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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/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/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.