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Kayla Sapp, Ph.D.

Key Skills

- 10+ years of experience setting research goals and managing research projects in the fields of Computational Chemistry, Fluid Dynamics, and Theoretical Biophysics.
- Collaborative researcher who has designed and managed projects with multidisciplinary teams of scientists towards the goal of understanding the role of cell membranes in biological processes.
- Modeling expert who has developed and implemented multiple mathematical models of cell membrane systems using advanced mathematics and physics.
 - Statistical Mechanics, Continuum Mechanics, Dynamics, Numerical Simulations, Visualization
 - Fourier Analysis, Differential Equations, Spherical Harmonics, Statistics, Curve Fitting
- Scientific programmer with expertise using multiple languages and programs for scientific research.
 - Python, NumPy, SciPy, Matplotlib, R, C, Bash, LaTeX
 - gnuplot, Jupyter Notebook, Emacs, Mathematica, Microsoft Office
 - High Performance Computing (HPC), Slurm, Linux/Unix Shell, Git
- Machine Learning (ML) scientist who has taken the initiative to learn supervised/unsupervised learning algorithms and neural networks and has worked on applying them where appropriate.
 - Classification, Regression, Clustering, Dimensionality Reduction, Neural Networks, Convolutional Neural Networks, Autoencoders
 - PyTorch, TensorFlow, Keras, scikit-learn
- Engaging and enthusiastic technical communicator who effectively relays technical information to specialized and general audiences.
 - 8 peer-reviewed journal articles, 1 preprint, 15 poster presentations and 4 oral presentations

Experience

Postdoctoral Fellow

2017 – Present

National Institutes of Health, Bethesda, MD

- Lead researcher for 4 projects modeling cell membranes to understand their biological relevance resulting in 4 publications in highly rated physics and biophysics journals.
- Co-led a research project combining computational and theoretical techniques to investigate mechanical properties of the cell membrane resulting in a publication in a top biophysics journal.
- Served as the theory and mathematical modeling subject matter expert (SME) for the team which provided necessary support to projects leading to publications in top journals.
- Quickly and effectively learned and implemented C and R to perform simulation and analysis functions for collaborative research projects.
- Wrote Python programs, leveraging various packages, that numerically solved stochastic differential equations to model the dynamics of complex membrane systems.
- Developed mathematical models of the membrane, leveraging principles of statistical mechanics, that successfully explained phenomena observed in experiments.
- Took the opportunity to learn ML techniques and applied the algorithms to Molecular Dynamics (MD) data of cell membranes.

Graduate Research Assistant

2011 – 2016

University of Washington, Seattle, WA

- Designed and led 3 research projects that resulted in 2 publications, numerous presentations, a grant, and a fellowship award.
- Developed mathematical models of cell membranes that integrated membrane and particle dynamics to show that membranes are heavily influenced by what is bound to them and how.
- Learned and excelled at Python to compose code that performs numerical simulations and analysis functions.
- Communicated technical scientific research through enthusiastic and engaging oral and poster presentations at numerous conferences.

Education

Ph.D in Chemistry, *University of Washington, Seattle, WA*

2016

B.S. in Chemistry, *York College of Pennsylvania, York, PA*

2011

Minor in Math

Additional Training

- **Applied Machine Learning**: 7 week on-line course covering supervised/unsupervised learning algorithms, applications of the different methods, and how to implement them in Python with scikit-learn.
- **Introduction to Deep Learning**: Week long intensive on-line workshop focusing on the theory and proper application of neural networks and implementation of them in Python using Pytorch and Keras.

Publications/Presentations/Awards/Grants

- Co-authored 8 peer-reviewed publications and 1 preprint (*Authors contributed equally)
 - Hossein, A., Beaven, A., Sapp, K., Sodt, A. Softening in two-component lipid mixtures by spontaneous curvature variance. 2023. *BioRxiv*. (Submitted to the *Journal of Physical Chemistry*) DOI: 10.1101/2023.12.12.571323
 - **Sapp, K.**, Aleksanyan, M., Kerr, K., Dimova, R., Sodt, A. Kinetic relaxation of giant vesicles validates diffusional softening in a binary lipid mixture. 2023. *Physical Review E*. DOI: 10.1103/PhysRevE.107.054403
 - Beaven, A., **Sapp, K.**, Sodt, A. Simulated dynamic cholesterol redistribution favors membrane fusion pore constriction. 2022. *Biophysical Journal*. DOI: 10.1016/j.bpj.2022.12.024
 - Lessen, H. *, **Sapp, K.** *, Beaven, A., Ashkar R., Sodt, A. Molecular mechanisms of spontaneous curvature and softening in complex lipid bilayer mixtures. 2022. *Biophysical Journal*. DOI: 10.1016/j.bpj.2022.07.036
 - **Sapp, K.**, Sodt, A. Observed steric crowding at modest coverage requires a particular membrane-binding scheme or a complementary mechanism. 2022. *Biophysical Journal*. DOI: 10.1016/j.bpj.2021.12.036
 - **Sapp, K.**, Beaven, A., Sodt, A. Spatial extent of a single lipid's influence on bilayer mechanics. 2021. *Physical Review E*. DOI: 10.1103/PhysRevE.103.042413
 - **Sapp, K.**, Maibaum, L., Sodt, A. Simple differences in the protein-membrane attachment mechanism have functional consequences for surface mechanics. 2019. *Journal of Chemical Physics*. DOI: 10.1063/1.5119088
 - **Sapp, K.**, Maibaum, L. Suppressing membrane height fluctuations leads to a membrane-mediated interaction among proteins. 2016. *Physical Review E*. DOI: 10.1103/PhysRevE.94.052414
 - **Sapp, K.**, Shlomovitz, R., Maibaum, L. Seeing the forest in lieu of the trees: continuum simulations of cell membranes at large length scales. 2014. *Annual Reports in Computational Chemistry*. DOI: 10.1016/B978-0-444-63378-1.00003-3
- Selected to give 10+ poster and 3 oral presentations at various chemistry, physics, and biophysics conferences.
- Awarded the Alma Mater Travel Award from the UW Chemistry Department for a funded trip to YCP to give a seminar.
- Awarded the NIH Summer Research Mentor Award to mentor an undergraduate summer intern.
- Funded for 2 years at UW by the Molecular Biophysics Training Grant from the National Institute of General Medical Sciences of the NIH.
- Awarded the Graduate Student Merit Fellowship: Edwin and Phyllis Motell Endowed Fellowship in Chemistry.
- Awarded the Outstanding Chemistry Major Award by the Southeastern Pennsylvania Section of the American Chemical Society.
- Won First Place at the 2011 Student Scholars Week from the Department of Physical Sciences at YCP for undergraduate research.