

10. **Levine ZA**, Fischer SA, Shea JE, and Pfaendtner J. 2015. Trp-Cage Folding on Organic Surfaces. *The Journal of Physical Chemistry B*. 119 (33), 10417-10425. DOI: 10.1021/acs.jpcc.5b04213
11. Shea JE, **Levine ZA**. 2015. Studying The Early Stages Of Protein Aggregation Using Replica Exchange Molecular Dynamics Simulations. *Protein Amyloid Aggregation: Methods and Protocols (Methods in Molecular Biology)*. Edited by David Eliezer. ISBN: 978-1493929771. Humana Press
12. Vernier PT, **Levine ZA**, Ho MC, Xiao S, Semenov I, Pakhomov A. 2015. Picosecond and Terahertz Perturbation of Interfacial Water and Electroporation of Biological Membranes. *Journal of Membrane Biology*. 1-11. DOI: 10.1007/s00232-015-9788-7
13. Kohler S, **Levine ZA**, García-Fernández MA, Ho MC, Vernier PT, Leveque P, Arnaud-Cormos D. 2015. Electrical analysis of cell membrane poration by an intense nanosecond pulsed electric field, using an atomistic-to-continuum method. *Transactions on Microwave Theory and Techniques (IEEE)*, 63 (6), 2032,2040 DOI: 10.1109/TMTT.2015.2418764
14. **Levine ZA**, Venable RM, Watson MC, Lerner MG, Shea JE, Pastor RW, Brown FLH. 2014. Determination of Biomembrane Bending Moduli in Fully Atomistic Simulations. *Journal of the American Chemical Society*, 136 (39), 13582-13585. DOI: 10.1021/Ja507910r
15. Ho MC, Casciola M, **Levine ZA**, Vernier PT. 2013. Molecular Dynamics Simulations of Ion Conductance in Field-Stabilized Nanoscale Lipid Electropores. *Journal of Physical Chemistry B*, 117 (39), 11633-11640. DOI: 10.1021/jp401722g
16. Romeo S, Wu YH, **Levine ZA**, Gundersen MA, Vernier PT. 2013. Water influx and cell swelling after nanosecond electroporation. *Biochim. Biophys. Acta*, 1828(8), 1715-1722. DOI: 10.1016/j.bbame.2013.03.007
17. Ho MC, **Levine ZA**, Vernier PT. 2013. Nanoscale, Electric Field-Driven Water Bridges in Vacuum Gaps and Lipid Bilayers. *Journal of Membrane Biology*, 246(11), 793-801. DOI: 10.1007/s00232-013-9549-4
18. Tokman M, Lee JH, **Levine ZA**, Ho MC, Colvin ME, Vernier PT. 2013. Electric Field-Driven Water Dipoles: Nanoscale Architecture of Electroporation. *PLoS ONE*, 8:e61111. DOI: 10.1371/journal.pone.0061111
19. Vernier PT, **Levine ZA**, Gundersen MA. 2012. Water Bridges in Electroporation of Phospholipid Bilayers. *Proc. of the IEEE*. 101, 494-504. DOI: 10.1109/JPROC.2012.2222011
20. **Levine ZA**, Vernier PT. 2012. Calcium and Phosphatidylserine Inhibit Lipid Electropore Formation and Reduce Pore Lifetime. *Journal of Membrane Biology*. 245, 599-610. DOI: 10.1007/s00232-012-9471-1
21. Knecht V, **Levine ZA**, Vernier PT. 2010. Electrophoresis of neutral oil in water. *Journal of Colloid and Interface Science*. 352(2), 223-231. DOI: 10.1016/j.jcis.2010.07.002 **[Cover Article]**
22. **Levine ZA**, Vernier PT. 2010. Life Cycle of an Electropore: Field-Dependent and Field-Independent Steps in Pore Creation and Annihilation. *Journal of Membrane Biology*. 236(1), 27-36. DOI: 10.1007/s00232-010-9277-y
23. Vernier PT, **Levine ZA**, Wu YH, Joubert V, Ziegler MJ, Mir LM, Tieleman DP. 2009. Electroporation Fields Target Oxidatively Damaged Areas in the Cell Membrane. *PLoS ONE*, 4(11), e7966. DOI: 10.1371/journal.pone.0007966

### Manuscripts Under Review (1)

---

24. Oi C, Treado J, **Levine ZA**, Lim CS, Knecht KM, Xiong Y, O'Hern CS, Regan L. A threonine zipper that mediates protein-protein interactions: structure and prediction. *Protein Science*.

### Manuscripts In-Progress (5)

---

25. **Levine ZA**, Okada A, Taranishi K, Langen R, Cohen P, Shea JE. Reducing IAPP Aggregation with Mitochondrial Humanin Peptides; Results from Simulations and Experiments. Target: *JACS*
26. Wójcik S, Birol M, Rhoades E, Miranker M, **Levine ZA**. Designing small-molecule ligands that target intrinsically disordered proteins across multiple phases. Target: *Methods in Enzymology*
27. **Levine ZA**, Shea JE. Optimization of Mussel-Inspired Bioadhesives on Silicon Dioxide Surfaces. Target: *JPC Letters*.
28. **Levine ZA**, Cunha K, Shea JE. Folding and Adhesion of Mussel-Inspired Peptides on Inorganic Underwater Surfaces. Target: *JPC Letters*.
29. **Levine ZA**. Denaturing Human Aquaporin under Membrane-Permeabilizing Electric Fields.

## Conference Proceedings and Book Chapters (3)

---

1. **Levine ZA**. 2017. Lipid Electropore Lifetime in Molecular Models. Handbook of Electroporation. Edited by D. Miklavcic. ISBN 978-3-319-32887-4. Springer. DOI 10.1007/978-3-319-32886-7\_86.
2. **Levine ZA**. 2017. Effects of Heterogeneous Membranes and Electrolytes on Electropore Formation. Handbook of Electroporation. Edited by D. Miklavcic. ISBN 978-3-319-32887-4. Springer. DOI 10.1007/978-3-319-32886-7\_87.
3. Kohler S., Ho M, **Levine ZA**, Vernier PT, Leveque P, Arnaud-Cormos D, Electrical analysis of cell membrane poration induced by an intense nanosecond pulsed electric field, using an atomistic-to-continuum method. IEEE Microwave Symposium 2014.

## Achievements & Awards

---

XSEDE/NSF Supercomputing Allocation (TG-MCB170142/MCB140122)	2018, 2014
Dow Materials institute and Materials Research Laboratory Travel Fellowship	2015, 2016
Biophysical Society Education Travel Award	2014
Don Eden Award	2005
College of Science & Engineering Student Advisory Board	2005
Golden Key Honor Society	2004

## Outreach & Volunteering

---

- |   |      |
|---|------|
| 1. Guest Instructor for Methods and Logic Course at Yale                          | 2017 |
| 2. Biophysics instructor at the Telluride School on Theoretical Chemistry         | 2015 |
| 3. Science instructor for UCSB CNSI Family Ultimate Science Exploration           | 2015 |
| 4. Outreach volunteer for the MRL Science Teacher Workshop                        | 2014 |
| 5. Education outreach volunteer for the UCSB MRL: Ellwood elementary school       | 2014 |
| 6. Outreach scientist and speaker for the Santa Barbara Museum of Natural History | 2014 |

## Service

---

1. Reviewer – Science Magazine
2. Reviewer – Journal of Physical Chemistry (B/Letters)
3. Reviewer – Soft Matter
4. Reviewer – Journal of Membrane Biology
5. Reviewer – Journal of Colloids and Interface Science
6. Reviewer – Bioelectromagnetics Journal
7. Reviewer – Molecular BioSystems
8. Mentor to 2 undergraduate students.

## Invited Talks:

---

1. **Levine ZA**, Okada A, Teranishi K, Langen R, Shea JE. 2016. Reducing IAPP Aggregation with Mitochondrial Humanin Peptides; Results from Simulations and Experiments. Biophysical Society Annual Meeting. Los Angeles, CA, USA.
2. **Levine ZA**, Mullen RG, Shea JE. 2015. Protein folding and assembly on membrane-mimics in constant volume replica-exchange simulations. Invited Speaker for the “Role of Membranes in Amyloid-formation and the Pathogenicity of Amyloid Diseases” platform. American Chemical Society National Meeting. Denver, CO, USA.
3. **Levine ZA**, Larini L, LaPointe N, Feinstein S, Shea JE. 2014. Tau(273-284): A Molecular Dynamics Study of Intrinsically Disordered Protein Conformations in the Presence Of Osmolytes. Biophysical Society Annual Meeting. San Francisco, CA, USA.
4. **Levine ZA**, DeNardis NI, Vernier PT. 2013. Molecular Dynamics Interactions of Phospholipids and Hydrocarbons Between Silicon Electrodes. Biophysical Society Annual Meeting. Philadelphia, PA, USA.
5. **Levine ZA**, Vernier PT. 2012. Electropore Dynamics in Time-Dependent Electric Fields. Biophysical Society Annual Meeting. San Diego, CA, USA.
6. **Levine ZA**, Vernier PT. 2011. Temperature Modulation of Phospholipid Bilayer Electropore Creation and Annihilation. Biophysical Society Annual Meeting. Baltimore, MD, USA.

7. **Levine ZA**, Ziegler MJ, Vernier PT. 2010. Life Cycle of an Electropore: A Molecular Dynamics Investigation of the Electroporation of Heterogeneous Lipid Bilayers (PC:PS) In the Presence of Calcium Ions. Biophysical Society Annual Meeting. San Francisco, CA, USA.
8. **Levine ZA**, Vernier PT. 2010. Electropore Life Cycles in Heterogeneous Phospholipid Bilayers in the Presence of Calcium. Bioelectromagnetics Society Annual Meeting. Seoul, Republic of Korea.
9. **Levine ZA**, Vernier PT. Gordon Conference on Bioelectrochemistry. 2010. Lipid Bilayer Electropore Modulation using Calcium, Phosphatidylserine, and Temperature. Biddeford, ME, USA.
10. **Levine ZA**, Wu YH, Ziegler MJ, Tieleman DP, Vernier PT. 2009. Electroporation Sensitivity of Oxidized Phospholipid Bilayers. Biophysical Society Annual Meeting. Boston, MA, USA.
11. **Levine ZA**, Vernier PT. 2009. Increased Susceptibility of Oxidized Phospholipid Bilayers to Electroporation. University of California System-wide Bioengineering Symposium. University of California, Merced, USA.
12. **Levine ZA**, Vernier PT. 2009. Electroporation of Mixed Lipid Bilayers (PC:PS) in the Presence of Calcium. Biomedical Engineering Society Annual Meeting. Pittsburgh, PA, USA.
13. **Levine ZA**, Vernier PT. 2009. Electroporation of Mixed Lipid Bilayers (PC:PS) in the Presence of Calcium. Electroporation-based Technologies and Treatments Workshop. University of Ljubljana, Ljubljana, Slovenia.

### **Contributed Talks**

---

1. Tokman M, Lee JH, **Levine ZA**, Ho MC, Colvin ME, Vernier PT. 2014. Electric Field-Driven Water Dipoles: Nanoscale Architecture of Electroporation. Biophysical Society Annual Meeting. San Francisco, CA.
2. Vernier PT, Kohler S, Ho MC, **Levine ZA**, Leveque P, Arnaud-Cormos D. 2013. Toward the physical mechanisms of nanopulse-induced pore formation combining Molecular Dynamics and a 3D electromagnetic tool. Bioelectromagnetics Society Annual Meeting (BioEM). Thessaloniki, Greece.
3. Vernier PT, **Levine ZA**, and Wu YH. 2011. Nanoelectropores in cell membranes and simulated phospholipid bilayers. 21<sup>st</sup> International Symposium on Bioelectrochemistry and Bioenergetics of the Bioelectrochemical Society. Kraków, Poland.
4. Romeo S, Wu YS, **Levine ZA**, and Vernier PT. 2011. Water influx after nanoelectroporation. International Bioelectrics Symposium. Toulouse, France.
5. JH Lee, **ZA Levine**, PT Vernier, M Tokman, M Colvin. 2010. Electric Field Effects on Water and Water-Vacuum Interfaces in Molecular Dynamics Simulations. Biophysical Society Annual Meeting. San Francisco, CA, USA.
6. Vernier PT, **Levine ZA**, Wu YH, Joubert V, Ziegler MJ, Mir L, and Tieleman DP. 2009. Increased susceptibility of oxidized phospholipid bilayers to electroporation. 20<sup>th</sup> International Symposium on Bioelectrochemistry and Bioenergetics. Sibiu, Romania

### **Technical and Computational Skills**

---

C, C++, Perl, Python, Java, Fortran, MPI, OpenMP, pthreads, CUDA, Matlab, R, GROMACS, CHARMM, AMBER, NAMD, LAMMPS, COMSOL, SQL, HTML, CSS, XML, Oracle RDBMS. Scientific visualization and image processing using VMD, VisIt, and OpenGL. Experience with UTMOST and BSIM for SPICE modeling.