Derek Hart, PhD

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EXPERIENCE

Centers for Disease Control and Prevention (Contracted by ASRT Inc.) **Atlanta, Georgia**

Bioinformatician, Data Manager *Dec 2022 - Present*

- Developed new whole-genome sequencing assay and assembly pipelines to improve global tracking and elimination of measles, mumps, and rubella viruses. Extensive experience with Snakemake, Nextflow, Seqera Platform, Singularity/Docker, HPC, Python, R & Bash. Communicated methods via oral presentations at multiple global lab network meetings.
- Built ETL pipeline using cloud-based tools (e.g. Databricks) to create database and automate quality assessment of $>$100 molecular laboratories worldwide. Led consultations with data engineers and public health scientists to set database requirements.
- Created Rshiny dashboard to easily filter, aggregate, and visualize global measles database for rapid communication in meetings/presentations. Integrated Javascript libraries Highcharts & D3 to enable interactive geospatial plots and phylogenetic trees.
- Contributed to measles research in two peer-reviewed publications and two ongoing manuscripts.

Georgia Institute of Technology **Atlanta, Georgia**

Graduate Research Assistant *Jan 2017 - Nov 2022*

- Designed and implemented a new single-molecule FRET assay to explore how weak tensile force affects the stability of short DNA probes. Five years of wet lab experience; very familiar with DNA assay design and preparation.
- Performed molecular dynamics and Monte Carlo simulations on an HPC system, using advanced statistical sampling techniques, to characterize the structure of DNA during its binding/unbinding transitions. Used Python data science libraries for analysis and visualization.
- Presented research at multiple international conferences and on-campus seminars. Excellent at storytelling with data.
- Independently led and completed a research project combining experimental and compuational methods, resulting in a first-author publication for *Nucleic Acids Research* (link).

Graduate Teaching Assistant *Aug 2016 - Aug 2019*

- Mentored electromagnetism and biophysics students during laboratory sections and office hours. Presented complex scientific concepts verbally.

EDUCATION

Georgia Institute of Technology **Atlanta, Georgia**

PhD Physics 3.7 GPA *Aug 2016 - Sep 2022*

- **Area of Concentration:** Single-molecule biophysics
- **Thesis:** Hybridization and dehybridization of short oligonucleotides subject to weak tension
- **Minor:** Advanced Optics
- **Award:** Georgia Tech Institute Fellowship

Georgia Institute of Technology **Atlanta, Georgia**

MS Physics *Aug 2016 - May 2018*

Colorado School of Mines **Golden, Colorado**

BS Engineering Physics 3.9 GPA *Aug 2013 - May 2016*

- **Award:** Physics Faculty Distinguished Graduate

PUBLICATIONS

- B. Bankamp, G. Kim, D. Hart, A. Beck, Y. Zhang, M. Mamou, A. Penedos, R. Evans, P. Rota. “Global update on measles molecular epidemiology”. *Vaccines.* 12.7. (Jul. 2024)
- A. Beck, E. Lopareva, H. Hwang, D. Hart, M. de Almeida, P. Rota, B. Bankamp. “Rapid Communication: Evaluation of the sensitivity of a measles diagnostic real-time RT-PCR assay incorporating recently observed priming mismatch variants, 2024”. *Eurosurveillance.* 29.28. (Jul. 2024)
- M. Jumabaeva, E. Lopareva, M. Chen, D. Park, D. Hart, B. Bankamp, A. Beck. “Validation of High-Throughput Metagenomic Sequencing of Measles, Mumps and Rubella Viruses Using Simultaneous Complex Probe Enrichment”. (in preparation)

- E. Tiller, A. Mathis, A. Beck, D. Hart, C. Dixey, D. Sugerman. “Measles outbreak among undervaccinated children during an unseasonal increase of respiratory virus activity in pediatric populations Columbus, OH, 2022”. (in preparation)
- D. Hart, J. Jeong, J. Gumbart, H. Kim. “Weak tension accelerates hybridization and dehybridization of short oligonucleotides”. *Nucleic Acids Res.* 51.7. (Apr. 2023), pp 3030-3040

ORAL PRESENTATIONS

- 2024: “Using workflow managers to improve sequencing reproducibility and quality control”. Atlanta Winter Summit. Atlanta, GA.
- 2023: “Design of NGS Bioinformatics Pipeline to Improve Reproducibility and Quality Control”. 21st Global Measles and Laboratory Network Meeting. Virtual conference.
- 2022: “Weak tension accelerates hybridization and dehybridization of short oligonucleotides”. Annual Meeting of the International Physics of Living Systems Network. Montpellier, France.
- 2021: “Nucleic acid melting under small tension”. Annual Meeting of the American Physical Society. Virtual conference.
- 2021: “Kinetics of DNA melting and hybridization under small tension”. Physics of Living System Seminar. Atlanta, Georgia.
- 2019: “How do DNA bending and twisting affect CRISPR-Cas12 binding and cleavage?” Physics of Living Systems Seminar. Atlanta, Georgia.
- 2018: “Tracking Polymer Tangles”. Physics of Living Systems Seminar. Atlanta, Georgia.

TECHNICAL SKILLS

- **Programming**: Python, Bash, R, MATLAB, LaTeX, Groovy, Javascript, Perl, C++, SQL
- **Bioinformatics**: Snakemake, Nextflow, Seqera Platform, HPC, Linux, Git, BLAST, Geneious Prime, CLC Genomics Server, Docker, Singularity, MultiQC, Highcharts, D3
- **DNA Biology**: Primer and assay design, PCR (including RT-PCR), multiplexing, DNA isolation and characterization, gel electrophoresis, fluorophore modification, plasmid cloning, restriction digests
- **Modeling & Simulation**: Molecular Dynamics, Monte Carlo, forward-flux sampling, umbrella sampling, oxDNA, Hidden Markov Modeling
- **Data Science & Engineering**: Pandas, Tidyverse, Pyspark, Databricks, Azure, Scikit-learn, Matplotlib, Seaborn
- **Single-molecule Biophysics**: TIRF microscopy, FRET microscopy, surface passivation, rate kinetics, force spectroscopy
- **Interests**: Bouldering, Cooking, Japanese, D&D, Reading, Piano