Hannah K. Wayment-Steele, Ph.D.
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Education

Ph.D., Chemistry, Stanford University 2016 – 2021
M.Phil., Chemistry, Cambridge University (funded by the Churchill scholarship) 2015 – 2016
B.A. *magna cum laude*, Chemistry and Mathematics double major, Pomona College 2011 – 2015

Research Experience

Jane Coffin Childs Postdoctoral Fellow, Brandeis University 2022 – present
- Deep learning and high-throughput experiment for enzyme design.

Postdoctoral Fellow, Wyss Institute, Harvard Medical School 2021 – 2022
- Characterized DNA-based technologies for ultra-sensitive protein detection.

Graduate research with Rhiju Das and Vijay Pande, Stanford University 2016 – 2021
- Created biophysical models for RNA degradation, applied methods to design experimentally-validated model RNA therapeutics with improved shelf lives.
- Developed improved algorithms and novel experimental frameworks for RNA thermodynamic prediction using statistical mechanics to link high-throughput experiment and machine learning.
- Developed theoretical links between dynamical systems theory and unsupervised machine learning frameworks to create improved analysis tools for protein dynamics.

Graduate research with Daan Frenkel, Cambridge University 2015 – 2016
- Improved understanding of DNA nanomaterial nucleation and assembly via molecular modelling.

Select Honors and Awards

Jane Coffin Childs Postdoctoral Fellowship 2022
Award for Outstanding Graduate Research, ACS PHYS division, Journal Chemical Physics 2021
Chemical Computing Group Excellence Award, ACS COMP division 2021
Joseph R. McMicking Award, Stanford Chemistry Department 2021
NSF Graduate Research Fellowship 2016
Churchill Scholarship, Sir Winston Churchill Foundation of the USA 2015
John Stauffer Prize for Academic Merit in the Sciences (Pomona College) 2015
Awarded to one graduate annually in the natural sciences who exhibits the highest academic promise.
Beckman Scholar 2014
Goldwater Scholar 2014

Select Peer-Reviewed Publications

Wayment-Steele, H.K., Kladwang, W., Strom, A. I., Becka, A., Lee, J., Treuille, A., Eterna Participants, Das, R. (2022). RNA secondary structure packages evaluated and improved by high-throughput experiments. *Nature Methods* (In Press).

Wayment-Steele, H. K.*, Kladwang, W.*, Watkins, A. M.*, Kim, D. S.*, Tunguz, B.*, ... Das, R. (2022) Predictive models of RNA degradation via dual crowdsourcing. *Nature Machine Intelligence* (In Press).

Leppek, K.*, Byeon, G.W.*, Kladwang, W.*, **Wayment-Steele, H. K.*,** Kerr, C. H.*, ... Barna, M., Das, R. (2022) Combinatorial optimization of mRNA structure, stability, and translation for RNA-based therapeutics. *Nature Communications* (13) 1536. *Equal contributions.

Andreasson, J. O., Gotrik, M. R., Wu, M. J., **Wayment-Steele, H. K.,** Kladwang, W., Portela, F., Wellington-Oguri, R., Eterna Participants, Das, R., Greenleaf, W. J. (2022). Crowdsourced RNA design discovers diverse, reversible, efficient, self-contained molecular sensors. *Proceedings of the National Academy of Sciences* (119) 18.

Wayment-Steele, H.K., Kim, D.S., Choe, C.A., Nicol, J.J., Wellington-Oguri, R., Sperberg, R.A.P., Huang, P., Eterna Participants, Das, R. (2021). Theoretical basis for stabilizing messenger RNA through secondary structure design. *Nucleic Acids Research*, 48(18), 10604-10617.

Wayment-Steele, H. K., Wu, M., Gotrik, M., Das, R. (2019). Evaluating riboswitch optimality. *Methods in Enzymology*, 623, 417-450.

Kostrz, D., **Wayment-Steele, H. K.,** Wang, J. L., Follenfant, M., Pande, V. S., Strick, T. R., Gosse, C. (2019). A modular DNA scaffold to study protein–protein interactions at single-molecule resolution. *Nature Nanotechnology*, 14(10), 988-993.

Wayment-Steele, H. K., Pande, V. S. (2018). Variational encoding of protein dynamics benefits from maximizing latent autocorrelation. *The Journal of Chemical Physics*, 149(21), 216101.

Hernandez, C. X.*, **Wayment-Steele, H. K.*,** Sultan, M. M.*, Husic, B. E., Pande, V. S. (2018). Variational Encoding of Complex Dynamics. *Physical Review E*, 97(6), 062412. *Equal contributions.

Sultan, M. M., **Wayment-Steele, H. K.,** Pande, V. S. (2018). Transferable neural networks for enhanced sampling of protein dynamics. *Journal of Chemical Theory and Computation*, 14(4), 1887-1894.

Wayment-Steele, H. K., Frenkel, D., Reinhardt, A. (2017) "Investigating the role of boundary bricks in DNA brick self-assembly." *Soft Matter* (2017) 13, 1670-1680.

Wayment-Steele, H. K., Jing, Y., Swann, M. J., Johnson L. E., Agnarsson, B., Johal, M. S., Kunze, A. (2016) "Effects of Al^{3+} on phosphocholine and phosphoglycerol containing solid supported lipid bilayers." *Langmuir* 32:7, 1771–1781.

Full publication list at https://scholar.google.com/citations?user=MHNfkuUAAAAJ

Patent Applications

H. K. Wayment-Steele, E. Sharma, R. Das, W. Greenleaf. 63/245,744, "Systems and Methods to Determine Nucleic Acid Thermodynamics and Uses thereof", Sep. 17, 2021.

R. Das, **H. K. Wayment-Steele**. PCT/US2021/040026, "Systems and Methods to Enhance RNA Stability and Translation and Uses Thereof", July 1, 2021.

R. Das, C. A. Choe, **H. K. Wayment-Steele**, W. Kladwang, 17/364,890, "Systems and Methods to Enhance RNA Stability and Translation and Uses Thereof", June 30, 2021.

Software Repositories (Lead Developer)

"Superfolder COVID mRNA vaccines" https://github.com/DasLab/superfolder-covid-mrna-vaccines

- Public repository of designed stabilized sequences for S-2P mRNA COVID vaccines and variant strains.

"Arnie" https://github.com/DasLab/arnie

- General tool for comparing RNA structure algorithms. Used by over 1600 teams for data augmentation in machine learning competition on Kaggle.

Select Presentations

"Designing stabilized vaccines with community science." TEDx Washington High, Fremont, CA. May 1 2021.

"Inferring RNA ensembles via high-throughput data." Center for HIV-1 Studies Annual Workshop. April 5 2021.

"Improving the stability of RNA therapeutics through biophysics, machine learning, and crowdsourcing" IEEE Silicon Valley Chapter, Information Theory Society, Invited Talk, March 24 2021.

"Improving RNA structure prediction with high-throughput crowdsourced data". International Conference on Intelligent Systems for Molecular Biology (ISMB), Virtual. 13 July 2020.

Select Teaching, Mentorship, Outreach Experience

2021	Program mentor, Center for Genetically Encoded Materials REU, UC Berkeley
2020	Co-instructor, BIOL 4013, Topics in Genomics, Prairie View A & M University
2020	Program mentor, Stanford Summer Research Program
2019 – 2021	Outreach lead, Eterna Project
2017 – 2018	Teaching assistant mentor, Department of Chemistry, Stanford University
2016 – 2017	Teaching assistant, Department of Chemistry, Stanford University
2015	Supervisor, Nanotechnology Doctoral Training Center, Cavendish lab, Cambridge University