Curriculum Vitae
ESHEL FARAGGI

Adjunct Professor
Department of Physics
Indiana University Purdue University Indianapolis
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Education | Employment History | Lectures | Publications | Referee | Societies | Teaching

EDUCATION

• B.Sc., Hebrew University, Jerusalem, Israel 1993–1996, Physics / Mathematics
• Ph.D., University of Texas at Austin, 1996–2003, Statistical Physics,
Adviser: Linda E. Reichl
Thesis Title: Ferromagnetic properties of partially filled two-dimensional Ising lattices

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EMPLOYMENT HISTORY

• 2017-Now : Adjunct Professor, Department of Physics, Indiana University Purdue University Indianapolis, Indianapolis, Indiana USA
• 2012-Now : Consultant, Battelle Center for Mathematical Medicine, The Research Institute at Nationwide Children's Hospital, 700 Children's Drive, Columbus, OH, USA
• 2012-Now : Physicist, Research and Information Systems, Carmel, Indiana USA
• 2012-2017 : Visiting Professor, Department of Biochemistry and Moleculaar Biology, Indiana University School of Medicine, Indianapolis, Indiana USA
• 2007-2012 : Research Associate, Center for Computational Biology and Bioinformatics, School of Informatics, Indiana University Purdue University, Indianapolis, Indiana USA
• 2003-2006 : Research Associate, Department of Physics, Florida International University, Miami, Florida USA
• 1999-2003 : Research Assistant, Department of Physics, University of Texas, Austin, Texas USA
• 1996-2003 : Teaching Assistant, Department of Physics, University of Texas, Austin, Texas USA

PUBLICATIONS

In preparation

1. Eshel Faraggi, Tuo Zhang, Yaoqi Zhou, A. Keith Dunker and Andrzej Kloczkowski, "The role of age and disorder in protein-protein interactions".
2. Eshel Faraggi, A. Keith Dunker, Robert Jernigan, and Andrzej Kloczkowski, "Comparing sequence to structural entropy in related proteins".

Forthcoming

1. Eshel Faraggi, Robert Jernigan, and Andrzej Kloczkowski, "Scoring protein models using a modified Levenberg Marquardt machine learner".
2. Eshel Faraggi, Robert Jernigan, and Andrzej Kloczkowski, "Predicting the effect of missense mutations across species".

Published

1. Basu, S., Zhao, B., Biro, B., Faraggi, E., Gsponer, J., Hu, G., ... & Kurgan, L. (2024). DescribePROT in 2023: more, higher-quality and experimental annotations and improved data download options. Nucleic Acids Research, 52(D1), D426-D433.
2. Faraggi, E. (2022). There is only charge: Heisenberg-Coulomb based theory of the quarks, nucleons, and the nuclei. Authorea Preprints.
3. Jernigan, R. L., Sankar, K., Jia, K., Faraggi, E., & Kloczkowski, A. (2021). Computational ways to enhance protein inhibitor design. Frontiers in Molecular Biosciences, 7, 607323.
4. Faraggi, E., Jernigan, R. L., & Kloczkowski, A. (2021). A Hybrid Levenberg-Marquardt Algorithm on a Recursive Neural Network for Scoring Protein Models. Artificial Neural Networks, 307-316.
5. Zhao, B., Katuwawala, A., Oldfield, C. J., Dunker, A. K., Faraggi, E., Gsponer, J., ... & Kurgan, L. (2021). DescribePROT: database of amino acid-level protein structure and function predictions. Nucleic Acids Research, 49(D1), D298-D308.
6. Kryshtafovych, A., Moult, J., Billings, W. M., Della Corte, D., Fidelis, K., Kwon, S., ... & CASP-COVID participants. (2021). Modeling SARS-CoV-2 proteins in the CASP\u2010commons experiment. Proteins: Structure, Function, and Bioinformatics, 89(12), 1987-1996.
7. Faraggi, E., Dunker, A. K., Jernigan, R. L., & Kloczkowski, A. (2019). Entropy, Fluctuations, and Disordered Proteins. Entropy, 21(8), 764.
8. Alterovitz, W. L., Faraggi, E., Oldfield, C. J., Meng, J., Xue, B., Huang, F., ... & Dunker, A. K. (2019). Many-to-one binding by intrinsically disordered protein regions. In PACIFIC SYMPOSIUM ON BIOCOMPUTING 2020 (pp. 159-170).
9. Faraggi, E., and Kloczkowski, A. (2019). Protein Secondary Structure Assignments and Their Usefulness for Dihedral Angle Prediction. In Computational Methods to Study the Structure and Dynamics of Biomolecules and Biomolecular Processes (pp. 699-712). Springer, Cham.
10. Keasar, Chen, et al. "An analysis and evaluation of the WeFold collaborative for protein structure prediction and its pipelines in CASP11 and CASP12." Scientific reports 8.1 (2018): 9939.
11. Faraggi, E., Krupa, P., Mozolewska, M., Liwo, A., and Kloczkowski, A. (2018). Reoptimized UNRES potential for protein model quality assessment. Genes, 9(12), 601.
12. Faraggi, E., Gerstman, B. S., and Kloczkowski, A. (2017). A superposition test for the emergence of nonlinearities in a laser irradiated spherical absorber. arXiv preprint arXiv:1711.02986.
13. Faraggi, Eshel, A. Keith Dunker, Joel L. Sussman, and Andrzej Kloczkowski. "Comparing NMR and X-ray protein structure: Lindemann-like parameters and NMR disorder." Journal of Biomolecular Structure and Dynamics (2017): 1-11.
14. Faraggi, Eshel, and Andrzej Kloczkowski. "Accurate Prediction of One-Dimensional Protein Structure Features Using SPINE-X." Prediction of Protein Secondary Structure (2017): 45-53.

15. Zhou, Yaoqi, Andrzej Kloczkowski, Eshel Faraggi, and Yuedong Yang, eds. Prediction of Protein Secondary Structure. Springer New York, 2017.
16. Faraggi, Eshel, Maksim Kouza, Yaoqi Zhou, and Andrzej Kloczkowski. "Fast and Accurate Accessible Surface Area Prediction Without a Sequence Profile." Prediction of Protein Secondary Structure (2017): 127-136.
17. Kouza, Maksim, Girik Malik, Eshel Faraggi, Andrzej Kolinski, Irina Buhimschi, and Andrzej Kloczkowski. "Prediction of Protein Aggregation Propensities using GOR Method." Biophysical Journal 112, no. 3 (2017): 198a-199a.
18. Kouza, Maksim, Eshel Faraggi, Andrzej Kolinski, and Andrzej Kloczkowski. "The GOR Method of Protein Secondary Structure Prediction and Its Application as a Protein Aggregation Prediction Tool." Prediction of Protein Secondary Structure (2017): 7-24.
19. Tuo Zhang, Eshel Faraggi, Zhixiu Li, and Yaoqi Zhou. "Intrinsic Disorder and Semi-disorder Prediction by SPINE-D." Prediction of Protein Secondary Structure (2017): 159-174.
20. Eshel Faraggi and Andrzej Kloczkowski, "GENN: a GEneral Neural Network for learning tabulated data with examples from protein structure prediction." Artificial Neural Networks. Springer New York, 2015. 165-178.
21. Faraggi, Eshel, Yaoqi Zhou, and Andrzej Kloczkowski. "Accurate single-sequence prediction of solvent accessible surface area using local and global features." Proteins: Structure, Function, and Bioinformatics (2014).
22. Faraggi, Eshel, and Andrzej Kloczkowski. "A global machine learning based scoring function for protein structure prediction." Proteins: Structure, Function, and Bioinformatics 82, no. 5 (2014): 752-759.
23. Li, Zhixiu, Yuedong Yang, Eshel Faraggi, Jian Zhan, and Yaoqi Zhou. "Direct prediction of profiles of sequences compatible to a protein structure by neural networks with fragment-based local and energy-based nonlocal profiles." Proteins: Structure, Function, and Bioinformatics (2014).
24. Zhang, Tuo, Eshel Faraggi, Zhixiu Li, and Yaoqi Zhou. "Intrinsically semi-disordered state and its role in induced folding and protein aggregation." Cell biochemistry and biophysics 67, no. 3 (2013): 1193-1205.
25. A. Kloczkowski, P. Gniewek, E. Faraggi, M. Zimmermann, D. Gront, M. Pawlowski, R. L. Jernigan, and A. Kolinski, "New Methods to Improve Protein Structure Prediction and Refinement". Biophys. J. 104, 229 (2013)
26. J. Gao, E. Faraggi, Y. Zhou, J. Ruan and L. Kurgan, "BEST: Improved Prediction of B-Cell Epitopes from Antigen Sequence", PLoS ONE 7(6): e40104. doi:10.1371/journal.pone.0040104 (2012)
27. T. Zhang*, E. Faraggi*, B. Xue, A. K. Dunker, V. N. Uversky and Y. Zhou, "SPINE-D: Accurate prediction of short and long disordered regions by a single neural-network-based method", J. Biomol. Struc. Dyn. 29, 799-813 (2012)
28. E. Faraggi, T. Zhang, Y. Yang, L. Kurgan and Y. Zhou, "SPINE X: Improving protein secondary structure prediction by multi-step learning coupled with prediction of solvent accessible surface area and backbone torsion angles", J. Comput. Chem. 33, 259-267 (2012)
29. Eshel Faraggi, "Symmetrical charge-charge interactions in ionic solutions: implications for biological interactions". http://arxiv.org/abs/1201.0556 (2012)
30. Y. Yang, E. Faraggi, H. Zhao and Y. Zhou, ''Improving protein fold recognition and template-based modeling by employing probabilistic-based matching between predicted one-dimensional structural properties of the query and corresponding native properties of templates'' Bioinformatics 27, 2076-2082 (2011)
31. Tuo Zhang, Eshel Faraggi, and Yaoqi Zhou, "Fluctuations of backbone torsion angles

obtained from NMR-determined structures and their prediction". Proteins, 78, 3353-3362 (2010)
32. Y. Zhou, D. Yuan, Y. Yang, E. Faraggi, H. Lei, "Trends in template/fragment-free protein structure prediction" (Invited feature article) Theor. Chem. Accounts, 128, 3-16 (2010)
33. Yaoqi Zhou, and Eshel Faraggi; "Prediction of one-dimensional structural properties of proteins by integrated neural networks". Protein Structure Prediction: Method and Algorithms , edited by H. Rangwala and G. Karypis, Wiley, (2010)
34. Eshel Faraggi, Yuedong Yang, Shesheng Zhang, and Yaoqi Zhou. "Predicting Continuous Local Structure and the Effect of Its Substitution for Secondary Structure in Fragment-Free Protein Structure Prediction". Structure 17, 1515-1527 (2009)
35. Bin Xue, Eshel Faraggi, and Yaoqi Zhou. "Predicting residue-residue contact maps by a two-layer, integrated neural-network method". Proteins 76, 176-183 (2009)
36. Eshel Faraggi, Bin Xue, and Yaoqi Zhou. "Improving the prediction accuracy of residue solvent accessibility and real-value backbone torsion angles of proteins by guided-learning through a two-layer neural network". Proteins 74, 857-871 (2009)
37. Eshel Faraggi, Daniel T. Robb. "Locally converging algorithms for determining the critical temperature in Ising systems". Physical Review B, 78(13) 134416 (2008)
38. Bin Xue, Ofer Dor, Eshel Faraggi, and Yaoqi Zhou. "Real-value prediction of backbone torsion angles". Proteins 72, 427-433 (2008)
39. Eshel Faraggi, and Bernard S. Gerstman. "Acoustical resonant absorption of pulsed laser radiation by a spherical absorber". J. Appl. Phys. 102(12), 123505 (2007). Selected for publication in the Virtual Journal of Biological Physics Research, Volume 15, Issue 1.
40. Eshel Faraggi, Bernard S. Gerstman, and Jinming Sun. "The emergence of nonlinear behavior and chaos in laser irradiated spherical absorber". Chaos 17(1), 013101 (2007). Selected for publication in the Virtual Journal of Biological Physics Research, Volume 13, Issue 3.
41. Eshel Faraggi, "An electrostatic model for biological cell division". http://arxiv.org /abs/1006.3961 (2006)
42. Eshel Faraggi, Bernard S. Gerstman, " Analyzing chaos in the pressure generated by laser absorption by microparticles". Proceedings of the SPIE, Vol. 6436, pp. 643617 (2007)
43. Eshel Faraggi, Linda E. Reichl, and Dan T. Robb. "Magnetic behavior of partially filled finite Ising surfaces". Physical Review B 74(1) 014407 (2006) http://dx.doi.org /10.1103/PhysRevB.74.014407
44. Eshel Faraggi. "Explicit solutions to phenomenological models of magnetization reversal of thin ferromagnetic films in the presence of a sawtooth magnetic field". Journal of Magnetism and Magnetic Materials 303(1), 49 (2006) http://dx.doi.org /10.1016/j.jmmm.2005.10.228
45. Eshel Faraggi, Bernard S. Gerstman, "Resonant absorption in nanometer gold spherical particles". Proceedings of the SPIE, Vol. 6084, pp. 608405/1-12 (2006)
46. Bernard S. Gerstman, Eshel Faraggi, and Jinming Sun, "Chaos in the pressure generated by laser absorption by microparticles". Proceedings of the SPIE, Vol. 6084, pp. 608406/1-8 (2006)
47. Eshel Faraggi, Bernard S. Gerstman, and Jinming Sun. "Biophysical Effects of Pulsed Lasers in the Retina and Other Tissues with Strongly Absorbing Particles: Shockwaves and Explosive Bubble Generation". Journal of Biomedical Optics 10, 64029 (2005)
48. Corneliu Nistor, Eshel Faraggi, J. L. Erskine. "Magnetic Energy Loss in Permalloy

Thin Films and Microstructures". Physical Review B 72, 014404 (2005)
49. Eshel Faraggi, Shijun Wang, and Bernard Gerstman, "Stress confinement, shock wave formation, and laser-induced damage". Proceedings of the SPIE Vol. 5695, pp. 209-215 (2005)
50. Eshel Faraggi, Bernard S. Gerstman, and Shijun Wang, "Response to pulsed radiation by a spherical solid absorber immersed in a transparent fluid". Proceedings of the SPIE Vol. 5696, pp. 101-109 (2005)
51. Bernard S. Gerstman, Shijun Wang, and Eshel Faraggi, "Ab-Initio Calculations for Shock Wave and Bubble Production with Gaussian Temporal Laser Pulses". Proceedings of the SPIE, Progress in Biomedical Optics and Imaging, Vol. 5319, pp. 217-223 (2004)
52. Dan T. Robb, Linda E. Reichl, and Eshel Faraggi. "Simulation of hysteresis in magnetic nanoparticles with Nose thermostatting". Physical Review E 67(5), 056130 (2003)
53. Eshel Faraggi, "Nonlinear behavior in Ferromagnetism: Simple observations and possible implications". http://arxiv.org/abs/nlin.SI/0209006 (2002)

Books

1. Zhou, Yaoqi, Andrzej Kloczkowski, Eshel Faraggi, and Yuedong Yang, eds. Prediction of Protein Secondary Structure. Springer New York, 2017.
2. Eshel Faraggi (ed.), "Protein Structure". Invited by INTECH Publications - Croatia (2012) ISBN 978-953-51-0555-8
3. Eshel Faraggi, "My Adventures in Ferromagnetism: Properties of Partially Filled Two-Dimensional Ising Systems". Invited by VDM Verlag - Germany (2009) ISBN 978-3-639-15942-4

LECTURES/ABSTRACTS (Partial List)

• Eshel Faraggi, Linda E. Reichl, and Dan T. Robb, "Monte-Carlo Simulations in Ferromagnetism: Semi-Filled Ising Surfaces". American Physical Society, March 2002 meeting, Indianapolis, Indiana.

• Eshel Faraggi, "Nonlinear behavior in Ferromagnetism: Simple Observations and possible implications". American Physical Society, March 2002 meeting, Indianapolis, Indiana.

• Eshel Faraggi, Linda E. Reichl, and Dan T. Robb, "Monte-Carlo Simulations in Ferromagnetism: Semi-Filled Ising Surfaces". American Physical Society, March 2003 meeting, Austin, Texas.

• Eshel Faraggi, Linda E. Reichl, and Dan T. Robb, "Locally converging algorithms in two dimensional ferromagnetism". American Physical Society, March 2003 meeting, Austin, Texas.

• Eshel Faraggi, "Ferromagnetic Properties of Partially Filled Two-Dimensional Ising Lattices". Final oral defense, April 2003, University of Texas, Austin, Texas.

• Bernard S. Gerstman, Shijun Wang, and Eshel Faraggi, "Ab-Initio Calculations for Shock Wave and Bubble Production with Gaussian Temporal Laser Pulses". SPIE

Photonics West, January 2004, San Jose, California.
• Eshel Faraggi, Bernard S. Gerstman, and Shijun Wang, "Resonant Absorption". Baltimore Meeting on Laser Safety, Baltimore, Maryland (March 2004)
• Eshel Faraggi, "What is complexity?", Seminars given at the physics departments of the Hebrew University, Tel-Aviv University, Technion, Weizmann Institute of Science, Bar-Ilan University, and Ben-Gurion University. Israel (January 2005)
• Eshel Faraggi, Bernard S. Gerstman, and Shijun Wang, "Response to pulsed radiation by a spherical solid absorber immersed in a transparent fluid". SPIE Photonics West, January 2005, San Jose, California.
• Eshel Faraggi, Shijun Wang, and Bernard Gerstman, "Stress confinement, shock wave formation, and laser-induced damage". SPIE Photonics West, January 2005, San Jose, California.
• Eshel Faraggi, "An electrostatic model for biological cell division". Seminars given at the Hebrew University, Jerusalem, Israel and at the Ben-Gurion University, Beer-Sheva, Israel (January 2006)
• Eshel Faraggi, Bernard S. Gerstman, "Resonant absorption in nanometer gold spherical particles". SPIE Photonics West, January 2006, San Jose, California.
• Bernard S. Gerstman, Eshel Faraggi, and Jinming Sun, "Chaos in the pressure generated by laser absorption by microparticles". SPIE Photonics West, January 2006, San Jose, California.
• Eshel Faraggi, Bernard S. Gerstman, "Resonant absorption in micrometer and nanometer absorbing particles". American Physical Society, March 2006 meeting, Baltimore, Maryland.
• Eshel Faraggi, “Scaling of hysteresis in phenomenological models of thin ferromagnetic films”. American Physical Society, March 2006 meeting, Baltimore, Maryland.
• Eshel Faraggi, Bin Xue, Yaoqi Zhou, “Guided learning”. The Fifth Annual Indy Regional Bioinformatics Conference, 2008, Indianapolis, Indiana
• Eshel Faraggi, “Twin Peaks: identifying the structure of the protein's dihedral angle distribution and its implication for its prediction”. CCBB, IUPUI 2008, Indianapolis, Indiana.
• Eshel Faraggi, Yaoqi Zhou, “A new level of accuracy for dihedral angle prediction”. The Sixth Annual Indy Regional Bioinformatics Conference, 2009, Indianapolis, Indiana
• Eshel Faraggi, Yaoqi Zhou, “A new level of accuracy for dihedral angle prediction”. The Seventh Biotechnology and Bioinformatics Symposium (BIOT-2009), Lincoln, Nebraska
• Eshel Faraggi, Yuedong Yang, Shesheng Zhang, and Yaoqi Zhou, “Predicting Continuous Local Structure and the Effect of Its Substitution for Secondary Structure in Fragment-Free Protein Structure Prediction” From Computational Biophysics to Systems Biology meeting, 2010, Traverse City, Michigan
• Y. Yang, E. Faraggi, and Y. Zhou, “SPARKS-X: Improving the single fold-recognition technique by employing statistical error potentials” Critical Assessment of protein Structure Prediction 9, 2010, Pacific Grove, California

• T. Zhang, E. Faraggi and Y. Zhou, “Intrinsic disorder prediction using neural networks” Critical Assessment of protein Structure Prediction 9, 2010, Pacific Grove, California
• T. Zhang, E. Faraggi and Y. Zhou, “Meta server approach for intrinsic disorder prediction” Critical Assessment of protein Structure Prediction 9, 2010, Pacific Grove, California
• E. Faraggi, Y. Yang, and Y. Zhou, “Using Neural Networks to Aid a Human in Predicting Protein Structure” Critical Assessment of protein Structure Prediction 9, 2010, Pacific Grove, California
• J. Zhan, Y. Yang, E. Faraggi, Y. Liu, and Y. Zhou, “Enrichment of destabilizing mutations and mutations of conserved residues in minor allele frequency” Genetic Analysis Workshop, 2010, Boston, Massachusetts
• E. Faraggi, “Why hire me?” (Invited) Purdue University Structural Biology, 2011, West Lafayette, Indiana
• E. Faraggi, T. Zhang, Y. Zhou, A. K. Dunker and A. Kloczkowski, "The role of age and disorder in protein-protein interactions" (Invited) Mathematical and Computational Medicine, 2012, Xcaret, Mexico.
• E. Faraggi and A. Kloczkowski, "Whole Protein Native Fitness Potentials" (Invited) Critical Assessment of protein Structure Prediction 10, 2012, Gaeta, Italy.
• E. Faraggi, A. K. Dunder, J. Sussman and A. Kloczkowski, "On the relationship between NMR and X-Ray derived protein structures" (Invited) Weizmann Institute of Science, 2012, Rehovot, Israel.
• E. Faraggi and A. Kloczkowski, "Whole Protein Native Fitness Potentials" American Physical Society, March Meeting, 2013, Baltimore, Maryland.
• E. Faraggi, "Symmetrical charge-charge interactions in ionic solutions and implications for cell division" American Physical Society, March Meeting, 2013, Baltimore, Maryland.
• E. Faraggi and A. Kloczkowski, "Whole Protein Native Fitness Potentials" (Conference Chair) Protein Folding, Dec. 2013, Cancun, Mexico.
• E. Faraggi, Y. Zhou, and A. Kloczkowski, "Accurate single-sequence prediction of solvent accessible surface area. What can we learn?" (Conference Chair) Protein Folding, Jul. 2014 Punta-Cana, Dominican Republic.
• E. Faraggi, "Physically Meaningful Model of Cell Division and Other Mathematical Constructs Related to Medicine" (Invited Speaker) Mathematical Medicine, Dec. 2014 Playa Del Carmen, Mexico.
• Co-organized and co-chaired the 3rd International Conference on Protein and RNA Structure prediction. Also gave the talk: E. Faraggi, A. K. Dunder, J. Sussman and A. Kloczkowski, "On the relationship between NMR and X-Ray derived protein structures" (Invited Speaker) 2015, Punta Cana, Dominican Republic.
• E. Faraggi, A. K. Dunker, J. L. Sussman, and A. Kloczkowski, "On the relationship between NMR and XRay derived structures" (Invited Speaker), The 8th International Conference on Structural Genomics, June 2015, Rehovot, Israel.
• E. Faraggi "Using Deep Learning to Optimize UNRES", (Co-organized and Co-chaired),

The 1st International Conference on Conmputational Genomic and Pr oteomics, Oct. 2016, Guanacaste, Costa-Rica.
• The 12th Critical Assessment of Protein Structure Prediction (CASP12), (Invited), Dec. 2016, Gaeta, Italy.
• From Computational Biophysics to Systems Biology. Invited. Co-chaired a session on machine learning and big data. 2017, Cincinnati, Ohio.
• E. Faraggi, "Lindemann-like parameters and NMR disorder" (Invited Speaker), 2nd International Conference on Computational Genomics and Proteomics, 2017, Panama.
• E. Faraggi and A. Kloczkowski, "Fast and accurate prediction of one-dimensional protein structural properties using a Levenberg-Marquardt recursive neural network" (Co-organized and Co-chaired), The 4th International Conference on Protein and RNA Structure Prediction, Dec. 2017, Montego Bay, Jamaica.
• The 13th Critical Assessment of Protein Structure Prediction (CASP13), (Invited), Dec. 2018, Cancun, Mexico.
• E. Faraggi, "Machine Learning in Structural Biology and Other Approaches" (Invited Speaker) The 4th Mathematical Medicine Conference, Dec. 2018, Cancun, Mexico.

SOCIETIES

• American Physical Society
• American Association for the Advancement of Science -- former member
• Israeli Physical Society

TEACHING

• Physics 102N : E&M Lab, undergraduates, UT Austin.
• PS303 : Physical Science - Mechanics, undergraduates, UT Austin
• Revised Ph102N lab-manual with Roger Bengtson -- lab supervising professor. UT Austin, Summer 1998.
• PS219, PHYS251 : Physics at IUPUI.

REFEREE DUTIES

• Computers in Biology and Medicine
• Symmetry
• Optics and Lasers in Engineering
• Journal of Theoretical Biology
• PLOS One
• Journal of Chemical Physics
• ETC
